

NATIONAL GUIDELINES FOR THE ASSESSMENT AND THE MANAGEMENT OF CARDIOVASCULAR DISEASES

Second Edition | 2025

IMPRINT

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National Guidelines for the Assessment and Management of Cardiovascular Diseases

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FOREWORD

Noncommunicable diseases (NCDs) – including cardiovascular conditions, hypertension, and diabetes – are responsible for an estimated 41 million deaths worldwide each year. Strikingly, nearly 80% of these deaths occur in low- and middle-income countries such as Ghana and many others across Sub-Saharan Africa. In these settings, individuals often develop NCDs at younger ages, live with them longer, and experience earlier mortality compared to those in high-income nations. The rising burden of NCDs is placing immense pressure on families and impeding national development.

In Ghana, cardiovascular diseases remain the leading cause of death among both men and women. Our hospitals are increasingly overwhelmed by patients presenting with complications that could have been prevented or better managed through early diagnosis, lifestyle modifications, and sustained medical care. In response to this growing challenge, the Ghana NCD Policy (2022) affirms the government's commitment to reducing the incidence and impact of NCDs, promoting healthier lifestyles, and improving the quality of life for individuals living with chronic conditions.

To support these goals, the second edition of the *National Guideline for the Assessment and Management of Cardiovascular Diseases* serves as a critical tool in Ghana's public health strategy. It integrates the latest scientific evidence and international best practices to strengthen prevention, early detection, referral pathways, integrated service delivery, patient counseling, and the use of innovative tools—all aimed at enhancing the quality and continuity of care, particularly at the primary and sub-district levels.

By establishing clear and practical standards, the guideline equips Ghana's health workforce to deliver equitable and effective cardiovascular care nationwide. It directly supports national targets to reduce premature NCD-related mortality by 25% by 2030, aligns with the Sustainable Development Goals, and contributes to the WHO Global Action Plan target of ensuring that at least 50% of individuals with hypertension and diabetes receive treatment and achieve disease control. Additionally, the Ghana Medical Trust Fund (MahamaCares) Bill provides essential financial safeguards to support the treatment and management of chronic diseases.

I wish to express my heartfelt gratitude to all stakeholders – experts, partners, and institutions – whose dedication and expertise were instrumental in developing this guideline. Let us continue to work together to ensure its effective implementation. I am confident that its full adoption will significantly advance our collective fight against cardiovascular diseases and reduce their impact across the nation.



Kwabena Mintah Akandoh (MP)

Minister for Health
Ghana

October 2025

PREFACE

Cardiovascular diseases (CVDs) are a growing public health problem in Ghana and across Africa. Stroke and other CVDs have become leading causes of death, driven by increasing risk factors such as hypertension.

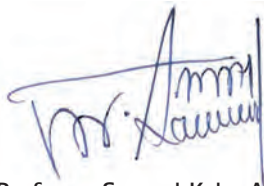
The World Health Organization (WHO) identifies cardiovascular diseases (CVDs) as one of the top two causes of death in Ghana, second only to diarrheal illnesses. According to the Ghana Health Service 2017 Annual Report, the prevalence of hypertension, a major risk factor for CVDs, ranges from 19% to 48% of the adult population and continues to rise. This increase is largely attributed to longer life expectancy and the growing prevalence of contributing factors such as being overweight and obesity.

Early diagnosis and effective management of these risk factors have the potential to significantly reduce the fatal consequences of CVDs. However, nearly half of individuals diagnosed with hypertension already show signs of end-organ damage, reflecting prolonged periods of undetected or untreated disease.

At the heart of improving risk assessment and management are nationally approved guidelines, which facilitate the standardization of care and access for all.

These guidelines, developed by experts across all levels of healthcare and in collaboration with key stakeholders, provide recommended approaches and essential information for clinicians and other healthcare workers. They serve as a practical guide for assessing and managing the most common CVDs in Ghana and are applicable at all levels of care, whether in facilities without a doctor, those with a general practitioner, or those with a physician specialist.

We trust that these guidelines will serve as a valuable tool for all healthcare workers in strengthening CVD prevention and management in Ghana.



Professor Samuel Kaba Akoriyea

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1 INTRODUCTION

1.1 CARDIOVASCULAR DISEASE BURDEN

Non-communicable diseases such as heart diseases, stroke, diabetes, cancers, respiratory diseases, injuries, etc. account for 66% of the 60 million deaths worldwide; 80% of these deaths occur in low- and middle-income countries (LMIC). People in LMICs tend to get NCDs at younger ages, suffer longer, and die sooner than those in high income countries. Almost half of NCD deaths are attributable to cardiovascular diseases (hypertension, stroke, heart attack, heart failure, etc.).

Globally, cardiovascular diseases (CVDs) are the number one cause of death. According to statistics from the World Heart Federation (WHF), CVDs were responsible for about 20.5 million (31%) deaths worldwide in 2023¹. Heart attack (myocardial infarction) and stroke contributed to 85% of these deaths². Modernization in societies (fast foods, sedentary lifestyle, technologies, etc.) brings along changes in behaviour and lifestyle, and consequently changes in the health and disease patterns³. The major population risk factors for CVDs include age, smoking, history of hypertension or diabetes mellitus, obesity, unhealthy diet, alcohol misuse, lack of physical activity, dyslipidemia, family history of heart disease, ethnicity/race and psychosocial factors^{4,5}.

Global Burden of Cardiovascular Diseases: Projections from 2025 to 2050

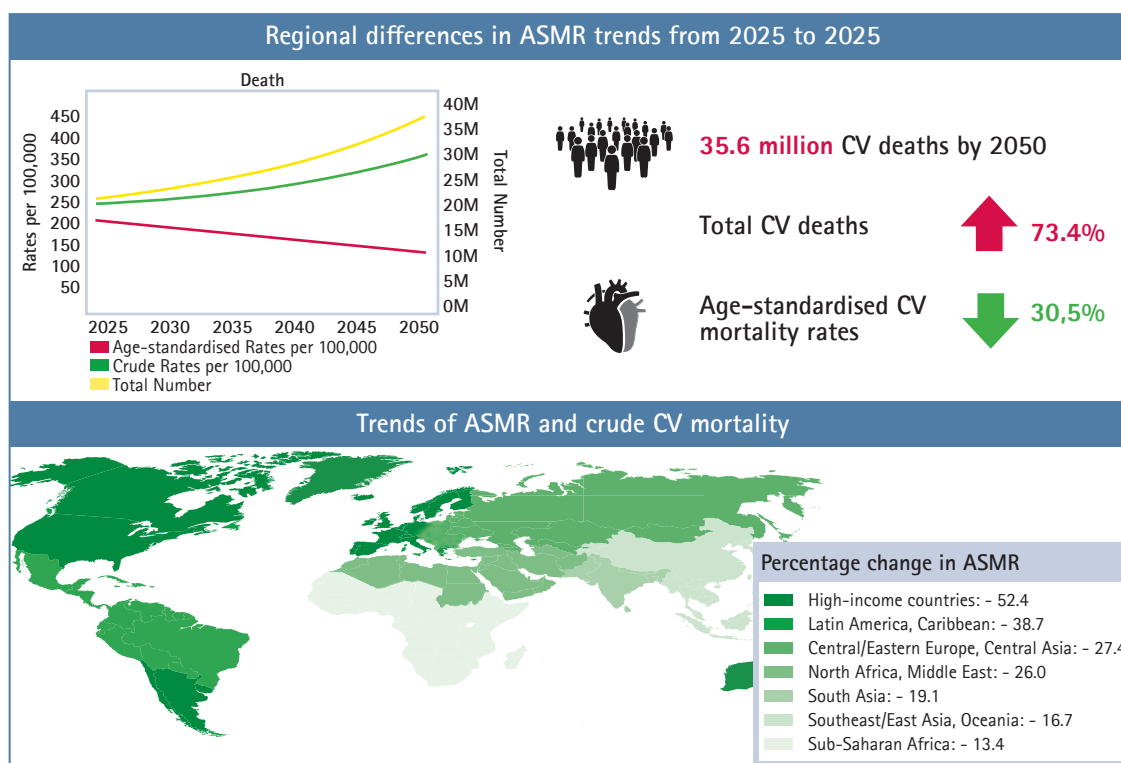


Figure 1: The rise in crude CV burden forecasted from 2025 to 2050 contrasts a fall in age-standardized mortality⁶

LMICs are the most affected by CVDs. Globally, about 80% of CVD-related deaths as well as 87% of CVD-related disabilities occur in LMICs⁵. Although high income countries have put in place measures that are working to decrease their CVD rates, the same cannot be said for LMICs⁴. Between 1990 and 2013, sub-Saharan Africa remained the only part of the world that had an increase in the CVD-related deaths⁵.

CVD related deaths in sub-Saharan Africa continue to increase with stroke being responsible for nearly half a million deaths in 2012⁵. Sub-Saharan Africa is also known to record the world's highest prevalence of rheumatic heart disease (RHD) i.e. 15-20 per 1000 people⁶. Hypertension, the leading risk factor for CVDs, is rising rapidly and has been predicted to increase by 60% among adults by 2025⁴.

1.2 EFFORTS TO REDUCE CVD RELATED DEATHS

In sub-Saharan Africa, individuals at high risk of CVDs are usually at the peak of their productive years⁴. There are local and international efforts to improve the control of NCDs through lifestyle modification coupled with early detection and management. The Sustainable Development Goals (SDGs) aim to ensure healthy lives and promote well-being for all⁷.

In Ghana, several efforts are underway to improve NCD and cardiovascular health. The revision of the NCD Policy and Strategy in 2022.

The Ghana NCD Policy 2022 has the following objectives:

- ▶ To reduce the exposure to the risk factors that contribute to NCDs
- ▶ To strengthen early detection and management to reduce morbidity and mortality from NCDs
- ▶ To strengthen the health system for NCD prevention and control
- ▶ To strengthen multi-sectoral collaboration for NCD prevention and control
- ▶ To ensure sustainable funding and other resources for NCD prevention and control

To improve the prevention, early detection and the appropriate management of NCD/CVD, the following interventions have been put in place to improve NCD/CVD care:

- Development of National Diabetes Guidelines
- Setting up of National NCD Steering Committee with involvement of key stakeholders and partners
- The Development of national NCD Screening Guidelines
- -technical Working Groups (TWG) for Diabetes and CVD
- Network of Practise and Chronic Care Module to improve the management of diseases, including NCD in the sub-district levels of care such as health centres and CHPS compounds

Ghana has adopted the WHO Package of Essential Non-communicable Diseases Interventions (PEN) to help scale up essential NCD services and reduce the burden of diseases through primary health care. The WHO PEN emphasis the need for integrated healthy lifestyle and self-care counselling at the primary level.

Table 1: Recommendations for self-care for CVDs and risk factors

Raised blood pressure: Self-measurement with affordable technologies	Heart failure: Need for cardiac rehabilitation, including graded exercise, weight measurements and adjustment of diuretics
Diabetes mellitus: Self-monitoring of blood sugar and adjusting of medications, especially insulin	Need for Anticoagulation: Self-monitoring of blood anticoagulation (e.g Warfarin) and adjusting dosage
Obesity: Self-measurement of weight and waist circumference	Chronic kidney diseases: Self-monitoring of weight and urine output, and to inform carers of relevant change
	Stroke: Home carers to monitor swallowing difficulties, pressure points and mobility

1.3 PURPOSE AND IMPORTANCE OF CVD GUIDELINES REVIEW

Several randomized controlled trials have been published since the publication of the 2019 *National Guidelines for the Management of Cardiovascular Diseases* which necessitated the update of some aspects of the management of CV diseases. The 2024 Focused Update addresses key changes in recommendations for the management of CV disease. Recent evidence up to 30th September 2023 was considered. Major randomized controlled clinical trials, meta-analyses, and other national guidelines were discussed, and the practice-changing evidence was included when they were deemed for beneficial clinical outcomes. Experts in the technical working group (TWG) worked on evidence in the areas of their specialization. Some of the current recommendations included 2023 *ESC Guidelines for the management of endocarditis, acute coronary syndromes, diagnosis and treatment of acute and chronic heart failure, management of cardiomyopathies, management of cardiovascular disease in patients in diabetes*, 2023 *ESH Guidelines for the management of arterial hypertension* endorsed by the International Society of Hypertension (ISH), 2020 Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease⁹, 2022 *AHA/ACC/HFSA*.

Other evidence included *Guidelines for the Management of Heart Failure, 2023*; *AHA/ACC/ACCP/ASPC/NLA/PCNA Guidelines for the Management of Patients with Chronic Coronary Disease*¹¹ among other recent publications on cardiovascular diseases.

The TWG focused on the practicality of the evidence in the Ghanaian/sub-Saharan African medico-jurisdiction, considering all the challenges facing medical practice in developing countries yet not compromising on the standard of care. The review was to ensure that all the recommendations will positively impact on morbidity and mortality. All the current recommendations are synergistic with the recommendations of the 2019 *National Guidelines for the Management of Cardiovascular Diseases*.

1.4 PROCESSES IN THE DEVELOPMENT OF CVD GUIDELINES

The review was done by the relevant stakeholders: the Ministry of Health and its agencies such the Ghana Health Service, including the NCD Control Programme, Disease Control Program as well as academia, including teaching hospitals.

The processes involved in the review of the guidelines include

- ▶ Stakeholder planning workshop
- ▶ Stakeholder selection of the relevant information and current recommendations
- ▶ Selection of writers, reviewers and editorial team
- ▶ Development of draft revised CVD Guidelines
- ▶ Stakeholder review and recommendation
- ▶ Final version submission to Ministry of Health
- ▶ Approval of the guidelines for use in Ghana

1.5 LEVEL OF EVIDENCE (LOE)

The recommendations made for the management of CVDs in these guidelines were based on data from studies or research. The weight of evidence is graded A to C as shown in *table 2* below.

Table 2: Level of evidence

Level of evidence	
Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses
Level of evidence B	Data derived from single randomized clinical trial or large non-randomized studies
Level of evidence C	Consensus of the experts and/or small studies, retrospective studies, registries

1.6 STRUCTURE/ORGANIZATION OF CVD GUIDELINES

The CVD guidelines begin with an introduction, which describes the burden of CVDs globally and narrows down to Ghana. It highlights the need for having national CVD guidelines as well as the importance of each level of healthcare in the management of CVDs. The document continues to describe CVD risk assessment and prevention, symptoms and signs of CVDs and details nine⁶ CVDs that are of high public health importance in Ghana. The structure is summarised below:

STRUCTURE OF THE CVD GUIDELINES:

- 1 Introduction
- 2 Cardiovascular diseases risk, assessment and prevention
- 3 Symptoms and signs of cardiovascular diseases
- 4 Cardiac arrest
- 5 Diseases
 - 5.1 Hypertension
 - 5.2 Stroke
 - 5.3 Chest pain, coronary artery disease and myocardial infarction
 - 5.4 Heart failure
 - 5.5 Venous thromboembolism
 - 5.6 Acute rheumatic fever
 - 5.7 Rheumatic heart disease
 - 5.8 Infective endocarditis
 - 5.9 Cardiac arrhythmias

1.6.1 LEVELS OF CARE

The levels of care and facilities available vary from region to region. The Essential Medicine List (EML) of Ghana has 7 categories of prescription to bring clarity to the medicine that can be prescribed at various levels. These categorizations include:

- Level A Community-based health planning and services (CHPS; the lowest level)
- Level M Midwifery
- Level B1 Health centre without doctor
- Level B2 Health centre with doctor
- Level C District hospital

- Level D Regional/teaching hospital
- Level SM Specialist medicines

To enhance ease of recommendation of therapy at various levels of care in Ghana, the stakeholders recommended the following levels for this CVD guideline:

Level 0 – For all levels
Level 1 – Primary level of Care A (subdistrict facilities, including health centres, CHPS,) without a doctor: A/B1
Level 2 – Primary level of Care B (Health Centre) with a doctor: B2
Level 2 – Primary level of Care B (district hospitals and polyclinics): C
Level 3 – Secondary level Care- Secondary hospital (regional hospitals): D
Level 4 – Tertiary level Care tertiary hospital (including teaching hospitals): SM

NB: Any facility with a specialist (primary, secondary or tertiary) can prescribe C, S and SD

- ▶ Management of diseases for the different levels is clearly indicated by the respective colour for easy use of the guidelines.
- ▶ Medicines outside the scope of the essential medicines list (EML) are clearly indicated by the diamond symbol ◆.

1.7 RECOMMENDED RESOURCES NEEDED FOR CVD MANAGEMENT

The WHO’s technical package for CVD management in primary health care recommends the following technologies/resources, tools and medications for primary health care facilities (for primary care facilities with only non-physician health workers, most of the medicines below are required for refill of prescriptions issued by physicians at a higher level of care).

Table 3: Various levels of care and recommended resources

Resources needed	Primary Health Facility	Secondary Health Facility	Tertiary Health Facility
Diagnostic equipment	<ul style="list-style-type: none"> ▪ Blood pressure (BP) machine ▪ Stethoscope ▪ Glucometer and strips ▪ A weighing scale ▪ A tape measure ▪ A stadiometer (for height assessment) ▪ Waist/hip charts ▪ Body Mass Index (BMI) charts ▪ Thermometer ▪ CVD risk assessment tools ▪ Strips for urinalysis 	<ul style="list-style-type: none"> ▪ Equipment in Level 1 ▪ Haematology equipment and reagents ▪ Biochemistry equipment and reagents ▪ Ophthalmoscope ▪ X-ray ▪ Electrocardiograph (ECG) machine 	<ul style="list-style-type: none"> ▪ Equipment in levels 1 and 2 ▪ Echocardiogram machine (high specification) ▪ Blood analysis: fasting blood sugar, electrolytes, creatinine, cholesterol and lipoproteins ▪ Cardiac catheterisation lab ▪ Ambulatory BP ▪ Holter monitoring device/system ▪ Holter ECG recorder/system ▪ Treadmill or bicycle ergometer for stress ECG test ▪ Facilities for telemedicine ▪ A critical care unit

Table 3: Various levels of care and recommended resources

Resources needed	Primary Health Facility	Secondary Health Facility	Tertiary Health Facility
Medications	<ul style="list-style-type: none"> ▪ Thiazide-like diuretic ▪ Diuretics (including Spironolactone and Furosemide) ▪ Beta-blockers (eg. Bisoprolol, Metoprolol) ▪ Digoxin ▪ Clopidogrel ▪ Statins (eg. Atorvastatin) ▪ ACEI/ARB (eg. Lisinopril, Losartan) ▪ Aspirin 	<ul style="list-style-type: none"> ▪ Thiazide-like diuretic ▪ Diuretics (including Spironolactone and Furosemide) ▪ Beta-blockers (eg. Bisoprolol, Metoprolol) ▪ Digoxin ▪ Warfarin ▪ Clopidogrel ▪ Statins (eg. Atorvastatin) ▪ ACEI/ARB (eg. Lisinopril, Losartan) ▪ Aspirin ▪ Calcium-channel blocker (eg. Nifedipine, Amlodipine) 	<ul style="list-style-type: none"> ▪ CVD risk medications ▪ Heart failure medications ▪ Antiarrhythmic medications ▪ Antiplatelets ▪ Advanced cardiac life support medications

1.8 PRESCRIPTION WRITING

Medicine is to be prescribed only when they are necessary in the management of a patient following a clear or probable diagnosis. In all cases, the benefit of administering the medicine should be considered in relation to the risk involved. This is particularly important in special patient populations such as pregnant women when the risk of both mother and foetus must be considered.

STANDARD PRESCRIPTIONS SHOULD:

- Be written legibly in ink, except if done through the electronic medical records (EMR)
- Be dated
- State the full name (and address if possible) of the patient
- Specify the age and weight of the patient (especially in the case of children)
- Bear the generic name of the medication and the required dosage
- Be written completely by the prescriber (certified) and not left for another person to complete
- Be signed in ink by the certified prescriber or signed electronically in EMR
- Bear the contact details of the prescriber (e.g., full name, licence or regulatory number of prescriber, facility name and telephone number)

THE FOLLOWING SHOULD BE NOTED WHEN WRITING A PRESCRIPTION:

- Names of medicines and preparations should be written in full.
- Generic names should always be used as advised by these guidelines.
- Avoid the use of unnecessary decimal points (e.g. 5mg and not 5.0mg).
- Where decimals are unavoidable, use a zero in front of the decimal point where there is no other figure (0.5ml and not .5ml).
- Quantities of 1 gram or more should be written in grams (e.g. 1g, 4g).
- Quantities less than 1 gram should be written in milligrams (e.g. 500mg and not 0.5g).
- Quantities less than 1mg should be written in micrograms (e.g. 500micrograms and not 0.5mg).
- 'Micrograms' and 'nanograms' should not be abbreviated; similarly, 'units' should not be abbreviated.
- Use the term millilitre and not cubic centimetre.
- State the dose and dosing frequency clearly. (There is a need to actually state the time interval such as 6 hourly, 8 hourly, 12 hourly every 24 hours etc instead of once daily, twice daily, 3 times or 4 times daily)

- State the quantity to be supplied and/or indicate the number of days of treatment required.
- Clearly state the route of administration; avoid the use of the parenteral route of administration except where there are clear clinical indications for this route; use the oral route whenever possible.

1.9 REFERRAL

PRIMUM NON NOCERE! FIRST, DO NO HARM!

To better serve patients, it is vital that healthcare professionals know when to refer appropriately for next level or specialized management. These guidelines make provision for referral of patients to other health facilities.

PATIENTS SHOULD BE REFERRED IF:

1. The health facility lacks the appropriate resources needed for the diagnosis and management of the patient in the form of:
 - Lack of expertise/qualified health workers
 - Lack of appropriate diagnostic tools
 - Lack of appropriate medication
2. The patient and family request for second opinion or different level of care

Patients should be referred in accordance with agreed arrangements to facilities where the necessary competence, diagnostic tools and support exist.

- ▶ Notification and prior discussion of the case should be undertaken to ensure that the receiving health facility is adequately prepared for continuity of care.

THE REFERRAL LETTER SHOULD CONSIST OF:

- Date
- Name and contact of physician/health worker and institution the patient is referred from
- Name of patient, age, sex, contact of relative
- Reason for referral
- The patient's history, clinical findings, test results and prior treatment
- The provisional diagnosis
- Initial treatment given
- Signature of the referring physician/health worker

- ▶ The referral letter should be structured clearly with headings so that the receiving clinician will find the relevant information easily.
- ▶ See *annex 1 (page 214)* for a copy of the referral letter.
- ▶ It is recommended that feedback is given to the referring clinician/health facility to help advice on future management of the patient and other patients.

FEEDBACK SHOULD INCLUDE:

- Final diagnosis
- Long term management plan including follow up instructions
- Name and contact of physician

- ▶ See *annex 2 (page 215)* for a copy of the feedback form.

FACILITATED REFERRAL

In an emergency such as stroke, heart failure, hypertensive emergencies, etc, stabilization or provision of initial therapy in consultation with the next level of care is very critical. Transportation to the next level of care should be coordinated and accompanied by a clinician in the ambulance to ensure safe transport and hand-over of the emergency cases

1.10 CONFLICT OF INTEREST

Stakeholders (writers, reviewers, funders, partners and editors) declare that they have no personal interests or benefits in the development of these CVD guidelines.

EMERGENCY CONTACTS

POLICE: 191/18555

AMBULANCE: 193/112

FIRE SERVICE: 192/999

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WHO Prescription guidelines

NOTES

2 RISK FACTORS FOR CARDIOVASCULAR DISEASES

LIST OF ABBREVIATIONS AND ACRONYMS

ABI	ANKLE BRACHIAL INDEX	HDL	HIGH-DENSITY LIPOPROTEIN
AFR	AFRICA	LDL	LOW-DENSITY LIPOPROTEIN
ASCVD	ATHEROSCLEROTIC CARDIOVASCULAR DISEASE	PAD	PERIPHERAL ARTERY DISEASE
BMI	BODY MASS INDEX	TG	TRIGLYCERIDES
BP	BLOOD PRESSURE	VLDL	VERY LOW-DENSITY LIPOPROTEIN
CAD	CORONARY ARTERY DISEASE	WHO/ISH	WORLD HEALTH ORGANIZATION/ INTERNATIONAL SOCIETY OF HYPERTENSION
CVD	CARDIOVASCULAR DISEASE	WHR	WAIST HIP RATIO
DM	DIABETES MELLITUS		
FBS	FASTING BLOOD SUGAR		

2.1 INTRODUCTION

Risk factors are conditions or unhealthy lifestyle behaviours that, when present, put people at greater likelihood of developing atherosclerotic cardiovascular diseases (ASCVD). The term ASCVD comprises: coronary artery disease, peripheral artery disease, cerebral and carotid artery disease. Some of the risk factors such as hypertension can cause CVD directly without going through atherosclerosis. For instance, hypertension can cause heart failure from hypertensive heart disease, aortic dissection and hemorrhagic stroke.

Several CVD risk factors have been identified. Early detection and management of these CVD risk factors will help prevent and/or slow the progression of CVDs. Many of these CVD risk factors are controllable (modifiable risk factors) whereas a few cannot be controlled/modified and are not dependent on lifestyle (non-modifiable risk factors)¹. However, modifiable risk factors one to have increased risk on the non-modifiable factors.

Although much of the burden of CVDs can be explained by the well-established risk factors, several emerging risk factors have been identified. The emerging risk factors for CVD become significant when added to the traditional risk factors (accelerate the development of CVDs)^{1,2,3}

Table 4: Traditional and emerging cardiovascular risk factors

Traditional cardiovascular risk factors		Emerging cardiovascular risk factors ³
Modifiable CVD risk factors	Non-modifiable CVD risk factors	
Hypertension	Age (>35yrs in males, >45yrs in females)	Chronic kidney disease
Diabetes mellitus	Family history of premature CVD (age <55yrs in males, <65yrs in females)	Left ventricular hypertrophy
Dyslipidemia (high LDL, low HDL, high Triglycerides)	Male sex	Atrial fibrillation
Obesity and overweight		Microalbuminuria
Excessive alcohol consumption		HIV infection
Tobacco smoking		Air pollution
Physical inactivity		Carotid intima media thickness
Obstructive sleep apnea		Ankle-brachial pressure index <0.9
Unhealthy diet		Hyperfibrinogenaemia
Pregnancy related:		Hyperuricemia
▪ Gestational diabetes		Hyperhomocysteinaemia
▪ Preeclampsia		Lipoprotein (a)
▪ Preterm delivery		Coronary artery calcification
▪ Intrauterine growth restriction		Chronic obstructive pulmonary disease
▪ Pregnancy loss		Raised inflammatory markers, eg. IL-6
		Vitamin D deficiency
		Arterial wall stiffness

2.2 RISK ASSESSMENT

2.2.1 TOTAL RISK ASSESSMENT

Counting the number of risk factors present in an individual does not give accurate estimate of atherosclerotic cardiovascular disease (ASCVD) risk. It is more beneficial if the ASCVD risk is expressed as

10-year or 30-year (lifetime) risk or cardiovascular age. Several risk assessment models are available for estimating the risk of initial ASCVD events in asymptomatic individuals. However, no single risk assessment model will be best suited for all patients⁴. These guidelines adopt the World Health Organization (WHO) risk assessment tool⁵.

2.2.2 WORLD HEALTH ORGANIZATION/INTERNATIONAL SOCIETY OF HYPERTENSION (WHO/ISH) RISK PREDICTION CHART

Chart for West African sub-region, which Ghana falls under. Before using the chart, make sure the following information is available: gender, age, presence or absence of diabetes, smoking status, systolic blood pressure (BP) and total blood cholesterol. For health facilities, which cannot check blood cholesterol, use the appropriate chart that does not have total cholesterol (non-laboratory chart)⁵.

I. HOW TO USE THE WHO/ISH PREDICTION CHART

Select the appropriate chart depending on the presence diabetes or laboratory results

Laboratory Based Chart

Step 1: Select diabetes or non-diabetes

Step 2: Select male or female tables.

Step 3: Select smoker or non-smoker boxes.

Step 4: Select age group box (e.g. if age is 50-59 years select 50, if 60-69 years select 60 etc.).

Step 5: Within this box or cell, find the nearest cell where the individuals' systolic blood pressure (mmHg) and total blood cholesterol level (mmol/l) cross or intercept. The colour of this cell determines the 10-year ASCVD risk of developing a stroke or heart attack which is expressed in percentages (from <10% to >40%).

Non-Laboratory-Based Chart

Step 1: Select male or female tables.

Step 2: Select smoker or non-smoker boxes.

Step 3: Select age group box (e.g. if age is 50-59 years select 50, if 60-69 years select 60 etc.).

Step 4: Select the BMI

Step 5: Within this box or cell, find the nearest cell where the individuals' systolic blood pressure (mmHg) intercept. The colour of this cell determines the 10-year ASCVD risk of developing a stroke or heart attack which is expressed in percentages (from <10% to >40%).

II. RECOMMENDED ACTION PER RISK CATEGORY

Table 5: Recommended action per risk category

Risk score	Recommended action	Evidence rating
Low 10-year risk (<10 %) LDL 3.0 mmol/l)	Reassure and encourage to maintain a healthy lifestyle (e.g. regular exercise, healthy diet etc. see below)	B
Intermediate 10-year risk (10-30 %) (LDL 2.6 mmol/l)	Engage patient in discussions on lifestyle changes and treat for hypertension, diabetes and high blood cholesterol when indicated	B
High 10-year risk (>30 %) (LDL <1.8 mmol/L)	Recommend lifestyle changes and treat for hypertension, diabetes and high blood cholesterol when indicated. Check for the presence of CVDs and treat appropriately	A

III. PRACTICAL POINTS

- Individuals with already established atherosclerotic CVD do not require the use of risk assessment tools; they are already high risk and managed as such.
- First degree relatives (parents and siblings) of individuals with high CVD risk should be advised to undergo CVD risk assessment.
- The WHO/ISH risk score may underestimate the total CVD risk in certain individuals. Therefore, treatment decisions can be made in certain cases: e.g. persistently raised BP (>160/100mmHg), or blood cholesterol (>8mmol/l), or diabetes with renal disease⁵; the chart (figure 2) shows aggregated risk scores but for a very high level of one risk, treatment can be initiated to correct or reduce this individual risk.

WHO Cardiovascular Disease Risk Laboratory-Based Charts

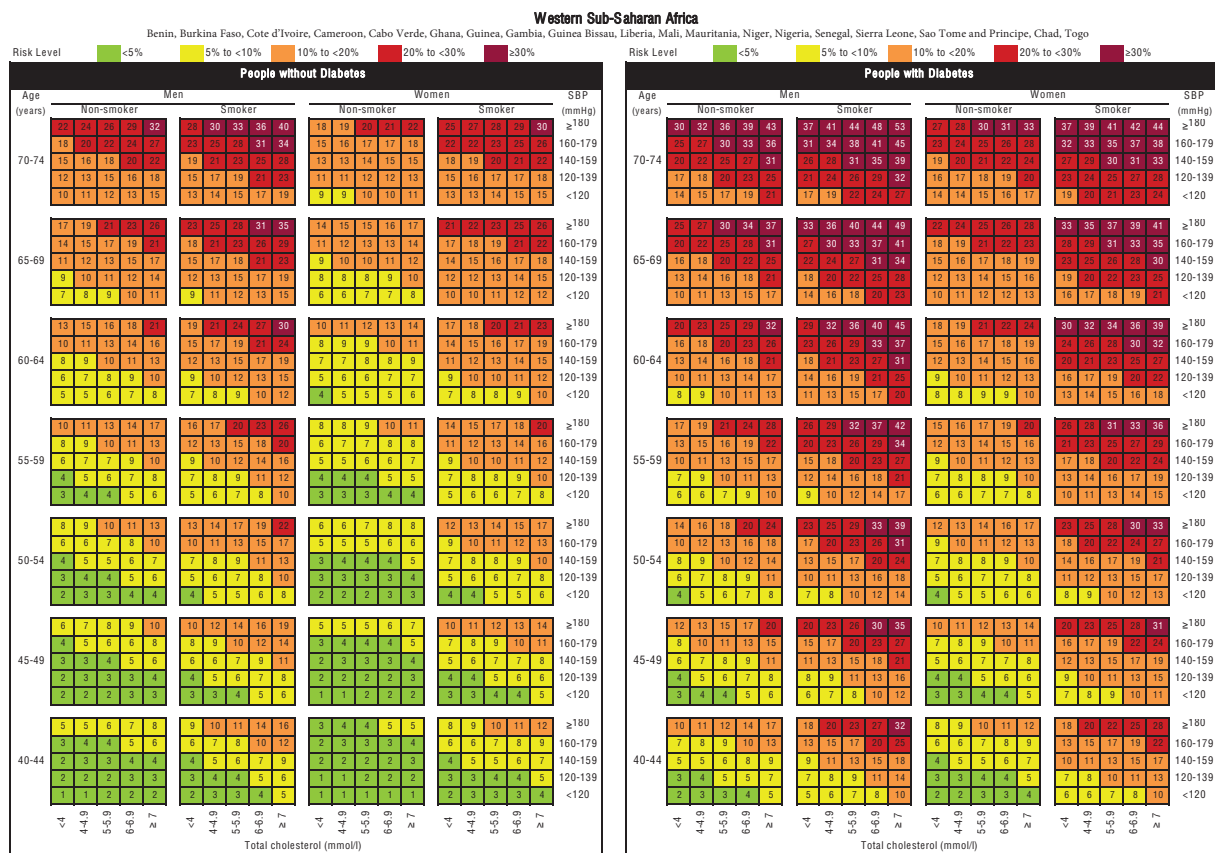


Figure 2: WHO risk chart for West Africa: laboratory-based chart (with lipid levels)

WHO Cardiovascular Disease Risk Non Laboratory-Based Charts

Western Sub-Saharan Africa

Benin, Burkina Faso, Cote d'Ivoire, Cameroon, Cabo Verde, Ghana, Guinea, Gambia, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Sao Tome and Principe, Chad, Togo

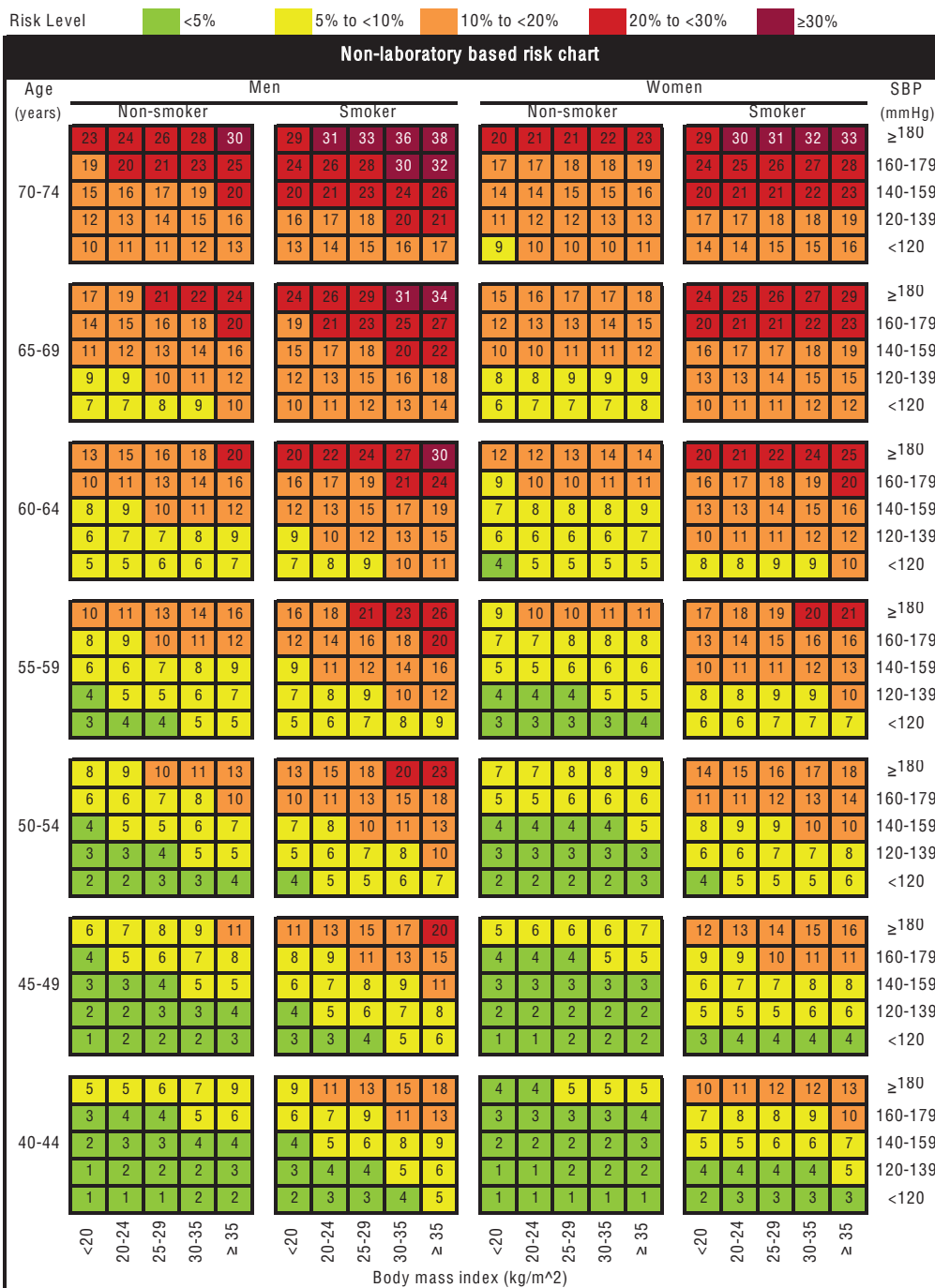


Figure 3: WHO Risk chart for West Africa: non-laboratory-based chart (without lipid levels).

2.2.3 LIFESTYLE MODIFICATION FOR THE PREVENTION AND MANAGEMENT OF CVDs

Lifestyle modification involves altering long term habits typically of eating or physical activity and maintaining the new behaviour. This is important in the prevention and management of CVDs. It requires long term commitment on the part of the health worker and patient. The specific lifestyle recommendation will depend on existing co-morbidities (other relevant medical conditions).

Lifestyle modification includes:

I. BEHAVIOURAL CHANGES

- Lifestyle modifications require a change in mindset; making small changes at a time
- Successful initiation and maintenance of lifestyle changes require commitment to the process of change
- The family and caregivers can influence the patients' lifestyle choices and should be involved in the care process
- Lifestyle recommendations must be tailored to the individual's socioeconomic status and the patient's own assessment of his self-competencies
- Patients must be guided to set realistic goals

II. STRESS MANAGEMENT

- Elevated levels of stress particularly chronic stress are associated with CVDs⁷
- Behavioural interventions for dealing with stress include having a positive outlook, healthy coping and relaxation techniques
- Patients needing professional help must be referred to the clinical psychologist

III. EATING PATTERNS

- Food composition must be individualized as "one size does not fit all" (Evidence Rating A)⁸
- In making lifestyle recommendations, the focus is not on individual nutrients (like carbohydrates, proteins, etc) but rather on meal patterns because meals are eaten in patterns rather than specific components (Evidence rating C)
- The meals recommended must take into consideration the cultural preferences of the patient
- Creating a caloric deficit is to be added for managing patients with obesity; the average adult requires about 25 to 30 kcal/kg body weight per day to maintain the current body weight; creating a deficit of about 500 kcal/day will result in gradual weight loss
- The energy requirement is activity dependent i.e. a sedentary job may require less energy than field workers or those in the construction industry
- Obesity in children is on the increase, reaching epidemic proportions; eating patterns are a learned behaviour; it is important that children are introduced to healthy options at an early age
- Where available, a diet therapist should be involved

Table 6: General nutritional recommendations

Recommendations	Evidence rating
<ul style="list-style-type: none"> Consume whole grains with high fiber content to avoid glucose surges (refined carbohydrates are absorbed faster) e.g. unpolished rice, wheat, maize⁹ 	B
<ul style="list-style-type: none"> Consume foods high in polyunsaturated fat e.g. salmon, herrings, tuna, mackerel, etc. and mono-unsaturated fat e.g. groundnuts, cashew nuts, olive oil, avocado, pear¹⁰ Avoid trans-fat e.g. margarine Limit intake of saturated fats from both plant and animal sources e.g. butter¹¹ 	A
<ul style="list-style-type: none"> Reduce total daily salt intake (dietary salt should not exceed 1 teaspoon full per day)¹² Alternative, the use potassium enrich low sodium salt should be encouraged 	AB
<ul style="list-style-type: none"> Daily intake of fruits and vegetables (consume ≥ 5 portions of fresh fruit and vegetables/day)¹³ 	AB

IV. PHYSICAL ACTIVITY

Specific recommendations must be individualized based on the presence of co-morbidities (other relevant medical conditions). Supervised physical activity is more encouraged than unsupervised activity.

Table 7: Recommendations for physical activity

Recommendations	
Type of activity	<ul style="list-style-type: none"> Outdoor (e.g. walking, cycling) Indoor (strength training, swimming, aerobics, etc.) Use the staircase instead of lift where possible
Frequency	<ul style="list-style-type: none"> Most days of the week for outdoor activities 2-3 times weekly for indoor activities
Duration	<ul style="list-style-type: none"> At least 150 minutes a week but not less than 10 minutes a stretch; depends on level of intensity and tolerance
Intensity	<ul style="list-style-type: none"> High: 80% of maximum heart rate e.g. running, skipping Moderate: 60% of maximum heart rate e.g. brisk walking, household cleaning Low-intensity: 40% of maximum heart rate e.g. strolling on level ground

V. SEDENTARY TIME AND MOBILITY BREAK

Prolonged sedentary time adversely affects cardiovascular risk²⁰⁻²² (Evidence Rating A).

Patients must therefore consciously track the amount of time they spend being sedentary. Similarly, patients should have mobility breaks after prolonged immobility.

Table 8: Sedentary time

Recommendations	Evidence rating
Patients are encouraged to break periods of prolonged sitting with brief periods of activity; 3-5 minutes for every hour of sitting	C

VI. USE OF SUBSTANCES

Table 9: Substance use and abuse

Recommendations	Evidence rating
Avoid or stop smoking; patients must be assisted to quit using tobacco and shisha	C
Reduce alcohol consumption (limit alcohol to ≤ 2 units per day men and ≤ 1 unit per day women)	B

A unit of alcohol is equivalent to:

- 1 standard glass of beer (375 ml)
- 1 small glass of wine (100 ml)
- 1 tot of spirit (30 ml)

VII. QUALITY SLEEP

For adult, 7-9 hours of sleep is required with 1.5-2 hour for REM sleep and 1-2 hours of deep sleep.

VIII. SOCIAL SUPPORT OR NETWORK

Individuals with good social support and network has reduced CVD risk. This leads to improved lifestyle choices, better management of chronic conditions, and reduced stress levels.

2.2.4 RISK MANAGEMENT THROUGH PRIMARY AND SECONDARY PREVENTION

The goal of the preventive approach is to target the modifiable risk factors by implementing measures to control them to levels where they are less likely to pose a danger for the development of ASCVD. ASCVD risk assessment has become the norm in shared-decision making with patients²³. Non-modifiable risk factors should be documented and factored into clinical decisions. Risk estimation is useful in assessing a patient's risk of developing ASCVD. (Refer to *figure 2*)

Table 10: Target levels for important cardiovascular risk factors

Modifiable risk factor	Target
Hypertension	<140/90 mmHg
Diabetes mellitus	HbA1c <7% or FBS <6 mmol/l
LDL cholesterol	Very high risk: <1.8 mmol/l, or a reduction of at least 50% reduction from baseline High risk: <2.6 mmol/l, or a reduction of at least 50% reduction from baseline Moderate risk: <2.6mmol/L with at least 50% reduction from baseline Low risk: <3.0mmol/L
HDL cholesterol	>1.0mmol/L in males, >1.2mmol/L in females
Triglycerides	<1.7mmol/L. Search for other risk factors if high
Obesity	BMI 20–25 kg/m ² Waist circumference <94cm for males, 80cm for females
Physical inactivity (PA)	150 minutes of moderate-intensity physical activity weekly, preferably 30 minutes 5-days a week
Diet	Low in saturated fat with a focus on wholegrain products, vegetables, fruit and fish Reduce total daily salt (sodium) intake. Alternatively, use of potassium-enriched low sodium salt
Smoking	Abstain from all forms of tobacco
Alcohol consumption	Reduce alcohol consumption (limit alcohol to ≤2 units per day men and ≤1 unit per day women)
Quality sleep	For adults, 7-9 hours of sleep is required with 1.5-2 hour for REM sleep and 1-2 hours of deep sleep

PRIMARY PREVENTION

MANAGEMENT OF ELEVATED LIPID LEVELS

High blood cholesterol levels increase the risk of clinical ASCVD²⁵. Among the lipoprotein carriers of serum cholesterol, low-density lipoprotein (LDL) is the primary atherogenic (bad) cholesterol. Thus, it is important to target low levels of LDL. It must be noted that there are other forms of cholesterol abnormalities, which can also lead to ASCVD such as low levels of high-density lipoprotein (HDL) and high levels of triglycerides (TG) or very low-density lipoprotein (VLDL). The use of lifestyle (non-pharmacological) and pharmacological interventions/treatment are recommended to reduce blood levels of cholesterol¹⁶.

Statins are the first line pharmacological agents used for reducing LDL cholesterol and are categorised by their potency (*table 11*) in reducing LDL levels usually in 8-12 weeks of taking the medications daily. Other medications such as Ezetimibe* and Evolocumab* can be added to statins to enhance reduction of LDL to target levels.

Table 11: Categories of statin based on potency (Adapted from Guideline on the Management of Blood Cholesterol ¹⁷)

Intensity	LDL-C lowering effect (goal)	Statins (oral)
High intensity	≥50%	Atorvastatin 40–80mg Rosuvastatin 20–40mg
Moderate intensity	30%–49%	Atorvastatin 10–20mg Rosuvastatin 5–10mg Simvastatin 20–40mg
Low intensity	<30%	Simvastatin 10mg

Table 12: Risk category and pharmacological intervention

Adult patient risk category	Recommendation/goals
20 to 39 years old with family history of premature ASCVD	<ul style="list-style-type: none"> Estimate lifetime risk and manage If LDL >4.1 mmol/l, consider statin therapy
40 to 75 years without diabetes with LDL between 1.8 and 4.9 mmol/l (3 categories)	
1. High risk	Start statin therapy with goal to reduce LDL by >50%
2. Intermediate risk	Start statin with goal to reduce LDL by 30%–49%
3. Low risk	Educate patient and encourage lifestyle changes
Adults with LDL above 4.9 mmol/l	Irrespective of the risk score, start high intensity statin therapy
Diabetes mellitus and aged 40 to 75 years (2 categories)	
1. High risk	High intensity statin otherwise use moderate intensity statin
2. Intermediate risk	Start moderate intensity statins
Age >75 years	Individualized clinical assessment, risk discussion and encourage shared-decision making

In patients with established ASCVD, the recommendation is that the “lower the better” when it comes to cholesterol management. The goals of treatment are LDL-C below 1.8 mmol/l or >50% LDL-C reduction, when target level cannot be reached¹⁸.

Control of high blood pressure is a very important measure of secondary prevention (see *chapter 5* on management of hypertension).

CURRENT RECOMMENDATION

- Inclisiran is added as one of the lipid-lowering drugs.
- Patients with established ASCVD are categorized as “very high risk”. The recommended LDL-C target for this category is less than 1.4mmol/l or >50% LDL-C reduction, when the target level cannot be achieved.
- In very high-risk ASCVD patients add Ezetimibe[♦] to the patient’s maximally tolerated statin therapy if the LDL-C level remains ≥1.4 mmol/l.
- If the LDL-C level on a maximally tolerated statin and Ezetimibe[♦] remains ≥ 1.4 mmol/l, a PCSK9 inhibitor can be added.
- Bempedoic acid and ezetimibe are considered as options when statins are not sufficient or tolerated.

2.2.5 MANAGEMENT OF DYSLIPIDAEMIAS BY LEVEL OF CARE

PRIMARY HEALTH FACILITY: SUBDISTRICT (WITHOUT A DOCTOR)

MANAGEMENT (EVIDENCE LEVEL A)

EDUCATE PATIENTS ABOUT:

- Risk factors for CVDs
- Lifestyle modification – review lifestyle habits with regards to diet, physical activity, weight/BMI, tobacco use

EMPHASISE THE IMPORTANCE OF A HEALTHY LIFESTYLE:

- Diet modification: a low calorie, low saturated fat (animal fat), high polyunsaturated fat diet is recommended under the supervision of a dietician
 - Weight reduction for overweight and obese patients
 - Reduction of alcohol consumption in patients who drink excessively
 - Regular physical activity or exercise tailored to the individual patient
- ▶ Emphasise the importance of a normal blood pressure and regular blood pressure measurement (Refer to *chapter 5* in case BP is too high).

PRIMARY HEALTH FACILITY: DISTRICT HOSPITAL

INVESTIGATION

- Fasting blood lipid profile
- Thyroid function test (if lipid levels very high)
- Plasma protein (if lipid levels very high, to exclude nephrotic syndrome)
- Urine protein (if lipid levels very high, to exclude nephrotic syndrome)
- Fasting glucose level
- Blood pressure measurement

NON-PHARMACOLOGIC MANAGEMENT (EVIDENCE LEVEL A)

EDUCATE PATIENTS ABOUT:

- Risk factors for CVDs
- Lifestyle modification – review lifestyle habits with regards to diet, physical activity, weight/BMI, tobacco use
- Potential ASCVD risk reduction from lipid-lowering therapy
- The potential adverse effects of lipid-lowering therapy

EMPHASISE THE IMPORTANCE OF A HEALTHY LIFESTYLE:

- Diet modification: a low calorie, low saturated fat (animal fat), high polyunsaturated fat diet is recommended under the supervision of a dietician
- Weight reduction in overweight and obese patients
- Reduction of alcohol consumption in patients who drink excessively
- Regular physical activity of exercise tailored to the individual patient

PHARMACOLOGIC MANAGEMENT

LOW CVD RISK

- Simvastatin, oral 10-20mg at night

MODERATE CVD RISK – DIABETES AND CVD RISK EQUIVALENTS

- Atorvastatin, oral 10-20mg daily or
- Rosuvastatin, oral 5-10mg daily or
- Simvastatin, oral 20-40mg at night

HIGH CVD RISK

- Atorvastatin, oral 40-80mg daily
- Rosuvastatin, oral 20-40mg daily

- ▶ NOTE: In all cases, assess adherence and percentage LDL reduction and lifestyle changes with repeated lipid measurement 4 to 12 weeks after statin initiation or dose adjustment, repeated every 3 to 12 months as needed¹.

REFERRAL CRITERIA:

- ▶ All patients who remain outside the target values beyond 6 months should be referred to a health facility with a specialist.
- ▶ For control of an elevated BP please refer to chapter 5.1 of these guidelines.
- ▶ For the management of diabetes please refer appropriate diabetes guidelines.

REGIONAL OR TERTIARY HEALTH FACILITY

INVESTIGATION

- Fasting blood lipid profile
- Thyroid function test (if lipid levels very high)
- Plasma protein (if lipid levels very high, to exclude nephrotic syndrome)
- Urine protein (if lipid levels very high, to exclude nephrotic syndrome)
- Fasting blood sugar
- Blood pressure measurement

MANAGEMENT (EVIDENCE LEVEL A/B)

NON-PHARMACOLOGIC MANAGEMENT (EVIDENCE LEVEL A)

EDUCATE PATIENTS ABOUT:

- Risk factors for CVDs
- Lifestyle modification: review lifestyle habits with regards to diet, physical activity, weight/BMI, tobacco use
- Potential ASCVD risk reduction from lipid-lowering therapy
- The potential adverse effects of lipid-lowering therapy

EMPHASISE THE IMPORTANCE OF A HEALTHY LIFESTYLE:

- Diet modification: a low calorie, low saturated fat (animal fat), high polyunsaturated fat diet is recommended under the supervision of a dietician
- Weight reduction in overweight and obese patients
- Reduction of alcohol consumption in patients who drink excessively
- Regular physical activity of exercise tailored to the individual patient

PHARMACOLOGIC MANAGEMENT

LOW CVD RISK

- Simvastatin, oral 10-20mg at night

MODERATE CVD RISK – DIABETES AND CVD RISK EQUIVALENTS

- Atorvastatin, oral 10-20mg daily or
- Rosuvastatin, oral 5-10mg daily or
- Simvastatin, oral 20-40mg at night

HIGH CVD RISK

- Atorvastatin, oral 40-80mg daily or
- Rosuvastatin, oral 20-40mg daily

- ▶ NOTE: In all cases, assess adherence and percentage LDL reduction and lifestyle changes with repeated lipid measurement 4 to 12 weeks after statin initiation or dose adjustment, repeated every 3 to 12 months as needed¹.

IN VERY HIGH-RISK ASCVD PATIENTS

- Add Ezetimibe[◆] to the patient's maximally tolerated statin therapy if the LDL-C level remains ≥ 1.4 mmol/l
- If the LDL-C level on maximally tolerated statin and Ezetimibe[◆] remains ≥ 1.8 mmol/l, a PCSK9 inhibitor can be added

- ▶ NOTE: Very high-risk patients include patients with a history of multiple major ASCVD events or one major ASCVD event and multiple high-risk conditions.

IN PATIENTS WITH SEVERE HYPERCHOLESTEROLAEMIA (LDL-C LEVEL ≥ 4.9 MMOL/L) (EVIDENCE LEVEL B)

- Add Ezetimibe[◆] if the LDL-C level remains ≥ 2.6 mmol
- Add a PCSK9 inhibitor if the LDL-C level on statin and Ezetimibe[◆] remains $>(2.6\text{mmol/l})$ and the patient has multiple factors that increase subsequent risk of ASCVD events
- Add Bendoic acid and Ezetimibe[◆] for those who are intolerant of statin or have inadequate control in spite of tolerable dose of statin

- ▶ For management of hypertension please refer to chapter 5.1 of these guidelines.
- ▶ For the management of diabetes please refer to the appropriate guideline.

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NOTES

3 SYMPTOMS AND SIGNS OF CARDIOVASCULAR DISEASES

LIST OF ABBREVIATIONS AND ACRONYMS

AR	AORTIC REGURGITATION	PND	PAROXYSMAL NOCTURNAL DYSPNOEA
AV	ARTERIO-VEINUS	PUD	PEPTIC ULCER DISEASE
COPD	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	RA	RIGHT ATRIUM
DIC	DISSEMINATED INTRAVASCULAR COAGULOPATHY	RVF	RIGHT VENTRICULAR FAILURE
JVP	JUGULAR VEINUS PRESSURE	SAAG	SERUM-ASCITES ALBUMIN GRADIENT
MAO	MONOAMINE OXIDASE	SLE	SYSTEMIC LUPUS ERYTHEMATOSUS
PDA	PATENT DUCTUS ARTERIOSUS	TB	TUBERCULOSIS

3.1 SYMPTOMS OF CVDs

3.1.1 DYSPNOEA

- Dyspnoea is a subjective experience of breathing discomfort; also referred to as breathlessness.
- Orthopnoea - dyspnoea on lying flat.
- Paroxysmal nocturnal dyspnoea - dyspnoea that usually occurs during sleep; wakes patient up and may be relieved by standing or sitting.
- Dyspnoea of sudden onset should be treated as a medical emergency.

CAUSES

Table 13: Causes of dyspnoea

Causes of dyspnoea		
Cardiovascular	Respiratory	Others
<ul style="list-style-type: none"> ▪ Heart failure ▪ Constrictive pericarditis ▪ Arrhythmias ▪ Pericardial effusion ▪ Pulmonary emboli 	<ul style="list-style-type: none"> ▪ Bronchial obstruction ▪ Bronchospasm/asthma ▪ Chronic obstructive pulmonary disease (COPD) ▪ Infection e.g. pneumonia, pulmonary tuberculosis ▪ Interstitial fibrosis ▪ Tumour infiltration into lungs ▪ Pleural effusion 	<ul style="list-style-type: none"> ▪ Massive ascites ▪ Anaemia ▪ Hyperviscosity syndrome ▪ Muscular atrophy

Table 14: Differentiating features of cardiac vs. respiratory dyspnoea

Differentiating features of cardiac vs. respiratory dyspnoea	
Cardiac	Respiratory
<ul style="list-style-type: none"> ▪ Cough comes after the onset of dyspnoea ▪ Orthopnoea ▪ Paroxysmal nocturnal dyspnoea (PND) common ▪ Oedema ▪ Raised jugular venous pressure (JVP) ▪ Reduced urine output ▪ Improves with diuretics 	<ul style="list-style-type: none"> ▪ Cough prominent and precedes dyspnoea ▪ Sputum production ▪ Wheezing (more common) ▪ No PND; patient may have midnight awakening with cough and sputum ▪ No orthopnoea ▪ Normal urine output ▪ No change with diuretics

3.1.2 CHEST PAIN

Chest pain is discomfort or pain, pressure or tightness that is felt anywhere along the front of the body between the neck and upper abdomen.

Pain in the chest is a symptom that should not be ignored and can result from any of the following causes (see *table 15*). *Table 16* shows the clinical classification of angina.

CAUSES

Table 15: Causes of chest pain

Causes	
Cardiac	Non-cardiac
<ul style="list-style-type: none"> ▪ Unstable angina ▪ Stable angina (chest pain on exertion) ▪ Prinzmetal angina (variant angina) ▪ Pericarditis ▪ Aortic valve stenosis ▪ Mitral valve prolapse ▪ Pericardial effusion ▪ Congenital cardiac anomalies 	<ul style="list-style-type: none"> ▪ Pulmonary origin (pneumonia, pulmonary embolism, pleuritis, pneumothorax, asthma, COPD, acute bronchitis, lung abscess) ▪ Musculoskeletal (costochondritis, trauma, muscle pain, referred pain from spine, cancer induced pain) ▪ Mediastinal (aortic dissection, mediastinitis) ▪ Gastrointestinal (oesophagitis, gastritis, peptic ulcer disease (PUD), oesophageal spasm, cholecystitis, pancreatitis) ▪ Others (herpes zoster, post herpetic neuralgia) ▪ Psychogenic (panic attacks, psychiatric disorders, anxious state)

Table 16: Clinical classification of angina¹

Clinical classification of angina	
Typical angina (definite)	Meets all three of the following characteristics <ul style="list-style-type: none"> ▪ Substernal chest discomfort of characteristic quality and duration ▪ Provoked by exertion or emotional stress ▪ Relieved by rest and/or nitrates within minutes
Atypical angina (probable)	Meets any two of the above characteristics
Non-anginal chest pain	Meets one or none of the above characteristics

3.1.3 OEDEMA

This is due to an increase in interstitial fluid volume. It typically begins in dependent body parts (legs, sacrum). Anasarca is defined as gross, generalised swelling.

CAUSES

Table 17: Causes of body swelling

Causes of body swelling		
Cardiac	<ul style="list-style-type: none"> ▪ Heart failure ▪ Constrictive pericarditis 	
Venous	<ul style="list-style-type: none"> ▪ Venous insufficiency ▪ Deep vein thrombosis 	
Renal	<ul style="list-style-type: none"> ▪ Nephrotic syndrome ▪ Renal failure 	
Pulmonary	<ul style="list-style-type: none"> ▪ Pulmonary hypertension 	
Liver	<ul style="list-style-type: none"> ▪ Liver cirrhosis ▪ Liver failure 	
Medication	<ul style="list-style-type: none"> ▪ Calcium channel blockers, e.g. nifedipine 	<ul style="list-style-type: none"> ▪ Non steroidal anti inflammatory drugs (NSAIDs)
Others	<ul style="list-style-type: none"> ▪ Hypoproteinemias ▪ Lymphoedema ▪ Pregnancy ▪ Malnutrition 	

3.1.4 HAEMOPTYSIS

- Haemoptysis, or the coughing up of blood, can range from blood-streaking of sputum, to the presence of frank blood.
- Haemoptysis has a variety of causes, but the cause can be determined in most patients. It is important to identify the cause and location of the bleeding in order to guide treatment.

CAUSES

The usual causes of haemoptysis to look out for are listed in *table 18*:

Table 18: Causes of haemoptysis

Causes of haemoptysis		
Cardiovascular <ul style="list-style-type: none"> ▪ Left ventricular failure ▪ Mitral stenosis ▪ AV malformation 	Pulmonary <ul style="list-style-type: none"> ▪ Pulmonary embolism/infarction ▪ Bronchiectasis ▪ Cystic fibrosis ▪ Bullous emphysema 	Hematologic <ul style="list-style-type: none"> ▪ Disseminate intravascular coagulopathy (DIC) ▪ Bleeding disorder ▪ Thrombocytopenia
Infections <ul style="list-style-type: none"> ▪ Pulmonary TB ▪ Lung abscess ▪ Pneumonia 	Systemic diseases <ul style="list-style-type: none"> ▪ Vasculitis ▪ Goodpasture syndrome ▪ Systemic Lupus Erythematosus (SLE) 	Neoplastic <ul style="list-style-type: none"> ▪ Lung cancer ▪ Metastatic cancer
Drugs/toxins <ul style="list-style-type: none"> ▪ Anticoagulants ▪ Aspirin ▪ Thrombolytics 	Traumatic <ul style="list-style-type: none"> ▪ Chest injuries 	Iatrogenic <ul style="list-style-type: none"> ▪ Bronchoscopy ▪ Transtracheal aspiration

3.1.5 SYNCOPE

It is a temporary loss of consciousness usually related to insufficient blood flow to the brain or cerebral hypoperfusion characterised by rapid onset, short duration, and spontaneous complete recovery.

It does not only carry the potential of harm to the patient but frequently carries a poorer prognosis when it is due to an underlying heart disease. This presentation should be distinguished from causes of transient loss of consciousness that are not due to global hypoperfusion such as seizure or hypoglycaemia and from presentations that may resemble transient loss of consciousness such as falls. Syncope should be differentiated from dizziness, presyncope, near-fainting and vertigo.

CAUSES

Table 19: Causes of syncope²

Non-cardiac	Cardiac
<ul style="list-style-type: none"> ▪ Reflex/neurogenic: <ul style="list-style-type: none"> ▪ Vasovagal 20-33% of all cases of syncope ▪ Carotid sinus hypersensitivity ▪ Situational (e.g. micturition, defecation, cough, swallowing) ▪ Orthostatic hypotension (volume depletion, medicine, autonomic dysfunction) ▪ Vertebrobasilar disease 	<ul style="list-style-type: none"> ▪ Arrhythmias: tachyarrhythmias and bradyarrhythmias ▪ Myocardial infarction or heart attack ▪ Structural: aortic stenosis, hypertrophic obstructive cardiomyopathy ▪ Pulmonary embolism ▪ Aortic dissection ▪ Cardiac tamponade ▪ Atrial myxoma

FEATURES DISTINGUISHING SYNCOPE FROM SEIZURES²

Table 20: Symptoms of syncope and seizure

Favours syncope	Favors seizure
<ul style="list-style-type: none"> ▪ Presyncope or preceded by dizziness ▪ Loss of consciousness after prolonged standing or sitting ▪ Sweating before the fall ▪ Short duration with spontaneous recovery 	<ul style="list-style-type: none"> ▪ Waking with tongue bite ▪ Postictal confusion or sleep ▪ Prodromal déjà vu or jamais vu

3.1.6 PALPITATIONS

Palpitations are defined as an unpleasant awareness of the forceful, rapid, or irregular beating of the heart. Below are some causes of palpitations (*table 21*).

Table 21: Causes of palpitation

Cardiac	Non-cardiac
<ul style="list-style-type: none"> ▪ Atrial fibrillation/flutter ▪ Atrial myxoma ▪ Atrial premature contractions ▪ Atrioventricular re-entry ▪ Cardiomyopathy ▪ Multifocal atrial tachycardia ▪ Sick sinus syndrome ▪ Supraventricular tachycardia ▪ Valvular heart disease ▪ Ventricular premature contractions ▪ Ventricular tachycardia 	<ul style="list-style-type: none"> ▪ Anaemia ▪ Alcohol ▪ Anxiety/stress ▪ Coffeine ▪ Cocaine ▪ Exercise ▪ Fever ▪ Hypoglycemia ▪ Nicotine ▪ Pheochromocytoma ▪ Pregnancy ▪ Hyperthyroidism ▪ Withdrawal of medications, e.g. Beta-blockers

3.2 SIGNS OF CVDS

3.2.1 GENERAL APPEARANCE

Although cardiac patients may appear healthy and comfortable at rest, patients with underlying CVD may have any or some of the following:

Table 22: General signs of CVD

Signs	Some associated conditions
Anxiety and restlessness	MI, hyperthyroidism
Diaphoresis/sweating	Tachyarrhythmias, MI, hyperthyroidism, cardiac tamponade
Cold clammy extremities and pallor	Low cardiac output states e.g. heart failure (HF), anaemia, shock
Cardiac cachexia	Severe chronic heart failure and other long-standing low cardiac output states.

3.2.2 DYSPNOEA AT REST (TACHYPNOEA)

This is increased respiratory rate or laboured breathing. It may be due to a heart disease or a respiratory disease (*refer to table 13*). The patient may be dyspnoeic on lying flat, and comfortable when he/she sits up.

3.2.3 OEDEMA

- May be present and pitting in nature and extent quantified
- Severe right heart failure may also be present with ascites and scrotal/vulvar oedema
- Anasarca is defined as gross, generalized oedema

3.2.4 ABNORMAL PULSE

Abnormal pulse may be a sign of cardiac disease.

- It may be rapid (>120bpm) or slow (<40bpm)
- It may be weak or thread
- It may be irregular
- It may be strong and bounding

Jugular venous pulse provides insight into the right heart pressure and function.

Table 23: Pulse and associated condition

Pulse	Associated condition
Diminished peripheral pulse	Peripheral vascular disease
Asymmetric pulse	Coarctation of aorta/aortic dissection Subclavian steal syndrome
Delayed upstroke in the carotid pulse (anacrotic pulse)	Aortic stenosis
Biphasic pulse/pulsus bisferiens	Aortic stenosis and aortic regurgitation, as well as hypertrophic cardiomyopathy causing subaortic stenosis
Pulsus paradoxus	Asthma, chronic obstructive pulmonary disease (COPD), pericardial tamponade
Pulsus alternans	Left ventricular failure
Collapsing pulse (water-hammer pulse/Corrigan's pulse)	Aortic regurgitation (AR), hyperdynamic circulation, patent ductus arteriosus (PDA), peripheral artero-venous fistula, arteriosclerotic aorta
Raised jugular venous pressure	Tricuspidal stenosis/regurgitation, hyperdynamic circulation, pericardial effusion, constrictive pericarditis, fluid overload, superior vena cava obstruction

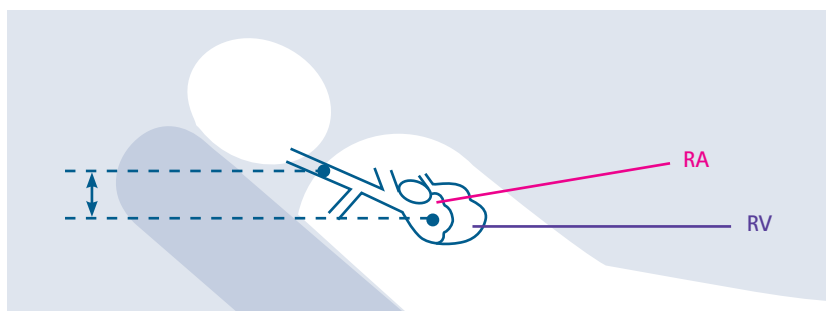


Figure 4: Measurement of jugular venous pressure
(Adapted from:
Maxine A. Papadakis,
Stephen J. McPhee,
Michael W. Rabow;
Current Medical Diagnosis
+ Treatment 2019)

3.2.5 ABNORMAL BLOOD PRESSURE

Abnormal blood pressure may be low or high.

- ▶ For blood pressure classification refer to *chapter 5.1* on hypertension.

3.2.6 CYANOSIS

- Cyanosis is defined as the bluish discoloration of the skin and mucous membranes due to hypoxia. It may be central or peripheral
- Central due to arterial desaturation or hypoxia from pulmonary disease, left heart failure, or right-to-left intracardiac or intrapulmonary shunting; the latter will not be improved by increasing the inspired oxygen concentration
- Peripheral cyanosis reflects impaired tissue delivery of adequately oxygenated blood e.g. in low-output states, polycythaemia or peripheral vasoconstriction

3.2.7 CLUBBING

- Occurs in chronic cyanotic states; it may be due to congenital heart diseases; other causes include non-cardiac conditions such as respiratory diseases and gastrointestinal diseases
- Differential clubbing of the toes but not the fingers suggest pulmonary hypertension related to a patent ductus arteriosus and a right to left shunt through the ductus

3.2.8 APEX BEAT

It is the most inferior, most lateral point on the precordium (anterior area of the chest covering the heart) at which the cardiac impulse can be felt. A displaced apex beat usually implies enlargement of the heart, called cardiomegaly.

3.2.9 PARASTERNAL HEAVES (LIFT) AND THRILLS

A parasternal heave (or lift) is a precordial impulse that may be felt (palpated) in patients with cardiac or respiratory disease. It usually suggests the presence of dilatation, as in right ventricular dilatation of severe pulmonary hypertension. A thrill is a vibratory sensation on the hand, frequently in the auscultatory areas of the valves. A thrill therefore is a palpable murmur.

3.2.10 HEART SOUNDS

Table 24: Heart sounds

Normal heart sounds	S1	S2
Event	Closure of atrioventricular valves	Closure of semilunar valves
Pitch	lower	higher
Duration	longer	shorter
Point of maximum intensity	Apex/mitral area	Base of heart
Pathological heart sounds	S3	S4
Event	Caused by turbulent flow into ventricles (rapid ventricular filling)	Atrial contraction against a stiff (non-compliant) ventricle
Pitch	Low	Low
Significance	Ventricular dilation May be heard in children and young adults (<40 years), but usually pathological in old age which may signify heart failure	Atrial dilatation in conditions like hypertensive heart disease and aortic stenosis

3.2.11 CARDIAC MURMURS

Cardiac or valvular dysfunction may lead to turbulent or abnormal flow called murmurs which are heard using the stethoscope. *Table 25* shows some cardiac diseases that give rise to murmurs and where they can best be heard.

Table 25: Cardiac murmurs

Valve	Side best auscultated	Location
Mitral	Left	5th intercostal space, midclavicular line
Aortic	Right	2nd intercostal, right sternal border
Tricuspid	Left	4th intercostal space, left sternal border
Pulmonary	Left	2nd intercostal space, left sternal border
Cardiac lesion	Murmur	Location
Mitral incompetence	Pansystolic murmur	Apex radiating to the axilla
Mitral stenosis	Mid-late diastolic rumbling murmur	Apex
Aortic incompetence	Early diastolic murmur	Left sternal edge
Aortic stenosis	Ejection systolic	Aortic area radiating to the neck/carotid artery
Tricuspid incompetence	Pansystolic murmur	Left sternal edge
Tricuspid stenosis	Mid-late diastolic murmur	Left sternal edge
Pulmonary incompetence	Early diastolic murmur	Left sternal edge
Pulmonary stenosis	Ejection systolic murmur	Left sternal edge

3.2.12 HEPATOMEGALY AND ASCITES

THESE SIGNS COULD POINT TO AN UNDERLYING CARDIAC DISEASE SUCH AS:

- Congestive heart failure
- Right-sided heart failure
- Constrictive pericarditis
- Endomyocardial fibrosis

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4 CARDIAC ARREST

LIST OF ABBREVIATIONS AND ACRONYMS

ACS	ACUTE CORONARY SYNDROME	ICD	IMPLANTABLE CARDIOVERTER DEFIBRILLATOR
ACLS	ADVANCED CARDIAC LIFE SUPPORT	MI	MYOCARDIAL INFARCTION
BLS	BASIC LIFE SUPPORT	SCD	SUDDEN CARDIAC DEATH
CAD	CORONARY ARTERY DISEASE	VT	VENTRICULAR TACHYCARDIA
CPR	CARDIOPULMONARY RESUSCITATION	VF	VENTRICULAR FIBRILLATION

4.1 INTRODUCTION

Sudden cardiac death (SCD) from cardiac arrest is the largest cause of natural death worldwide and is responsible for half of all heart disease deaths. Although resuscitation rates are improving throughout the world, the majority of individuals who suffer a sudden cardiac arrest will not survive¹. Such rapid deaths are often due to lethal ventricular arrhythmias in the setting of underlying coronary artery disease¹. In Africa, the hypertensive heart disease, cardiomyopathies and rheumatic heart disease account for most cardiac arrest².

DEFINITION

Cardiac arrest is the abrupt loss of heart function from the failure of the heart to pump effectively. Sudden cardiac arrest occurs when the heart develops an abnormal rhythm/function and can't pump blood. Cardiac arrest is often fatal if appropriate steps are not taken immediately³.

EPIDEMIOLOGY

Cardiac arrest is a major international public health problem accounting for an estimated 15–20% of all deaths.¹ Cardiac arrest resulting in sudden death is most common in adults with acquired structural heart disease, but it also rarely occurs in younger individuals with inherited disorders. Coronary artery disease is known to be the most common **underlying pathology**.

PREVENTION OF CARDIAC ARREST IN THE HOSPITAL AND COMMUNITY

For patients on admission, cardiac arrest can be prevented by regular surveillance of patients with cardiac, respiratory, shock, etc. Before cardiac arrest, some of the patients will go into peri-arrest state which, when not managed properly, can progress to cardiac arrest and sudden cardiac death.

- ▶ Preventing cardiac arrest in the community involves improving heart health and emergency preparedness.

CLASSIFICATIONS

Cardiac arrest is often classified into „shockable“ versus „non-shockable“, as determined by the ECG rhythm to refer to whether the cardiac dysrhythmia is treatable using defibrillation. The two „shockable“ rhythms are ventricular fibrillation and pulseless ventricular tachycardia while asystole and pulseless electrical activity are „non-shockable“.

AETIOLOGY

Coronary artery disease (CAD) is responsible for more than half of all SCDs resulting from cardiac arrest. Other structural heart disease (not related to CAD) account for 10% of all SCDs. Congestive heart failure, from whatever cause, increases the risk of SCD fivefold. Inherited arrhythmia syndromes in the setting of a structurally normal heart accounts for 5 to 10% of sudden cardiac arrests.

These are usually caused by genetic mutations of ion channels (channelopathies) that lead to a predisposition to fatal arrhythmias. Examples of these inherited arrhythmia syndromes include Long QT syndrome, Brugada syndrome and Short QT syndrome (these are ECG abnormalities that lead to dangerous ventricular arrhythmias).

In Africa, hypertensive heart disease, cardiomyopathies (peripartum cardiomyopathy, idiopathic dilated cardiomyopathy and endomyocardial fibrosis), pericardial disease and rheumatic valvular heart disease account for most cases of cardiac arrest³.

The most common reversible causes of cardiac arrest are summarized below (5Ts and 5Hs):

5Hs:

- Hypovolaemia
- Hypoxia
- Hydrogen ions (acidosis)
- Hypo-/Hyperkalaemia
- Hypo-/Hyperglycaemia

5Ts:

- Tension pneumothorax
- Tamponade (cardiac)
- Toxins (including drugs)
- Thrombosis (pulmonary embolism)
- Thrombosis (ACS or MI)

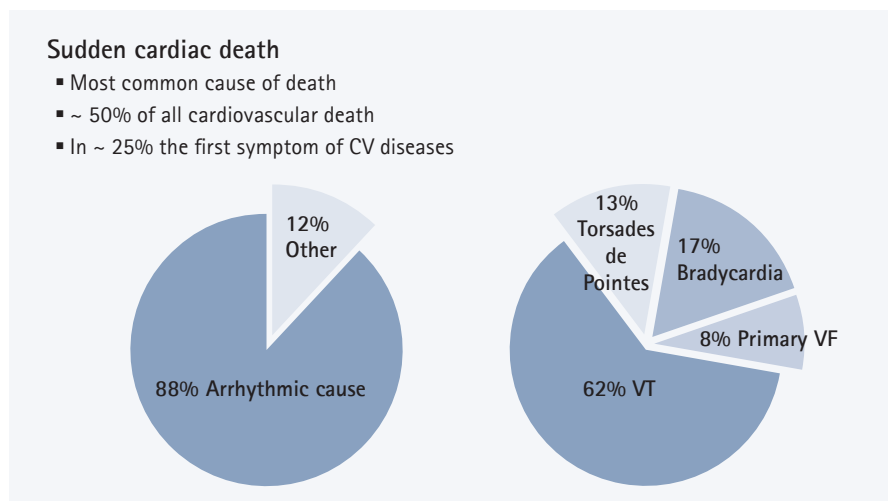


Figure 5: Causes of cardiac arrest and sudden cardiac death

PHASES OF CARDIAC ARREST

Cardiac arrest needs prompt intervention to prevent death because the window of opportunity for survival is very short. Figure 5 shows the phases of cardiac arrest which is commonly caused by VF. Best chance of survival occurs at the electrical phase.

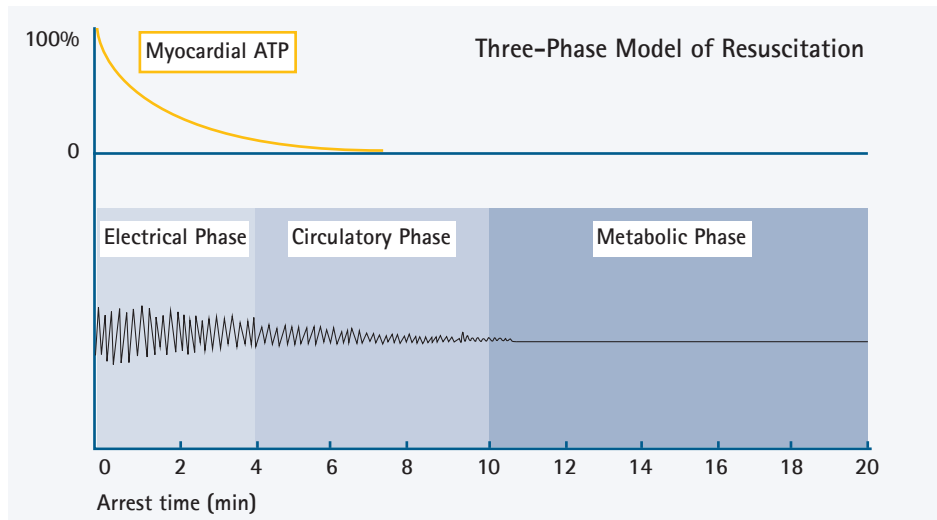


Figure 6: The three phases of cardiac arrest by Westfeldt and Becker (Adapted from JAMA 2002)

4.2 CLINICAL PRESENTATION OF CARDIAC ARREST

Cardiac arrest is not preceded by any warning symptoms in approximately half of victims. For those who do experience symptoms, they may include a new or worsening chest pain, fatigue, blackouts, dizziness, shortness of breath, weakness or vomiting. Cardiac arrest will be accompanied by a lack of palpable pulses in the victim. As a result of loss of cerebral perfusion, the victim will rapidly lose consciousness and breathing will stop.

4.3 CARDIAC ARREST AND EMERGENCY RESPONSE CAPACITY

PREVENTION OF CARDIAC ARREST

PLEASE NOTE: CARDIAC ARREST CAN OCCUR AT ANYTIME AND ANY PLACE IN SEEMING HEALTHY INDIVIDUALS.

The general public and the health system in Ghana should build capacity in manpower, infrastructure and system to manage cardiac arrest. The capacity building should include but not be limited to:

1. Training of pupils and students of primary, secondary and tertiary educational institutions in basic life support (BLS).
2. Training commercial drivers and security agencies in first aid and basic life support (BLS).
3. Provision of Automated External Defibrillators (AED) at large institutions such as banks, schools, churches, mosques, airports, ports/harbours and ministries.
4. Training of health professionals in basic and advance resuscitation:
 - Pre-service training of Community Health Workers (CHO), midwives and nurses in basic life support
 - (BLS) and training of physician assistants and doctors in advance cardiac life support (ACLS)
 - In-service training (continuous professional development (CPD)) of CHO, midwives and nurses in basic life support (BLS), and training of physician assistants and doctors in advance cardiac life support (ACLS)
5. Formation of emergency response teams in health facilities.

Each health facility should have a dedicated team to respond to emergencies at various units.

The team should be able to respond to emergencies within 5 minutes. This requires that for each day and shift, there would be a team with requisite skills, equipment and medications to respond to emergencies.

6. Paramedics should have requisite training and skills in resuscitation.
7. Ambulances should have the requisite equipment and medicines necessary for resuscitation and care of the sick.
8. Clear lines of communication between the referring and receiving health institutions to ensure continuity of care and to prevent unnecessary delays.

4.4 MANAGEMENT OF CARDIAC ARREST ACCORDING TO LEVEL OF CARE

Sudden cardiac arrest is an emergency. Cardiopulmonary resuscitation (CPR) beginning with chest compressions should commence immediately after securing scene safety and calling for help. Defibrillation should be attempted as soon as it is available, and the rhythm is “shockable” (see AHA adult cardiac arrest algorithm: *figure 6 and 7*).

PRIMARY LEVEL FACILITIES: SUB-DISTRICTS (WITHOUT A DOCTOR)

- ▶ Refer to BLS healthcare provider adult cardiac arrest algorithm.

LABORATORY INVESTIGATIONS

- Random blood sugar
- Full blood count
- ▶ NB: Laboratory investigations should not delay patient referral after Return of Spontaneous Circulation (ROSC), until the heart can sustain itself without CPR. A second ECG should be done if ROSC is achieved. Refer Fig 8 for post cardiac arrest care or immediately after ROSC

PHARMACOLOGICAL TREATMENT

- ▶ Refer patient to a facility with a doctor as soon as patient develops a pulse (ROSC).
Give oxygen if hypoxaemic (SpO₂ < 90%)

PRIMARY LEVEL FACILITIES : DISTRICT HOSPITALS

- ▶ Refer to adult cardiac arrest algorithms (BLS and ACLS see *figure 7 and 8*).

LABORATORY AND OTHER INVESTIGATIONS

- Full blood count
- Random blood sugar
- Blood urea and electrolytes

- Arterial blood gases (ABGs)
- Thyroid function
- Liver function
- Lipid profile
- Electrocardiogram
- Chest X-ray

PHARMACOLOGICAL TREATMENT

Identify reversible causes (H's and T's as above) and treat accordingly after Return of Spontaneous Circulation (ROSC).

- ▶ Refer to facility with a physician specialist after ROSC.

SECONDARY AND TERTIARY LEVEL FACILITIES: REGIONAL AND TEACHING HOSPITALS

- ▶ Refer to adult cardiac arrest algorithms (BLS and ACLS see figure 7 and 8).

LABORATORY AND OTHER INVESTIGATIONS

- Full blood count
- Random blood sugar
- Blood urea and electrolytes
- Arterial blood gases (ABGs)
- Thyroid function
- Liver function
- Lipid profile
- Cardiac enzymes
- Electrocardiogram
- Chest X-ray
- Echocardiogram

PHARMACOLOGICAL TREATMENT AND DEVICE THERAPY

- Identify and treat reversible causes (H's and T's)
- Consider targeted temperature management
- Treat underlying structural and coronary heart disease
- Consider secondary prevention strategies in consultation with cardiologist (e.g. Beta-blockers and Implantable cardioverter defibrillator (ICDs))

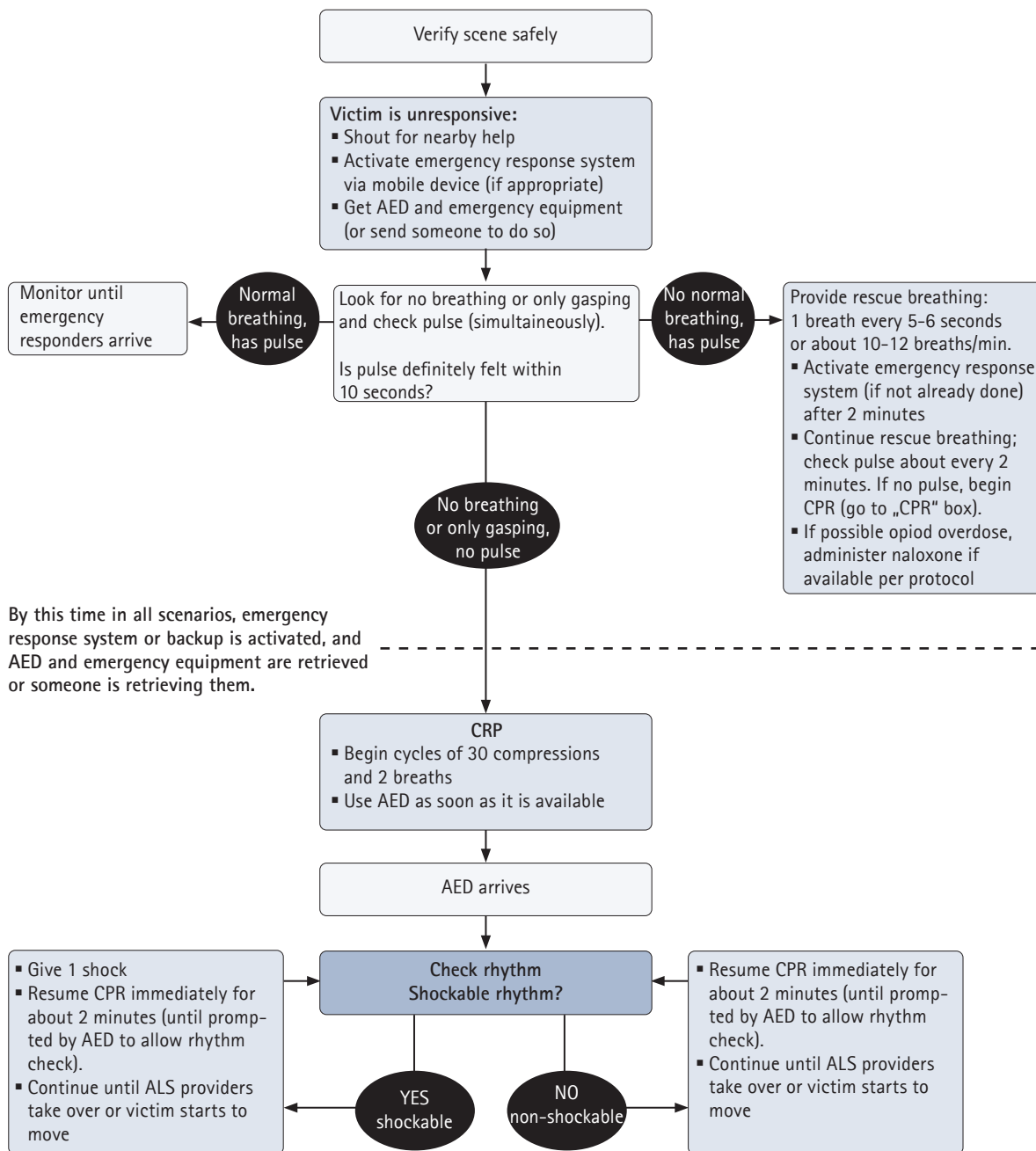


Figure 7:
Basic Life Support (BLS) Algorithm (Adapted from American Heart Association 2, 2015)

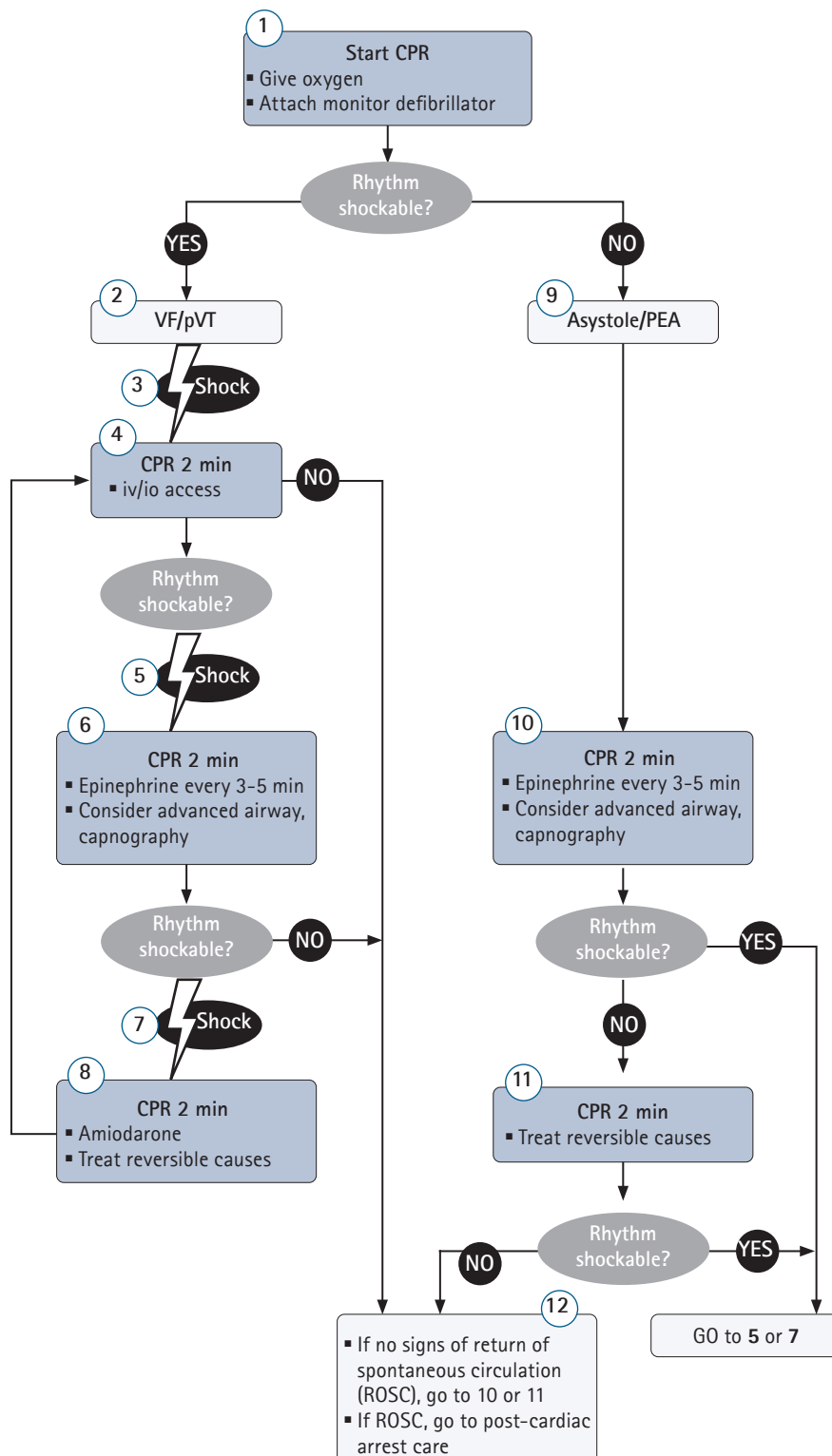


Figure 8:
Advance Cardiac Life Support (ACLS) Algorithm (Adapted from American Heart Association 2, 2015)

- Further explanations for *figure 7* can be found in the table on the *below*.

Table 26: Advance Cardiac Life Support (ACLS)

CPR quality	
<ul style="list-style-type: none"> ▪ Push hard (at least 2 inches (5 cm) and fast (100-120/min) and allow complete chest recoil ▪ Minimize interruptions in compressions ▪ Avoid excessive ventilation. ▪ Change compressor every 2 minutes, or sooner if fatigued ▪ If no advanced airway, 30:2 compression-ventilation ratio ▪ Quantitative waveform capnography ▪ If PETCO₂ <10 mmHg, attempt to improve CPR quality ▪ Intra-arterial pressure ▪ If relaxation phase (diastolic) pressure <20 mmHg, attempt to improve CPR quality 	
Shock energy of defibrillation	
<ul style="list-style-type: none"> ▪ Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available ▪ Second and subsequent doses should be equivalent, higher doses may be considered ▪ Monophasic: 360 J 	
Drug therapy	
<ul style="list-style-type: none"> ▪ Epinephrine iv/io dose: 1mg every 3-5 minutes ▪ Amiodarone iv/io: first dose: 300mg bolus; second dose: 150mg 	
Advanced airway	
<ul style="list-style-type: none"> ▪ Endotracheal intubation or supraglottic advanced airway ▪ Waveform capnography or capnometry to confirm and monitor ET tube placement ▪ Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions 	
Return of spontaneous circulation (ROSC)	
<ul style="list-style-type: none"> ▪ Pulse and blood pressure ▪ Abrupt sustained increase in PETCO₂ (typically ≥ 40 mmHg) ▪ Spontaneous arterial pressure waves with intra-arterial monitoring 	
Reversible Causes	
<ul style="list-style-type: none"> ▪ Hypovolemia ▪ Hypoxia ▪ Hydrogen ion (acidosis) ▪ Hypo-/hyperkalemia ▪ Hypothermia 	<ul style="list-style-type: none"> ▪ Tension pneumothorax ▪ Tamponade, cardiac ▪ Toxins ▪ Thrombosis, pulmonary ▪ Thrombosis, coronary

ADDITIONAL CURRENT RECOMMENDATIONS

- Early administration of epinephrine is recommended:
 - As soon as appropriate in a non-shockable rhythm
 - It may be reasonable to administer epinephrine after initial defibrillation attempt has failed cardiac arrest with a shockable rhythm.
- Double sequential defibrillation for refractory shockable rhythm has not been established as a useful modality of management
- Cardiac arrest survivors are recommended to have rehabilitation assessment and treatment for physical, neurologic, cardiopulmonary, and cognitive impairments before discharge

- For Pregnant women with cardiac arrest the focus should be on:
 - High-quality CPR
 - Avoidance of aortocaval compression by left lateral uterine displacement
 - Fetal monitoring should not be undertaken during cardiac arrest in pregnancy because of likely interference with resuscitation
 - Continuous fetal monitoring for bradycardia during targeted temperature management (to keep temperature at 32-36°) as a potential complication
- Giving medications intravenously is preferred over intraosseous (bone) route

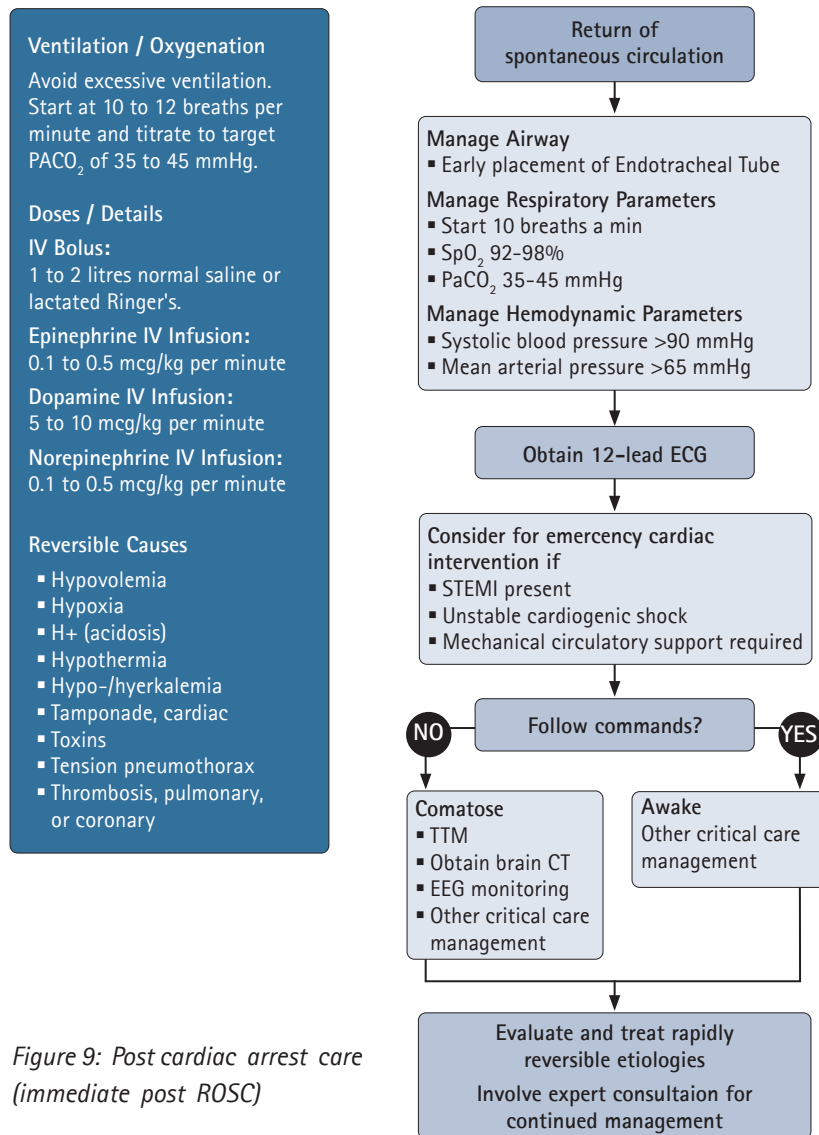


Figure 9: Post cardiac arrest care (immediate post ROSC)

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5 DISEASES

5.1 HYPERTENSION

LIST OF ABBREVIATIONS AND ACRONYMS

ABPM	AMBULATORY BLOOD PRESSURE MONITORING	FBS	FASTING BLOOD SUGAR
ACEI	ANGIOTENSIN CONVERTING ENZYME INHIBITOR	HF	HEART FAILURE
ACS	ACUTE CORONARY SYNDROME	HPT	HYPERTENSION
ARB	ANGIOTENSIN RECEPTOR BLOCKER	LVH	LEFT VENTRICULAR HYPERTROPHY
BB	BETA-BLOCKER	MI	MYOCARDIAL INFARCTION
BP	BLOOD PRESSURE	NSAIDS	NONSTEROIDAL ANTI-INFLAMMATORY DRUG
CCB	CALCIUM CHANNEL BLOCKER	OPD	OUTPATIENTS' DEPARTMENT
CKD	CHRONIC KIDNEY DISEASE	PRN	AS NEEDED/REQUIRED
CVD	CARDIOVASCULAR DISEASE	SBP	SYSTOLIC BLOOD PRESSURE
DBP	DIASTOLIC BLOOD PRESSURE	TSH	THYROID STIMULATING HORMONE

5.1.1 INTRODUCTION

DEFINITION

"Hypertension is defined as systolic blood pressure (SBP) values ≥ 140 mmHg and/or diastolic blood pressure (DBP) values ≥ 90 mmHg"¹. This definition applies to those, who are 18 years and above. For children and teenagers, BP centiles are preferred in diagnosing hypertension^{1,2}.

- White coat office (clinic or OPD) hypertension is a form of hypertension in untreated patients where the BP is persistently elevated when measured in the clinic but normal when measured outside the clinic using ambulatory blood pressure monitoring (ABPM) and/or home blood pressure monitoring (HBPM)^{1,2}.
- Masked ambulatory hypertension is a form of hypertension in untreated patients where the BP is normal in the office/clinic but elevated when measured outside the office using ABPM and/or HBPM^{1,2}.

EPIDEMIOLOGY

The prevalence of hypertension in Ghana is 27.3% among adults. In 2020 19% of Ghanaians were aware of their hypertension status, 67.6% of those who were aware were on treatment and of those on treatment only 11.6% had their BPs under control³. There is a continuous relationship between increase in BP and the risk of stroke, CKD, HF, and the development and progression of CKD.

CLASSIFICATION

*Table 27: Classification of hypertension¹
(Adapted from the 2018 ESC/ESH Guidelines for the Management of Arterial Hypertension)*

Category	Systolic Blood Pressure (mmHg)	and/or	Diastolic (Blood Pressure mmHg)
Optimal	<120	and	<80
Normal	120-129	and/or	80-84
High normal	130-139	and/or	85-89
Grade 1 hypertension	140-159	and/or	90-99
Grade 2 hypertension	160-179	and/or	100-109
Grade 3 hypertension	≥ 180	and/or	100-109
Isolated systolic hypertension	≥ 140	and	<90

5.1.2 AETIOLOGY

The causes of hypertension are classified into two main groups: primary and secondary hypertension.

PRIMARY OR ESSENTIAL HYPERTENSION

The cause of this form of hypertension is multifactorial; mainly driven by lifestyle behaviours such as excess salt throughout life, insufficient potassium intake throughout life, inadequate physical inactivity,

overweight, etc. It is however the most common form of hypertension and contributes to about 90% of cases in adults⁴. Primary hypertension is largely preventable through healthy lifestyle measures.

RISK FACTORS FOR PRIMARY OR ESSENTIAL HYPERTENSION

Table 28: Risk factors of primary or essential hypertension

Non-modifiable risk factors	Modifiable risk factors	
1. Age (above 45 in men and 55 years in women)	1. Overweight/central obesity	8. Alcohol abuse
2. Race (more in black population)	2. Sedentary lifestyle	9. Weight gain or loss in the past
3. Family history	3. Smoking	10. History of erectile dysfunction
	4. High salt intake	11. History of sleep apnoea or snoring
	5. Low potassium consumption	12. Distress at work/home
	6. Low vitamin D	13. Long-term cancer survival
	7. Stress	

SECONDARY HYPERTENSION

This form is due to an underlying cause that can be diagnosed and treated. It contributes to about 10% of people with hypertension, and may account for up to 50% of cases of resistant hypertension⁴. Common causes are listed in the *table 29* below.

Table 29: Causes of secondary hypertension and important clinical features^{2,7}

Aetiology	Clinical features
Renal	
Renal parenchymal disease: <ul style="list-style-type: none"> ▪ Chronic glomerulonephritis ▪ Adult polycystic disease ▪ Chronic tubulointerstitial nephritis 	Periorbital oedema, nocturia, generalized body swelling, anaemia
Renal artery stenosis	Renal artery bruit
Endocrine	
Conn's syndrome	Muscle weakness or spasms, hypokalaemia, metabolic alkalosis
Cushing's syndrome	Obesity, increased abdominal girth, purple striae, moon face
Phaeochromocytoma	Palpitations, diaphoresis, headaches
Thyroid disease	Hyperthyroidism: weight loss despite increased appetite, excessive sweating, heat intolerance Hypothyroidism: weight gain, cold intolerance, constipation, lethargy, fatigue, hair loss
Acromegaly	Coarse facial appearance, headache, visual impairment, large hands and feet
Hyperparathyroid disease	Bone + joint pains, abdominal pain, fatigue, nausea, vomiting, polyuria, kidney stones
Adrenal hyperplasia	Muscle weakness or spasms, hypokalaemia, metabolic alkalosis
Cardiovascular	
Aortic coarctation	Radio-femoral delay, bruit
Medication	
Oral contraceptives, steroids, vaso-pressin, non steroidal anti-inflammatory drugs (NSAIDs), psychoactive/recreational drugs (amphetamines, cocaine)	Look out for these medicines in the patient's history
Others	
Obstructive sleep apnoea	Apnoeic during sleep, daytime sleepiness, snoring

5.1.3 CLINICAL PRESENTATION

SYMPTOMS¹⁻³

Hypertension is the leading cause of death in sub-Saharan Africa yet hypertension is generally asymptomatic. Onset of symptoms generally heralds onset of complications such as eye, heart and kidney disease.

OCCASIONALLY HYPERTENSIVES MAY HAVE THE FOLLOWING SYMPTOMS:

- Palpitation
- Headache
- Breathlessness
- Chest pain
- Easy fatigability
- Transient loss of consciousness
- Visual disturbance
- Seizure

OTHER FEATURES OF INTEREST DURING THE CLINICAL ENCOUNTER INCLUDE:

- Time of the first diagnosis of hypertension, including records of any previous medical screening or hospitalization
- Stable or rapidly increasing BP
- Recordings of current and past BP values by self-BP measurements
- Current/past antihypertensive medications including their effectiveness and intolerance.
- Adherence to therapy for previous hypertension in pregnancy/preeclampsia

Drugs that predispose to hypertension include⁵:

- Paracetamol (acetaminophen)
- Immunosuppressive drugs
- Anticancer drugs
- Nasal vasoconstrictors

SIGNS¹⁻³

The signs seen are usually due to the underlying pathology or complication of the hypertension.

- Displaced apex due to enlarged heart
 - Renal bruit (renovascular hypertension)
 - Radio-femoral delay (coarctation of aorta)
 - S3 heart sound (heart failure)
 - S4 heart sound (hypertensive heart disease)
 - Flame-shaped haemorrhages, cotton wool spots and papilloedema in the eye
- ▶ Refer to *chapter 3* on symptoms and signs for further information.

BLOOD PRESSURE (BP) MEASUREMENT

BLOOD PRESSURE MEASUREMENT IN THE HEALTH FACILITY

Proper measurement of BP is very vital to accurately diagnose hypertension. The current standard of care for blood pressure measurement is the automated sphygmomanometer for use both in hospitals and at home. Other available BP measuring tools that can be used are the aneroid and the mercury sphygmomanometers.

The use of the mercury sphygmomanometer is currently discouraged because of the mercury content. Below is the recommended way of taking BP measurements at the health facility.

RECOMMENDED METHOD FOR BP MEASUREMENT IN THE HEALTH FACILITY SETTING¹⁻³:

- Patient should sit comfortably for 3–5 minutes before BP measurement (except in emergency cases in which the BP should be measured immediately, and repeated in 3–5 minutes).
- The systolic blood pressure should be initially measured by palpating the radial pulse.
- Take three BP measurements 1–2 minutes apart. Additional measurements should be performed if the first two readings differ by >10 mmHg. The patient's BP is the average of the last two BP readings.
- At patient's first visit, measure the BP in both arms, and if >10mmHg difference, the arm with the higher reading should be used for future BP measurements.
- The patient should be comfortably seated, the arm should be exposed and supported at the level of the heart.
- Ensure that the patient has not smoked or ingested caffeine-containing foods or drinks in the previous 30 minutes before the BP measurement (Advise patient to avoid these substances on subsequent visits).
- The appropriate cuff size should be selected for the patient. A large cuff (15 cm) is preferred for patients with a mid-upper arm circumference (MUAC) >33 cm. Those with MUAC <33 cm require the standard cuff (12 cm). The length of the bladder within the cuff should be 75–100% and the width, 35–50% of the arm circumference³.
- In patients with suspected orthostatic hypotension (low BP on standing) such as the elderly and diabetics, measure BP after 1 and 3 minutes of standing at their first consultation.
- Use Korotkoff I and V (disappearance) to identify SBP and DBP respectively during auscultatory BP measurement.
- In patients with atrial fibrillation (irregularly irregular pulse) manual auscultatory method with aneroid sphygmomanometer is preferred, however where it is not available, repeated BP measurements with automated or semiautomated sphygmomanometer should be done to improve accuracy.

(Adapted from the 2024 ESC Guidelines for the Management of Arterial Hypertension)

CONFIRMING THE DIAGNOSIS OF HYPERTENSION

- Office BP is recommended for diagnosis of hypertension because it is the one method by which hypertension-related risk, benefits of antihypertensive treatment, and treatment-related BP thresholds and goals are based.
- A rise in office BP (SBP 140mmHg or DBP 90mmHg) should be confirmed by at least two to three visits due to the fluctuation of blood pressure, unless the BP values noted during the initial visit are noticeably raised (grade 3 hypertension) or the CV risk is considerable, including the existence of HMOD (hypertension mediated organ damage).
- At the first office visit, BP should be measured in both arms. A consistent between arm SBP difference >15–20 mmHg suggests atheromatous disease and is associated with increased CV risk. All subsequent measurements should be made on the arm with the highest BP readings.
- Out-of-office BP is a source of multiple BP-related information before and during treatment. It is therefore recommended to obtain additional information on BP values by ABPM or HBPM or both if available
- To validate the diagnosis of hypertension and identify BP phenotypes, repeated office BP data should be gathered or ABPM/HBPM should be done whenever practical, when office BP is elevated. When office BP data yield inconsistent results, ABPM or HBPM may be particularly crucial.

BLOOD PRESSURE MEASUREMENT DEVICE SELECTION

- A list of validated devices recommended for blood pressure measurement can be found at www.stridebp.org
- Semiautomatic or automatic, upper arm cuff devices are recommended for office and out-of-office BP measurement (home and ambulatory)
- Hybrid manual auscultatory devices with LCD or LED display, or digital countdown, or shock-resistant aneroid devices can be used for office BP measurement if semiautomatic or automated devices are not available.
- When BP cannot be measured by an upper arm cuff device, a validated electronic wrist-cuff device may be used.
- Only properly validated devices should be used. (see <https://www.stridebp.org/>)
- Cuffless BP devices should not be used for the evaluation or management of hypertension in clinical practice.

ADDITIONAL INDICES AND SIGNS TO LOOK OUT FOR ON PHYSICAL EXAMINATION^{1,9}

- Body Mass Index (BMI)
Ideal BMI <25 kg/m², overweight 25–30 kg/m², obese >30 kg/m²
- Waist circumference (WC)
Ideal WC <94 cm in men and <80 cm in women; in the obese, WC in men >102 cm; women >88 cm
- Peripheral pulses:
 - Absent (peripheral artery disease)
 - Weak (peripheral artery disease, cardiac disease)
 - Irregular (cardiac arrhythmias)
- Unilateral weakness (hemiparesis or hemiplegia)

SCREENING FOR HYPERTENSION

Opportunistic screening refers to the practice of identifying and assessing individuals during routine healthcare encounters or at other public places like barber shops and pharmacy shops even if the primary reason is unrelated to pressure concerns in individuals ≥ 18 years.

- Case finding or opportunistic screening for hypertension is recommended in all adults.
 - Regular BP measurements are recommended in adults from the age of 40 years or earlier in patients at high risk.
 - In individuals without hypertension, intervals for repeated BP measurement should be scheduled depending on the BP level, the risk of hypertension, and CV risk.
 - In patients with high risk, annual follow-up is recommended.
- **Blood pressure should be checked for all adults at all hospital visits regardless of their presenting complaints, as part of opportunistic screening efforts.**

5.1.4 COMPLICATIONS OF HYPERTENSION

Hypertension is associated with multiple organ damage involving the heart, brain, kidneys, eyes and blood vessels¹⁰. Early detection and management of end-organ-damage will improve the outcome of management of hypertension. Hypertension combined with unhealthy diet (high salt intake and alcohol abuse), obesity, smoking, dyslipidaemia, reduced physical activity and diabetes, is associated with increased mortality⁴.

THE COMPLICATIONS OF HYPERTENSION:

- Stroke
- Subarachnoid haemorrhage
- Hypertensive encephalopathy
- Atherosclerosis
- Aortic dissection
- Arrhythmias
- Chronic kidney disease Retinopathy
- Heart attack or myocardial infarction
- Left ventricular hypertrophy
- Heart failure (systolic and diastolic)
- Pre-eclampsia/eclampsia

INVESTIGATION

PATIENTS DIAGNOSED WITH HYPERTENSION MUST HAVE THE FOLLOWING BASELINE TESTS PERFORMED AS PART OF THEIR EVALUATION:

- Full blood count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)
- Lipid profile
- Urine RE
- Electrocardiogram
- Chest x-ray

EXTENDED TESTS MAY BE DONE (IF AVAILABLE) FOR IDENTIFYING HMOD

These include:

- Ankle Branchial Pressure Index
- Echocardiography
- Carotid and femoral pulse wave velocity or branchial ankle pulse wave doppler
- Carotid artery ultrasound
- Coronary artery calcium score
- Abdominal ultrasound scan (to assess renal arteries and abdominal aorta)
- Kidney ultrasound
- Retina microvasculature
- Cognitive function (MMSE).
- Brain imaging (CT, MRI).

5.1.5 MANAGEMENT OF HYPERTENSION RELEVANT FOR ALL LEVELS OF CARE

The overall goal of managing hypertension is to adequately control the BP and maintain it at target levels as well as control risk factors and promote a healthy lifestyle in order to reduce associated morbidity and mortality. The recommended medications for initiating BP control are long-acting dihydropyridine calcium channel blockers, thiazide/thiazide-like diuretics, ACEI/ARBs (WHO). The prescription of Beta-blockers for hypertension care should be reserved for specialists with expertise in hypertension management.

OUT-OF-OFFICE/CLINIC BP MEASUREMENT

BP measurement outside the health facility can be done in two ways: ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM). These two remove the effect of white coat hypertension and also give BP measurements that are more reflective of the patient's BP.

► Refer to the *introduction section under hypertension* for definition of white coat hypertension.

AMBULATORY BP MONITORING (ABPM)

ABPM involves the use of a device that records and provides the average BP measurements over a given period, usually 24 hours. The device is usually set to take the BP measurements every 15-30 minutes and provides the average BP readings for daytime, night time and at the end of the 24 hours¹. Compared to the office BP measurement, the ABPM is a better predictor of cardiovascular events like myocardial infarction (MI) and stroke².

HOME BP MONITORING (HBPM)

HBPM is self-blood pressure monitoring that involves the use of validated, semi-automated BP monitors to record BP for at least 3 days before each clinic visit. At each BP measurement, the patient should be well relaxed, (at least 3-5 minutes rest), comfortable and should take two measurements 1-2 minutes apart. The average of all the BP readings will be used in assessing the patient's BP¹. HBPM is also a better predictor of CVDs than office BP measurement².

Table 30: Hypertension cutoff values for office and out-of-office BP measurements¹
(Adapted from The 2018 ESC/ESH Guidelines For The Management Of Arterial Hypertension)

Category	Systolic (mmHg)	and/or	Diastolic (mmHg)
Office BP	≥140	and/or	≥90
Ambulatory BP			
Daytime (or awake) mean	≥135	and/or	≥85
Night-time (or asleep) mean	≥120	and/or	≥70
24-hour mean	≥130	and/or	≥80
Home BP mean	≥135	and/or	≥85

NON-PHARMACOLOGICAL TREATMENT FOR ALL LEVELS OF CARE

Table 31: Non-pharmacological treatment for all levels¹⁻³

(Adapted from *The 2024 ESC/ESH Guidelines For The Management Of Arterial Hypertension*)

Lifestyle modification	Level of evidence
Reduce salt intake/avoid adding salt to food at table (dietary salt should be restricted to <5 g per day) Alternatively, potassium-enriched low sodium salt may be used	A
Regular intake of fruits, vegetables, fish, and unsaturated fatty acids (e.g. olive oil); consume low-fat dairy products and reduce intake of red meat	A
Weight reduction among hypertensive patients who are either obese or overweight, aim at BMI range of 20-25 kg/m ² and waist circumference of <94 cm in men and <80 cm in women	A
Regular exercise (30 minutes of moderate-intensity aerobic exercise such as walking, jogging, cycling, swimming, skipping, etc. 5 to 7 days per week)	A
Reduce or avoid alcohol consumption (Limit alcohol to <14 units per week for men and <8 units per week for women)	A
Avoid or stop smoking; refer patient to support groups to help in their cessation of smoking	B

5.1.6 MANAGEMENT OF HYPERTENSION ACCORDING TO LEVEL OF CARE

Regarding the management of patients with hypertension in general, the following are the recommended treatment targets⁵:

- Patients 18 to 64 years old: The goal is to lower office BP to < 130/80mmHg.
- Patients 65 to 79 years old: The primary goal of treatment is to lower BP to < 140/ 90mmHg. However, lowering BP to below 130/80mmHg can be considered if treatment is well tolerated.
- Patients 65 to 79 years old with ISH: The primary goal of treatment is to lower SBP in the 140 to 150 mmHg range.
 - A reduction of office SBP in the 130 to 139 mmHg range may be considered if well tolerated, albeit cautiously if DBP is already below 70 mmHg.
- Patients ≥ 80 years: Office BP should be lowered to a SBP in the 140 to 150 mmHg range and to a DBP 80 mmHg. A reduction of office SBP between 130 to 139 mmHg may be considered if well tolerated, albeit cautiously if DBP is already below 70 mmHg.

There are a few cautions to observe in the management of patients with hypertension:

- Target for SBP and DBP should be individualized in frail patients.
- Do not aim to target office SBP < 120mmHg and/or DBP < 70mmHg.
- In patients with low office DBP <70 mmHg, SBP should be still lowered, albeit cautiously, if on-treatment SBP is still well above target values.
- Reduction of treatment can be considered in patient aged 80 years or older with a low SBP (< 120mmHg) or in the presence of severe orthostatic hypotension or a high frailty level.

PRIMARY HEALTH FACILITY (WITHOUT A DOCTOR)

LABORATORY INVESTIGATION

- Full blood count
 - Blood urea, electrolytes and creatinine (kidney function tests)
 - Blood sugar (random blood sugar or fasting blood sugar)
 - Lipid profile
 - Urine RE
 - Electrocardiogram
 - Chest x-ray
- ▶ **If not available or results are abnormal, refer to the next level of care.**

PHARMACOLOGICAL TREATMENT (FOR PHYSICIAN ASSISTANTS)

GRADE 1 HYPERTENSION

(SBP 140–159 mmHg, DBP 90–99 mmHg) with inadequate control after 3 months of lifestyle modification or if patient has more than 3 risk factors:

- Male
- Age (men >55 years, women >65 years)
- Smoking
- Obesity (including abdominal obesity)
- Dyslipidaemia (high blood cholesterol)
- Impaired fasting glucose
- Family history of early coronary artery disease¹¹

Recommended therapy for Primary Health Facility (LEVEL OF EVIDENCE A) (Refer to *table 32* for doses)

- Monotherapy: thiazide (Bendroflumethiazide)/thiazide-like (indapamide) diuretic or calcium channel blockers (CCB)
 - If after 2–4 weeks of treatment response is not adequate, add second drug (dual therapy): CCB + Thiazide/thiazide-like diuretic (single pill combination therapy is preferable)
- ▶ **If BP remains uncontrolled (refer to *treatment objectives for target BP values*), refer patient to the next level of care: health facility with a doctor.**

GRADE 2 HYPERTENSION

(SBP 160–179 mmHg, DBP 100–109 mmHg)

Recommended therapy (LOE A)

- Dual therapy preferred: CCB + thiazide-like diuretic (single pill combination therapy is preferable)
- ▶ **If BP remains uncontrolled (refer to *treatment objectives for target BP values*), refer patient to the next level of care (health facility with a doctor). Primary health facility with a doctor may use ACE/ARB in addition to CCB + thiazide/thiazide-like diuretic to achieve target BP values.**

Criteria for referring a hypertensive patient to next level of care:

All patients should be referred to a facility with a doctor at least once for full investigation, after which they may be returned to the primary level facility for continuation of care.

- Patients who have SBP >180 mmHg and/or DBP > 110 mmHg
- Patients who have not attained target BP despite 4 weeks of adequate antihypertensive treatment
- Patients with pre-existing diabetes mellitus or blood sugar suggestive of diabetes mellitus (if dipstick positive for protein refer to health facility for evaluation and management of CKD. These patients are likely to benefit from early use of ACEI/ARBs)
- Patients with HIV/AIDS
- Hypertensives with complications such as heart failure, stroke and kidney disease

PRIMARY OR SECONDARY HEALTH FACILITY (WITH A DOCTOR)

LABORATORY INVESTIGATION

- Full blood cell count
- Urinalysis
- Blood glucose
- Blood urea, electrolytes and creatinine (including eGFR)
- Serum lipids
- Serum uric acid
- Chest X-ray
- 12-lead Electrocardiogram (ECG)

PHARMACOLOGICAL TREATMENT

GRADE 1 HYPERTENSION (SBP 140-159 mmHg, DBP 90-99 mmHg) with inadequate control after 3 months of lifestyle modification or if patient has more than 3 risk factors:

- Male
- Age (men >55 years, women >65 years)
- Smoking
- Obesity (including abdominal obesity)
- Dyslipidaemia (high blood cholesterol)
- Impaired fasting glucose
- Family history of early coronary artery disease¹¹

Recommended therapy (Level of evidence A):

- Monotherapy: thiazide-like diuretic or calcium channel blockers (CCB)
- If after 2-4 weeks of treatment response is not adequate, add second drug (dual therapy): CCB + Thiazide/thiazide-like diuretic (single pill combination therapy is preferable)
- ▶ **If BP remains uncontrolled (refer to treatment objectives for target BP values), refer patient to the next level of care: health facility with a doctor.**

GRADE 2 HYPERTENSION (SBP 160-179 mmHg, DBP 100-109 mmHg)

Recommended therapy (Level of evidence A):

- Dual therapy preferred: CCB + Thiazide-like diuretic (single pill combination therapy is preferable)
- ▶ **If BP remains uncontrolled (refer to treatment objectives for target BP values), refer patient to the next level of care: health facility with a doctor.**

Primary health facility with a doctor may use ACE/ARB in addition to CCB + thiazide/thiazide-like diuretic to achieve target BP values.

CRITERIA FOR REFERRING A HYPERTENSIVE PATIENT TO NEXT LEVEL OF CARE

- All patients should be referred to a facility with a doctor at least once for full investigation, after which they may be returned to the primary level facility for continuation of care
- Patients who have SBP >180 mmHg and/or DBP > 110 mmHg
- Patients who have not attained target BP despite 4 weeks of adequate antihypertensive treatment
- Patients with pre-existing diabetes mellitus or blood sugar suggestive of diabetes mellitus (if dipstick positive for protein refer to health facility for evaluation and management of CKD. These patients are likely to benefit from early use of ACEI/ARBs)
- Patients with HIV/AIDS
- Hypertensives with complications such as heart failure, stroke and kidney disease

PRIMARY OR SECONDARY HEALTH FACILITY (WITH A DOCTOR)

LABORATORY INVESTIGATION

- Full blood cell count
- Urinalysis
- Blood glucose (random blood sugar or fasting blood sugar)
- Glycated haemoglobin (HBA1C)
- Blood urea, electrolytes and creatinine (including eGFR)
- Serum lipids
- Uric acid
- Chest X-ray
- 12-lead Electrocardiogram (ECG)

PHARMACOLOGICAL TREATMENT

GRADE 1 HYPERTENSION (SBP 140-159 mmHg, DBP 90-99 mmHg) with inadequate control after 3 months of lifestyle modification or if patient has more than 3 risk factors:

- Male
- Age (men >55 years, women >65 years)
- Smoking
- Obesity (including abdominal obesity)
- Dyslipidaemia (high blood cholesterol)
- Impaired fasting glucose
- Family history of early coronary artery disease¹¹

Recommended therapy (Level of evidence A):

- Monotherapy: thiazide-like diuretic or calcium channel blockers (CCB)
- ▶ If after 2-4 weeks of treatment response is not adequate, add second drug (dual therapy):
CCB + Thiazide/thiazide-like diuretic

GRADE 2 HYPERTENSION (SBP 160-179 mmHg, DBP 100-109 mmHg)

Recommended therapy (Level of evidence A):

- Dual therapy preferred:
 - CCB + Thiazide-like diuretic or
 - ACE Inhibitor/ARB + Thiazide/Thiazide-like diuretic or
 - ACE Inhibitor/ARB + CCB
- ▶ Add third drug (multi-therapy) if response is not adequate after 2-4 weeks of treatment: ACE Inhibitor/ARB + CCB + thiazide/thiazide-like diuretic.

GRADE 3 HYPERTENSION (SBP \geq 180 mmHg, DBP \geq 110 mmHg)¹⁴

Recommended therapy (Level of evidence A):

- Use dual therapy at the beginning:
 - ACE Inhibitor/ARB + CCB or
 - CCB + thiazide/thiazide-like diuretic or
 - ACE inhibitor + thiazide/thiazide-like diuretic
- ▶ If response is not adequate within 2-4 weeks, add a third drug: ACE Inhibitor/ARB + CCB + thiazide/thiazide-like diuretic
 - ACE inhibitors or ARBs may be used in facilities that can monitor the potassium levels of patients, with ARBs preferred due to a lower risk of angioedema among black populations (3). Combining ACE inhibitors and ARBs is not recommended
 - Elderly patients may require lower doses of medication (e.g. half the dose Amlodipine: give 2.5mg instead of 5mg)
 - Add on therapy should be at lower doses for Beta-blockers and reduced for ACEI if patient is elderly or is on diuretics
 - Replace ACEI with ARBs, if patient cannot tolerate ACEI
- ▶ **If BP remains uncontrolled (refer to treatment objectives for target BP values), refer patient to the next level of care: health facility with a physician specialist.**

CRITERIA FOR REFERRING A HYPERTENSIVE PATIENT PATIENT TO A SPECIALIST

- All pregnant women with hypertension (refer to an obstetrician)
- Patients with abnormal results on urine dipstick or blood tests i.e. full blood cell count (anaemia), abnormal blood urea nitrogen (BUN)/blood urea, electrolytes and creatinine (BUE-Cr)
- Adolescents and children diagnosed with hypertension (refer to a paediatrician)
- Patients with suspected secondary cause of hypertension
- Patients with chronic heart disease, heart failure and coronary artery disease (refer to a cardiologist)
- Patients with renal insufficiency or chronic kidney disease (refer to a nephrologist)
- Patients with stroke or transient ischaemic attack, intracerebral haemorrhage, vascular dementia and lacunar infarction (refer to a neurologist)
- Patients with peripheral arterial disease (refer to a cardiologist or a vascular surgeon)
- Geriatric patients (\geq 80 years) being diagnosed with hypertension for the first time

TERTIARY HEALTH FACILITY (WITH A SPECIALIST)

INVESTIGATION FOR A TERTIARY HEALTH FACILITY⁷

All investigation under primary and secondary health facilities:

- Echocardiogram for those with symptoms and signs of hypertensive heart disease
- Pheochromocytoma –resting plasma catecholamines, urinary catecholamines and metabolites
- (metanephrines), MRI/CT scan of abdomen

- Cushing's syndrome - dexamethasone suppression test (overnight, low dose and high dose), 24-hour urinary free cortisol, plasma Adrenocorticotropic hormone levels, Corticotropin releasing hormone test, adrenal CT scan, head MRI
- Acromegaly - growth hormone level, glucose tolerance test, insulin-like growth factor-1 levels, MRI scan of head (pituitary tumour)
- Hyperparathyroid disease - serum parathyroid hormone, serum calcium, 24 hour urinary calcium, serum alkaline phosphatase
- Thyroid disease - serum TSH, free T3, free T4
- Renal parenchymal diseases - urinalysis, renal ultrasound, renal biopsy
- Renal artery stenosis - doppler of renal arteries, CT angiogram of renal arteries

PHARMACOLOGICAL TREATMENT

ELEVATED BP WITHOUT EVIDENCE OF TARGET ORGAN DAMAGE (TOD)

In hypertensive patients with no target-organ injury (preclinical CVD or a history of CVD), modestly lowering the target BP to <140/90 mmHg is recommended.

ELEVATED BP WITH TARGET ORGAN DAMAGE, PRECLINICAL CVD, OR CVD (SECONDARY PREVENTION)

For hypertensives with evidence of target-organ damage, BP levels should be consistently maintained below the target level of 130/80 mmHg. Physicians should look out for the following when managing patients with evidence of target organ damage:

- Albuminuria; spot urine albumin: creatinine ratio >200mg/g
- Abnormal renal function (with estimated glomerular filtration rate [eGFR] <60 ml/min/1.73m²)
- ECG with evidence of LVH
- Metabolic syndrome
- Framingham risk score corresponding to >20% 10-year CHD risk
- Glucose intolerance [2-hour post- prandial glucose ≥7.8 mmol/l]
- Impaired fasting glucose [5.6-6.9 mmol/l]
- Diabetes mellitus, and/or overt clinical CVD
- ▶ Most of the patients with TOD require multiple antihypertensives in order to maintain BP levels below the target level of 130/80 mmHg.
- ▶ Gradually reducing the BP over several weeks (or more) to the recommended target BP level is preferable.
- ▶ Caution must be taken to avoid rapidly lowering BP since rapid drop in BP can increase the risk of target-organ ischemia/dysfunction, particularly in hypertensives with widespread vascular disease and/or chronic kidney disease¹².

LABORATORY INVESTIGATION⁷

- Full blood cell count
- Urinalysis
- Blood glucose
- Blood urea, electrolytes and creatinine (including eGFR)
- Serum lipids
- Serum uric acid
- Chest X-ray
- 12-lead electrocardiogram (ECG)

SPECIAL INVESTIGATION FOR PATIENTS WITH SECONDARY HYPERTENSION

PHAEOCHROMOCYTOMA

- Resting plasma catecholamines
- Urinary catecholamines and metabolites (metanephrines)
- CT scan of abdomen

CUSHING'S SYNDROME

- Dexamethasone suppression test (overnight, low dose and high dose)
- 24h urinary free cortisol
- Plasma adrenocorticotropin hormone levels
- Corticotropin releasing hormone test
- Adrenal CT scan, head MRI

ACROMEGALY

- Growth hormone level
- Glucose tolerance test
- Insulin-like growth factor 1 levels, MRI scan of head (pituitary tumour)

HYPERPARATHYROID DISEASE

- Serum parathyroid hormone
- Serum calcium
- 24-hour urinary calcium
- Serum alkaline phosphatase

THYROID DISEASE

- Serum thyroid stimulating hormone
- Free T3
- Free T4

RENAL PARENCHYMAL DISEASES

- Urinalysis
- Renal ultrasound

RENAL ARTERY STENOSIS

- Doppler of renal arteries
- CT angiogram of kidneys

PHARMACOLOGICAL TREATMENT

ELEVATED BP WITHOUT EVIDENCE OF TARGET ORGAN DAMAGE (TOD)

In hypertensive patients with no target-organ injury (preclinical CVD or a history of CVD), modestly lowering the target BP to <140/90 mmHg is recommended.

ELEVATED BP WITH TARGET ORGAN DAMAGE, PRECLINICAL CVD, OR CVD (SECONDARY PREVENTION)

For hypertensive patients with evidence of target organ damage, BP levels should be consistently maintained below the target level of 130/80 mmHg. Physicians should look out for the following when managing patients with evidence of target organ damage:

- Albuminuria; spot urine albumin: creatinine ratio >30mg/g
- Abnormal renal function (with estimated glomerular filtration rate [eGFR] <60 ml/min/1.73 m²)
- ECG evidence of LVH
- Metabolic syndrome
- Framingham risk score corresponding to >20% 10-year CHD risk
- Glucose intolerance [2-hour post-load glucose ≥7.8 mmol/l]
- Impaired fasting glucose [5.6-6.9 mmol/l]
- Diabetes mellitus, and/or overt clinical CVD
- Most of the patients with TOD require multiple antihypertensives in order to maintain BP levels below the target level of 130/80 mmHg
- Gradually reducing the BP over several weeks (or more) to the recommended target BP level is preferable
- Caution must be taken to avoid rapidly lowering BP since rapid drop in BP can increase the risk of target-organ ischemia/dysfunction, particularly in hypertensives with widespread vascular disease and/or chronic kidney disease¹²

Table 32: Preferences for antihypertensive drugs by comorbidity for health facility with a physician specialist³

Co-morbidity	ACEI	ARB	Aldosterone antagonist	Beta-blocker	CCB	Diuretic
Diabetes/Pre-Diabetes	■	■		□	□	
CKD	■	■	x		□	□
HF	■	■	■	■	x	□
CHD/angina	■	□		■	■	□
Post-MI	■	■	■	■		□
Vascular disease risk	■	■				□
Recurrent stroke	■	■				□

■ indicates compelling indication (proven benefit);
 □ likely benefit or safety proven;
 X contraindication; ACEI, ACE inhibitor; ARB, Angiotensin receptor blocker; CCB, Calcium channel blocker; CKD, chronic kidney disease; CHD, coronary heart disease; MI, myocardial infarction.

Caution:

- If eGFR is <50 ml/min per 1.73 m², Eplerenone[♦] only; use spironolactone with caution; periodically check serum potassium
- Non-dihydropyridine CCBs (Diltiazem[♦] and Verapamil) are contraindicated in systolic HF

SINGLE PILL COMBINATION THERAPY

With advancement in medicine, the need for patients to swallow several pills or tablets of medication has decreased. Medications now come in combinations that are contained in a single pill or tablet. The European Society of Cardiology currently recommend that these combination medicine can be used as first line management for patients with hypertension¹. The benefits of these combination medication cannot be underestimated. These combination medication reduce pill burden, increase compliance. The benefits are derived from the synergistic effects of the combinations.

Some common combinations that can be found on the market include:

- ACE-I + calcium channel blocker: Perindopril[♦] + Amlodipine
 - ACE-I + diuretic: Lisinopril + Hydrochlorothiazide
 - ACE-I + calcium channel blocker + diuretic: Perindopril[♦] + Amlodipine + Indapamide[♦]
 - ARB + calcium channel blocker: Irbesartan[♦] + Amlodipine
 - ARB + diuretic: Candesartan + Hydrochlorothiazide
 - ARB + calcium channel blocker + diuretic: Valsartan + Amlodipine + Hydrochlorothiazide
- ▶ N.B. [♦] = drugs not in the Essential Medicines List (EML)

Compelling indications for specific anti-hypertensive therapies include:

- Heart failure: ACEI /ARB, Beta blocker, (diuretics for oedema)
- Tachyarrhythmias (atrial fibrillation): Beta blocker
- Previous stroke: ACEI/ARB
- Angina pectoris: Beta blocker, CCB
- Previous myocardial infarction: ACEI/ARB, BB
- Chronic kidney disease/proteinuria – ACEI/ARB, Hydralazine, Centrally acting agents
- Evidence of other HMOD (except end-stage kidney disease): ACEI/ARB
- Comorbid diabetes mellitus – ACEI/ARB

5.1.7 RESISTANT HYPERTENSION

Resistant hypertension is defined as the failure to control BP on ≥ 3 antihypertensive medications (including a diuretic) despite giving adequate doses, or controlling BP but on ≥ 4 antihypertensives including a diuretic. Co-morbidities such as obesity, type 2 diabetes mellitus, and CKD have been associated with the rapidly increasing prevalence of resistant hypertension in Africa^{4,13}. Inadequate control of BP is confirmed by ABPM or HBPM in patients whose adherence to therapy has been confirmed¹.

PRACTICAL TIPS FOR LOWERING BP IN RESISTANT HYPERTENSION

Treatable causes of resistant hypertension should be sought for and managed as much as possible. These causes include obstructive sleep apnoea (OSA), high-salt/low-potassium diet, alcohol abuse, NSAIDs, nasal decongestants, cocaine. Below is the recommendation for BP control in resistant hypertension:

THERAPEUTIC RECOMMENDATIONS FOR LOWERING BP IN RESISTANT HYPERTENSION

Scrutinize patient's current drug regimen:

- Stop medications (e.g. NSAIDs) that can affect BP lowering
- Look out for risk factors such as alcohol abuse and high salt intake which undermine pharmacological BP lowering

Review current antihypertensive drug regimen:

Avoid undesirable therapeutic combinations that are poorly tolerated and/or minimally effective (see recommended combinations on *pages 72 and 76*)

- Include ≥ 1 diuretic that is appropriate for the level of kidney function
- Consider adding a second diuretic with a complementary mechanism of action (e.g. Chlor-thalidone[♦] + spironolactone)
- ▶ If systolic heart function is normal (ejection fraction $\geq 50\%$), consider the simultaneous use of a dihydropyridine (DHP) and a non-DHP CCB
- ▶ If available, use noninvasively measured vascular function to guide therapeutic selections
- ▶ Consider referral to a hypertension specialist

In patients not controlled on ACEi/ARBs + CCB + thiazide/thiazide like diuretics with CKD Stage 1-35, i.e. eGFR >30ml/min/1.73m² add:

- Spironolactone (preferred) or other MRA or
- Beta-blocker or Alpha-1 blocker or
- Centrally acting agent
- ▶ Consider renal nerve denervation if eGFR >40ml/min/1.73m²

In patients not controlled on ACEi/ARBs + CCB + loop diuretics with CKD Stage 4-5 (not on dialysis), i.e. eGFR <30ml/min/1.73m² add

- Chlorthalidone (preferred) or other thiazide/ thiazide-like diuretic or
- Beta-blocker or Alpha-1 blocker or
- Centrally acting agent.
- ▶ Consider renal nerve denervation if eGFR >40ml/min/1.73m²

SPECIAL CONSIDERATIONS⁵

Diuretic use:

- Use thiazide/thiazide-like diuretic if eGFR >45 ml/min/1.73 m².
- Consider transition to loop diuretic if eGFR is between 30 to 45 ml/min/1.73 m²
- Use loop diuretic if eGFR <30 ml/min/1.73 m²
- MRA contraindicated if eGFR <30 ml/min/ 1.73 m²
- ▶ Caution if eGFR <45 ml /min/1.73 m² or serum potassium >4.5 mmol/l.

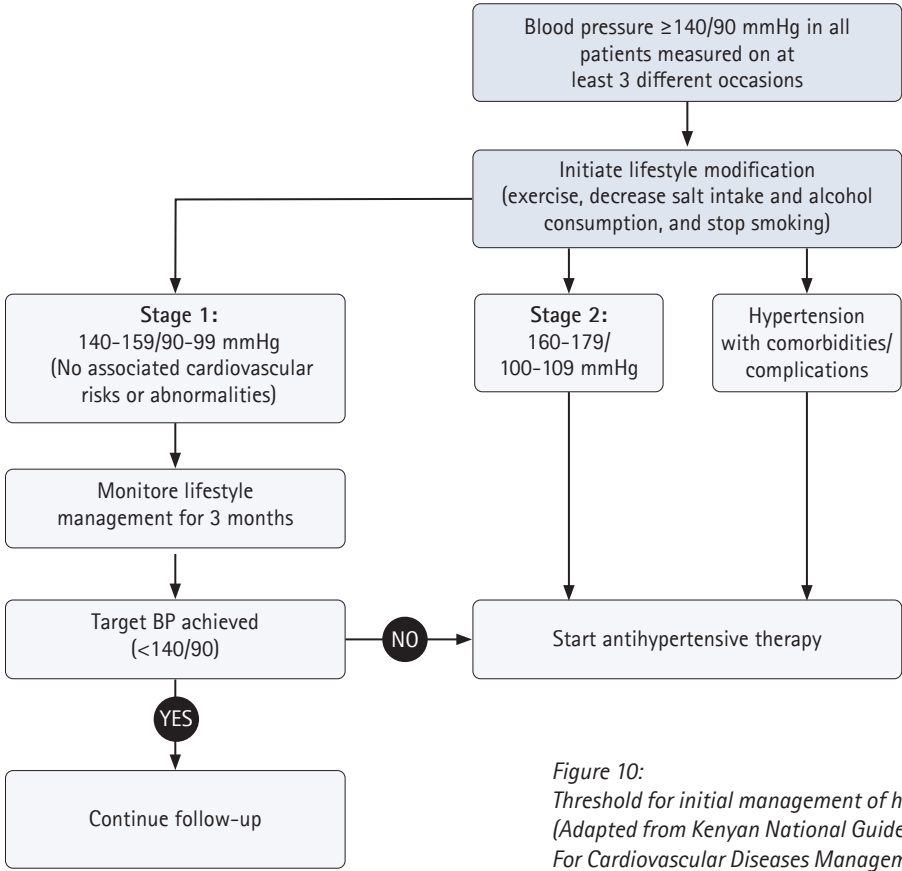


Figure 10: Threshold for initial management of hypertension (Adapted from Kenyan National Guidelines For Cardiovascular Diseases Management, 2018)

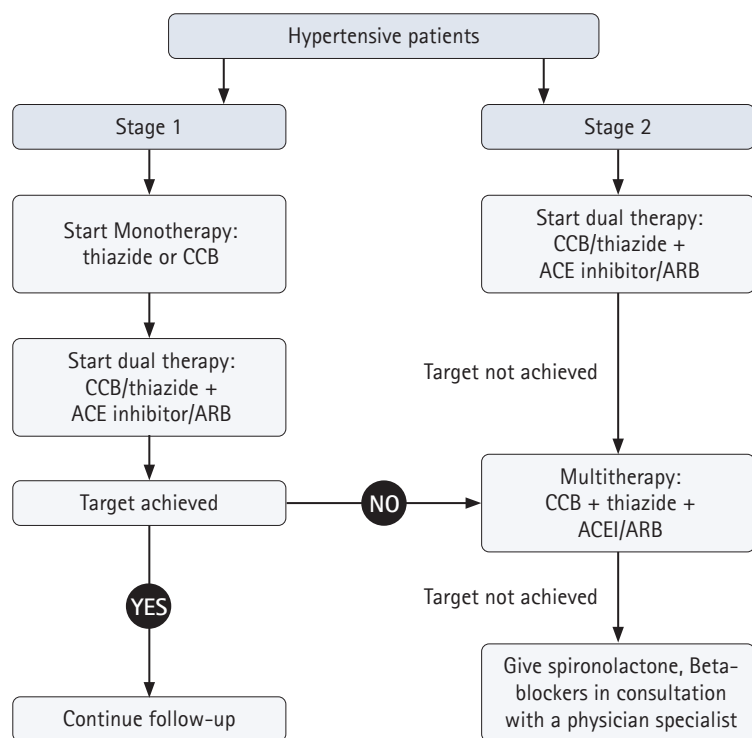


Figure 11:
Antihypertensive regimen for patients
(Adapted from Kenyan National Guidelines For
Cardiovascular Diseases Management, 2018)

Table 33: Antihypertensive medications, indications and contraindications⁹

Drug	Conditions favouring use	Contraindications	
		Compelling	Possible
Diuretics (thiazide-like; thiazide) <i>Indapamide*</i> , <i>Bendroflumethiazide</i> (Bendroflumethiazide)	<ul style="list-style-type: none"> ▪ Heart failure (HF) ▪ Elderly hypertensives ▪ Isolated systolic HTN (ISH) ▪ Hypertensives of african origin 	<ul style="list-style-type: none"> ▪ Gout 	<ul style="list-style-type: none"> ▪ Pregnancy ▪ Beta-blockers (especially <i>Atenolol</i>)
Diuretics (loop) <i>Frusemide</i> , <i>Torsemide*</i>	<ul style="list-style-type: none"> ▪ Renal insufficiency ▪ HF 		<ul style="list-style-type: none"> ▪ Pregnancy
Diuretics (anti-aldosterone) <i>Spironolactone</i>	<ul style="list-style-type: none"> ▪ HF ▪ Post-myocardial infarction ▪ Resistant hypertension 	<ul style="list-style-type: none"> ▪ Renal failure ▪ Hyperkalaemia 	
CCB (dihydropyridine) <i>Amlodipine</i> , <i>Nifedipine</i>	<ul style="list-style-type: none"> ▪ Elderly patients ▪ Isolated systolic hypertension ▪ Angina pectoris ▪ Peripheral vascular disease ▪ Carotid atherosclerosis ▪ Pregnancy 		<ul style="list-style-type: none"> ▪ Tachyarrhythmias ▪ HF especially with reduced ejection fraction
CCB non-dihydropyridine <i>Verapamil</i> , <i>Diltiazem*</i>	<ul style="list-style-type: none"> ▪ Angina pectoris ▪ Carotid atherosclerosis ▪ Supraventricular tachycardia 	<ul style="list-style-type: none"> ▪ AV block (grade 2 or 3) ▪ HF 	<ul style="list-style-type: none"> ▪ Constipation (<i>Verapamil</i>)
ACEI <i>Lisinopril</i> , <i>Perindopril*</i>	<ul style="list-style-type: none"> ▪ HF ▪ LV dysfunction ▪ Post-myocardial infarction ▪ Non-diabetic nephropathy ▪ Type 1 diabetic nephropathy ▪ Prevention of diabetic microalbuminuria ▪ Proteinuria 	<ul style="list-style-type: none"> ▪ Pregnancy ▪ Hyperkalaemia ▪ Bilateral renal artery stenosis ▪ Angioneurotic oedema (more common in Blacks than in Caucasians) 	
ARB <i>Valsartan</i> , <i>Losartan</i>	<ul style="list-style-type: none"> ▪ Type 2 diabetic nephropathy ▪ Type 2 diabetic microalbuminuria ▪ Proteinuria ▪ LVH ▪ ACEI cough or intolerance 	<ul style="list-style-type: none"> ▪ Pregnancy ▪ Hyperkalaemia ▪ Bilateral renal artery stenosis 	
Beta-blockers <i>Bisoprolol</i> , <i>Carvedilol</i>	<ul style="list-style-type: none"> ▪ Angina pectoris ▪ Post-myocardial infarction ▪ HF (<i>Carvedilol</i>, <i>Metoprolol</i>, <i>Bisoprolol</i>) ▪ achyarrhythmias 	<ul style="list-style-type: none"> ▪ Asthma ▪ Chronic obstructive pulmonary disease ▪ AV block (grade 2 or 3) ▪ Pregnancy (<i>Atenolol</i>) 	<ul style="list-style-type: none"> ▪ Peripheral vascular disease ▪ Bradycardia ▪ Glucose intolerance ▪ Metabolic syndrome ▪ Athletes and physically active patients ▪ Non-dihydropyridine CCBs (<i>Verapamil</i>, <i>Diltiazem*</i>)

Table 34: Antihypertensive medications and the common side effects^{4,13}
(Adapted from Kenyan National Guidelines For Cardiovascular Diseases Management, 2018)

Class	Example	Usual monotherapy (per os)	Maximum daily dose (per os)	Possible side effects
Long-acting CCB	<i>Amlodipine</i>	5mg OD	10mg OD	<ul style="list-style-type: none"> ▪ Oedema ▪ Headache ▪ Palpitations
	<i>Felodipine</i> ♦	5mg OD	10mg OD	
	<i>Nifedipine (Prolonged Release)</i>	30mg BD	30mg BD	
Thiazide diuretic	<i>Bendrofluazide</i>	2.5mg OD	5mg OD	<ul style="list-style-type: none"> ▪ Hypokalaemia ▪ Hyperuricaemia ▪ Hypocalciuria ▪ Hyperglycaemia ▪ Rash ▪ Dyslipidaemia
	<i>Hydrochlorothiazide</i>	25mg OD	50mg OD	
Thiazide-like diuretics	<i>Indapamide</i> ♦	2.5mg OD	2.5mg OD	<ul style="list-style-type: none"> ▪ Cough (ACEI) ▪ Hyperkalaemia ▪ Increased serum creatinine ▪ Angioedema
	<i>Chlorthalidone</i> ♦	12.5-25mg OD	25mg OD	
ACE inhibitor	<i>Captopril</i> ♦	25-50 BD	100mg BD	<ul style="list-style-type: none"> ▪ Hyperkalaemia, ▪ Renal impairment
	<i>Enalapril</i>	5-20mg daily in 1 or 2 divided doses	40mg daily OD	
	<i>Lisinopril</i>	10-20mg OD	40mg OD	
	<i>Perindopril</i> ♦	5mg OD	10mg OD	
	<i>Ramipril</i>	5-10mg OD	10mg OD	
ARB	<i>Candesartan</i>	8mg OD	32mg OD	<ul style="list-style-type: none"> ▪ Hyperkalaemia, ▪ Renal impairment
	<i>Irbesartan</i> ♦	150mg OD	300mg OD	
	<i>Losartan</i>	50mg OD	100mg OD	
	<i>Telmisartan</i> ♦	40mg OD	80mg OD	
	<i>Valsartan</i>	80mg OD	160mg OD	
Mineralo-corticoid receptor antagonist	<i>Spironolactone</i>	25mg OD	200mg OD	<ul style="list-style-type: none"> ▪ Hyperkalaemia, ▪ Gynaecomastia
	<i>Eplerenone</i>	50mg OD	200mg OD	
Second-line Antihypertensive medications				
Beta-blockers	<i>Bisoprolol</i>	5mg OD	20mg OD	<ul style="list-style-type: none"> ▪ Bradycardia ▪ erectile dysfunction, ▪ exacerbation of asthma
	<i>Carvedilol</i>	25mg BD	50mg BD	
	<i>Nebivolol</i>	5mg OD	10mg OD	
	<i>Metoprolol succinate</i>	50mg OD	100mg OD	
	<i>Labetalol</i>	200mg BD	400mg BD	
	<i>Atenolol</i>	50mg OD	100mg OD	
Centrally acting agents	<i>Methyldopa</i>	500mg BD or TDS	1000mg/day	<ul style="list-style-type: none"> ▪ Angina ▪ Orthostatic hypotension ▪ Gynaecomastia ▪ Rash ▪ Erectile dysfunction
	<i>Clonidine</i>	0.15mg BD	0.3mg/day	
	<i>Phenoxybenzamine</i> ♦	10mg BD	40mg TDS	
Potassium-sparing diuretics	<i>Amiloride</i> ♦	5mg OD	20mg OD	<ul style="list-style-type: none"> ▪ Hyperkalaemia
	<i>Triamterene</i>	25mg OD or divided doses	100mg OD or divided doses	
Loop diuretics	<i>Torsemide</i> ♦	5mg OD	20mg OD	<ul style="list-style-type: none"> ▪ Hyperuricaemia ▪ Hypokalaemia
	<i>Furosemide</i>	20mg OD	80mg OD	
Vasodilators	<i>Hydralazine</i>	25mg TDS	100mg TDS	<ul style="list-style-type: none"> ▪ Hypotension ▪ Palpitations
Alpha 1 receptor blocker	<i>Doxazosin</i>	4mg OD	8 mg OD	<ul style="list-style-type: none"> ▪ Hypotension ▪ Diarrhoea ▪ Tachycardia
	<i>Prazosin</i>	2mg BD	5mg BD	
	<i>Terazosin</i>	1mg OD	2mg OD	

ACE: angiotensin converting enzyme; ARB: angiotensin receptor blocker; CCB: Calcium channel blocker; OD: administer once daily; BD: administer twice daily; TDS: administer 3 times daily. ♦ = Drugs not on the EML

5.1.8 HYPERTENSIVE EMERGENCY

This refers to severely elevated BP (SBP >180 mmHg and/or DBP >120 mmHg) associated with progressive organ dysfunction. Patients with hypertensive emergencies require immediate BP reduction in order to avoid or limit target end organ damage and therefore require in-patient management with close monitoring².

EXAMPLES OF HYPERTENSIVE EMERGENCIES INCLUDE:

- Hypertensive encephalopathy
- Acute left ventricular failure
- Acute myocardial infarction
- Acute kidney injury
- Aortic dissection
- Subarachnoid haemorrhage
- Acute retinal haemorrhage or papilloedema

CLINICAL PRESENTATION

PATIENTS PRESENT WITH THE FOLLOWING ACUTE SYMPTOMS AND SEVERE HYPERTENSION:

- A = Altered consciousness
- B = Breathlessness
- C = Chest pain (in ischaemia)
- D = Deficit (weakness in one or more limbs) or decreased urinary output
- E = Oedema
- F = Fundus if feasible - haemorrhages, exudates, papilloedema
- G = Generalized seizures

MANAGEMENT OF HYPERTENSIVE EMERGENCY PER LEVEL OF CARE

PRIMARY HEALTH FACILITY

- ▶ **This is a medical emergency. Delay in the care will lead to increased mortality. Refer to the next level of care or to a specialist as soon as possible.**

INVESTIGATION

Refer to investigation for hypertension stated above for each level.

TREATMENT

- Resuscitate patient
- Give oxygen if available to patients who require oxygen
- Secure intravenous access
- Start oral antihypertensive (thiazides or calcium channel blockers)
- ▶ **Refer to a health facility with a doctor/physician specialist for further management.**
- ▶ **If patient is unconscious, pass nasogastric (NG) tube (if expertise is available), refer immediately.**

SECONDARY HEALTH FACILITY (WITH A DOCTOR)

INVESTIGATION

Refer to investigation for hypertension stated above for each level.

Head CT scan should be performed for hypertensive emergencies involving the central nervous system (CNS), (e.g. stroke, intracerebral haemorrhage, subarachnoid haemorrhage).

TREATMENT

- ▶ Initiate IV antihypertensives (refer to *table 32*) and institute rigorous monitoring of patient's vital signs.

Table 35: Hypertensive emergency management options²

Condition	Management option
Acute ischaemic stroke	Antihypertensive therapy is not routinely recommended for patients with acute stroke and hypertension (refer to stroke chapter for details)
Acute intracerebral haemorrhage	Lower BP to a target of 130-150/70-90mmHg within 6 hours of symptom onset, with IV anti-hypertensives such as labetalol or hydralazine
Subarachnoid haemorrhage	Maintain SBP <160 mmHg until the aneurysm is treated or cerebral vasospasm occurs. Oral Nimodipine* is used to prevent delayed ischaemic neurological deficits, but it is NOT indicated for treating acute hypertension
Aortic dissection	Immediately reduce the SBP < 110 mmHg and maintain it at this level unless signs of end organ hypoperfusion are present; preferred treatment includes a combination of <ul style="list-style-type: none"> ▪ Opioid analgesics (morphine sulphate) ▪ Beta blockers (e.g. <i>Labetalol, Esmolol*</i>) or CCBs (e.g. <i>Verapamil, Diltiazem*</i>) Avoid Beta-blockers, if there is aortic valvular regurgitation or suspected cardiac tamponade
Acute myocardial infarction or heart attack	<ul style="list-style-type: none"> ▪ Treat if SBP >160 mmHg and/or DBP >100 mmHg, reduce BP by 20-30% of baseline over 24 hours ▪ Thrombolytics are contraindicated if BP is >185/100 mmHg; preferred medications include Beta-blockers + <i>Nitroglycerin*</i>
Acute heart failure	Treat with vasodilators (in addition to diuretics) for SBP ≥140 mmHg, IV or sublingual <i>Nitroglycerin*</i> is the preferred agent
Pre-eclampsia/eclampsia	<ul style="list-style-type: none"> ▪ Prepartum and intrapartum: SBP should be <160 mmHg and DBP <110 mmHg ▪ If the platelet count is <100,000 cells/mm, SBP should be maintained below 150/100 mmHg ▪ Patients with eclampsia or pre-eclampsia should also be loaded with iv magnesium sulphate 4g diluted in 100ml normal saline given over 15 minutes then with an infusion of 2g/hour to avoid seizures ▪ Preferred medication: <i>Hydralazine, Labetalol, Nifedipine</i> Medication to avoid: <i>Nitroprusside*</i> ACEIs, <i>Esmolol*</i>
Acute kidney injury (AKI)	<ul style="list-style-type: none"> ▪ Slowly decrease BP by 20-25% within 24 hours using oral antihypertensives ▪ Do not aggressively drop the BP

Table 36: Intravenous medications used in hypertensive emergencies¹¹

Drug	Dose	Onset of action	Adverse effects	Comments
iv Furosemide	20-40mg in 1-2 minutes	5-15 minutes	<ul style="list-style-type: none"> ▪ Hypovolemia ▪ Hypokalemia 	May be used in combination with other drugs to maintain their efficacy; indicated in acute left ventricular failure
iv Labetalol	20-80mg iv	5-10 minutes	<ul style="list-style-type: none"> ▪ Scalp tingling ▪ Dizziness ▪ Nausea ▪ Heart block 	Can be used in many hypertensive emergencies; avoid in acute heart failure
iv Nicardipine*	5-15mg per hour as iv	5-10 minutes	<ul style="list-style-type: none"> ▪ Tachycardia ▪ Headache ▪ Nausea 	Can be used in many hypertensive emergency, avoid in acute heart failure
iv Nitroglycerine*	5-100µg/min	2-5 minutes	<ul style="list-style-type: none"> ▪ Headache ▪ Vomiting ▪ Methemo globi-naemia tolerance 	Useful in myocardial ischemia with hypertension
iv or im Hydralazine	20-40mg (repeat PRN)	5-20 minutes	<ul style="list-style-type: none"> ▪ Headache ▪ Palpitation ▪ Oedema ▪ Hypotension 	Useful in pregnancy related hypertension

* = Drugs not on the EML

PRN = as needed/required

(Adapted from the Indian Standard Treatment Guidelines on Hypertension, 2016)

5.1.9 PATIENT INFORMATION/EDUCATION AT ALL LEVELS

- Inform the patients that the antihypertensive medicine will not cure their hypertension rather reduce BP level thereby reduce their risk of complications.
- Educate patients on how to take the antihypertensive medications and on the importance of follow-up.
- Educate patients on the complications of uncontrolled hypertension such as stroke, heart failure, acute myocardial infarction or heart attack, aortic dissection, cardiac arrest etc. and also on the importance of following their recommended treatment regimen.
- Patients should be advised on the usefulness of home blood pressure monitoring as it has been shown to improve cardiovascular outcomes compared to clinic/office BP measurements.
- Educate patients on the importance of maintaining a healthy lifestyle.

5.1.10 PREVENTION OF HYPERTENSION

Primary hypertension prevention is hinged mainly on avoiding and controlling modifiable risk factors. This can be achieved through lifestyle modification.

- ▶ Refer to non-pharmacological management of hypertension for lifestyle modifications, that can help prevent primary hypertension (paragraph 5.1.2 and chapter 2: risk factors).

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NOTES

5 DISEASES

5.2 STROKE

LIST OF ABBREVIATIONS AND ACRONYMS

ABC	AIRWAY, BREATHING AND CIRCULATION	ICP	INTRACRANIAL PRESSURE
APTT	ACTIVATED PARTIAL THROMBOPLASTIN TIME	INR	INTERNATIONAL NORMALIZED RATIO
BMI	BODY MASS INDEX	IV	INTRAVENOUS
BP	BLOOD PRESSURE	LOE	LEVEL OF EVIDENCE
CHA2DS2-VASC	CONGESTIVE HEART FAILURE, HYPERTENSION, AGE \geq 75YRS; DIABETES; PRIOR STROKE/TIA/ THROMBOEMBOLISM; VASCULAR DISEASE; AGE 65-74YEARS; SEX CATEGORY	MDT	MULTIDISCIPLINARY TEAM
CKD	CHRONIC KIDNEY DISEASE	MI	MYOCARDIAL INFARCTION
CT	COMPUTED TOMOGRAPHY	MRI	MAGNETIC RESONANCE IMAGING
DVT	DEEP VEIN THROMBOSIS	NA	SODIUM
DWI	DIFFUSION WEIGHTED IMAGES	NG	NASO GASTRIC
ECG	ELECTROCARDIOGRAM	RTPA	RECOMBINANT TISSUE PLASMI- NOGEN ACTIVATOR
FFP	FRESH FROZEN PLASMA	SAH	SUBARACHNOID HAEMORRHAGE
HASBLED	HYPERTENSION, ABNORMAL LIVER/RENAL FUNCTION, STROKE HISTORY, BLEEDING PREDISPOSITION, LABILE INR, ELDERLY, DRUG/ALCOHOL USAGE	SIADH	SYNDROME OF INAPPROPRIATE ANTIDIURETIC HORMONE SECRETION
HBA1C	GLYCATED HAEMOGLOBIN	TIA	TRANSIENT ISCHEMIC ATTACK
ICD	INTERNATIONAL CLASSIFICATION OF DISEASES	TOE	TRANS-OESOPHAGEAL ECHO- CARDIOGRAM
		TPA	TISSUE PLASMINOGEN ACTIVATOR
		UTI	URINARY TRACT INFECTION
		VTE	VENOUS THROMBOEMBOLISM
		WHO	WORLD HEALTH ORGANISATION

5.2.1 INTRODUCTION

DEFINITION

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral infarction, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH)¹. This excludes trauma-related injuries. Definitions of the various classification of strokes are listed in *table 37*.

EPIDEMIOLOGY

Stroke is the leading cause of long-term disability and the second most common cause of death worldwide¹⁻⁴. About 71% of all stroke deaths are in lower and middle income countries⁵. Whereas high-income countries show significant reductions in stroke incidence of about 42% over the last 40 years, a 100% increase in stroke incidences occurred in lower and middle income countries over the same period^{3,5}. Sub-Saharan Africa has the highest burden of stroke with age-adjusted incidence of 316 per 100,000 people per year^{6,7}, age-adjusted prevalence of up to 14.6 per 1000 people⁵, and case fatality of up to 43% at 1 month and 84% at 3 years⁶⁻⁸.

Ghana and most other African countries have witnessed the epidemiological transition in disease morbidity and mortality⁹. In the last few years, the leading causes of death have shifted from communicable diseases to a combination of both communicable and chronic NCDs⁸⁻¹⁰. The rising incidence of mortality associated with cardiovascular disease (CVD) especially stroke have been unmatched. For instance, in Accra, CVD moved from being the seventh and tenth cause of death in 1953 and 1966 respectively to number one cause of death in 1991 to date⁹. In Komfo Anokye Teaching Hospital, stroke constituted 9.1% of total medical adult admissions and 13.2% of all medical adult deaths from January 2006 to December 2007¹¹.

The rising incidence and prevalence of hypertension in Ghana⁸⁻¹¹ especially in the urban communities implies that the burden of stroke will continue to increase until immediate action is taken to stop this trend.

CLASSIFICATION OF STROKES

Based on the stroke definition in the ICD-11 of WHO, cerebrovascular disease has been categorized and defined as in *table 37*, next page.

Table 37: Classification of strokes¹

Cerebrovascular disease categories and definitions (selected) in the ICD-11	
Stroke	
Ischaemic stroke	Definition: An episode of neurological dysfunction caused by focal cerebral, spinal, or retinal infarction. Evidence of acute infarction may come either from: <ul style="list-style-type: none"> ▪ neuroimaging or pathological evidence of infarction
Intracerebral haemorrhage	Definition: A focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma
Subarachnoid haemorrhage	Definition: Bleeding into the subarachnoid space (the space between the arachnoid membrane and the pia mater of the brain or spinal cord).
Transient ischaemic attack ⁺	Definition: A transient episode of focal neurological dysfunction caused by focal brain or retinal ischaemia without acute infarction in the clinically relevant area of the brain or retina
Cerebrovascular disease with no acute cerebral symptom+ (silent stroke)	<ul style="list-style-type: none"> ▪ Silent cerebral infarct (defined as an infarct demonstrated on neuroimaging or at autopsy that has not caused acute dysfunction of the brain) ▪ Silent cerebral microbleed ▪ Silent cerebral macrobleed ▪ Silent white matter abnormalities associated with vascular disease (defined as abnormalities in the cerebral white matter of proven or assumed vascular origin)

⁺ Categories not classified as "stroke"

AETIOLOGY

Identifying the underlying cause of stroke helps in evaluating patients, choosing purposeful diagnostic tests, predicting prognosis, and planning secondary preventive measures of stroke in daily clinical practice.

Table 38: Aetiology of stroke

Aetiology of stroke	
Infarcts	Haemorrhage/bleeds
A – Atherosclerosis	S – Structural lesion (e.g. cerebral aneurysms)
S – Small-vessel disease	M – Medications (anticoagulants, antiplatelets)
C – Cardiac pathology (embolic stroke)	A – Amyloid angiopathy
O – Other causes	S – Systemic disease/e.g. bleeding disorders
D – Dissection	H – Hypertension
	U – Unknown

RISK FACTORS

The risk factors of stroke can be grouped under **modifiable and non-modifiable risk factors**.

The top 11 potential **modifiable risk factors** associated with stroke occurrence according to the SIREN (the largest study done on stroke in Africa) has been arranged in decreasing order of magnitude in *table 37*.

These 11 identified risk factors account for 98.2% of population attributable risk with stroke among people from Ghana and Nigeria¹¹.

Table 39: Risk factors of stroke¹¹

Risk factors of stroke	
Non-modifiable	Modifiable
<ul style="list-style-type: none"> ▪ Age ▪ Sex ▪ Ethnicity ▪ Family history 	<ul style="list-style-type: none"> ▪ Hypertension ▪ Dyslipidaemia ▪ Regular meat consumption ▪ Elevated waist to hip ratio ▪ Diabetes mellitus ▪ Low intake of green leafy vegetables ▪ Psychological stress ▪ Added salt at the table ▪ Cardiac disease ▪ Physical inactivity ▪ Current use of cigarettes

5.2.2 CLINICAL PRESENTATION

SYMPTOMS AND SIGNS

The sudden onset of the symptoms is an important clue in the diagnosis of stroke. The time of symptom onset is crucial as it determines the mode of treatment. If the actual time is not known, the last time the patient was seen well should be used. A brief neurological examination should commence from the very moment the patient is seen.

SYMPTOMS

- Weakness of the limbs (usually one sided)
- Slurred speech
- Facial droop on one side
- Difficulty swallowing
- Confusion
- Loss of consciousness
- Loss of sensation
- Severe headaches that are usually unlike headaches in the past
- Loss of balance or coordination
- Vision changes in one eye or both
- Seizures
- Bladder and bowel incontinence
- Nausea and vomiting
- Behavioural changes

SIGNS

- Hemiplegia or hemiparesis (complete or incomplete weakness of one side respectively)
- Dysarthria (difficulty in articulation)
- Aphasia/dysphasia (difficulty in forming speech)
- Reduced level of consciousness
- Cranial nerve palsies commonly facial nerve palsy/weakness
- Nystagmus
- Quadriparesis (weakness in all limbs) in brain stem strokes
- Unilateral loss of sensation

► Refer to *chapter 3* of these guidelines for more detailed information.

5.2.3 MANAGEMENT ACCORDING TO LEVEL OF CARE

Management of acute stroke relies on brief but accurate history before any imaging or laboratory investigation is done. A quick non-contrast head CT scan is the most reasonable investigation to help identify the stroke type and appropriate management. Blood investigation may be carried out while waiting for image studies.

PRIMARY HEALTH FACILITY

LABORATORY INVESTIGATION

- Full blood cell count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)
- Glycated Haemoglobin (HBA1C)
- Lipid profile

LABORATORY INVESTIGATION

- Electrocardiogram
(instant finger stick glucose testing is acceptable in the emergency setting)
- ▶ **Laboratory investigation should not delay the referral.**

TREATMENT

- Assess ABC (airway, breathing and circulation) and correct any abnormalities if possible
- Perform a swallowing test, if patient fails do not give anything by mouth, pass an NG tube an NG tube
- Avoid lifting the patient on the affected limb to avoid shoulder subluxation
- Avoid putting objects into the patients mouth during a seizure episode; place patient on the lateral strong side, clear the area of sharp objects or obstacles and remove dentures or eyeglasses if present
- Elevate the head of the bed at 20-30 degrees
- Check vitals (blood pressure, pulse rate, respiratory rate, temperature) and random blood sugar
- Give suppository Paracetamol 1g if axillary temperatures are more than 37.2°
- ▶ **Do not give Aspirin when there is no CT scan to rule out a bleed**
- Give suppository Diazepam 10mg prior to referral for all patients who present with ongoing seizures to the health facility
- ▶ **Refer the patient after less than 30 minutes to a health facility with a physician specialist and the capacity to perform a head CT. Provide pre-hospital notification to the referring health facility that a suspected stroke is en route so that appropriate resources will be mobilised before arrival of the patient.**

SECONDARY HEALTH FACILITY (WITH A DOCTOR)

LABORATORY INVESTIGATION

- Full blood count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)
- Glycated Haemoglobin (HBA1C)
- Lipid profile

NON-LABORATORY INVESTIGATION

- Urgent non-contrast head CT scan or MRI (DWI and T2 flair)
- Electrocardiogram
- Echocardiogram

TREATMENT

- Assess ABC (airway, breathing and circulation) and to correct any abnormalities abnormalities if possible
- Perform a swallowing test, pass NG tube if patient fails and never give anything by mouth
- Avoid lifting the patient on the affected limb to avoid shoulder subluxation
- Avoid putting objects into the patient's mouth during a seizure episode, place patient on the lateral strong side, clear the area of sharp objects or obstacles and remove dentures or eyeglasses if present
- Elevate the head of the bed at 20-30 degrees
- Check vitals (blood pressure, pulse rate, respiratory rate, temperature, RBS)
- Give suppository Paracetamol 1g if axillary temperatures are more than 37.2°
- ▶ **Do not give Aspirin when there is no CT scan to rule out a bleed**
- Give suppository Diazepam 10mg if seizures do not self-abort in less than 5 minutes

IF PATIENT HAS NO CT SCAN:

- Patient showing signs of raised Intracranial Pressure (ICP), i.e. Cushing's triad (high BP, low pulse and irregular respiration), dilated pupils, increasing somnolence or decreasing level of consciousness start management as outlined below and refer to a teaching hospital.
 - IV Mannitol concentrated solution in a dose of range of 0.25-1 g/kg body weigh every 6-8 hours over 48 hours; each dose should run over 15-30 minutes. Alternatively, 300mls of IV 3% hypertonic saline can be given once daily over 15 to 30 mins. Use hypertonic saline in patients with known CKD or renal impairment^{12,13}.
 - Refer all patients with seizures to a facility with a physician specialist/neurologist
- ▶ For BP management see *chapter 5.1* on hypertension.

TERTIARY HEALTH FACILITY

LABORATORY INVESTIGATION

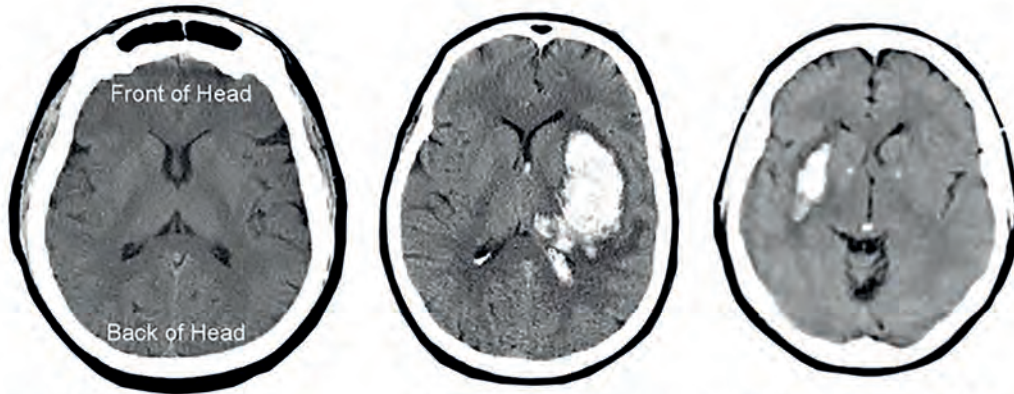
- Full blood cell count
- Blood sugar (instant finger stick glucose testing is acceptable in the emergency setting)
- Liver function test
- Lipid profile
- BUE + Creatinine
- HBA1C
- Thrombophilia screen for patients with no apparent cause of the stroke:
 - Antithrombin deficiency
 - Protein C deficiency
 - Protein S deficiency
 - Factor V Leiden
 - Prothrombin 20210 mutation
 - Antiphospholipid antibody
 - Homocysteine levels

NON-LABORATORY INVESTIGATION

- Non-contrast head CT scan
- MRI if available, MRI should be done among patients who presents after more than 4.5 hrs but less than 9 hrs to determine tissue viability for possible thrombolysis¹⁴
If available:
 - Carotid artery doppler for anterior circulation ischaemia
 - Vertebral artery doppler for posterior circulation ischaemia
 - 12-lead ECG and Holter ECG
 - Echocardiogram

N.B.

- Non-contrast head CT is a rapidly obtained, highly sensitive, and relatively more available investigation method.
- Rapid brain MRI offers the additional advantage of being both highly sensitive and specific for ischaemic stroke, particularly in cases of suspected stroke mimics^{1, 15}. In brain MRI, at least two sequences need to be done; diffusion weighted images (DWI) and apparent diffusion co-efficient (ADC). However, the availability and cost of MRI in Ghana limits its use in acute stroke.
- Holter ECG in suspected cardio-embolic stroke. A longer duration of this investigation is recommended (at least 72 hours) to diagnose atrial fibrillation. In some instances, implantable loop recorders (ILR) may be required in cryptogenic strokes¹⁶.
- Echocardiogram, preferable trans-oesophageal echocardiogram (TOE) in suspected cases of cardio-embolic strokes.



Normal CT Scan, Slice of Brain

Intracerebral Hemorrhage (bright white Area), CT Scan

Figure 12: Non-contrast CT scan showing haemorrhagic stroke

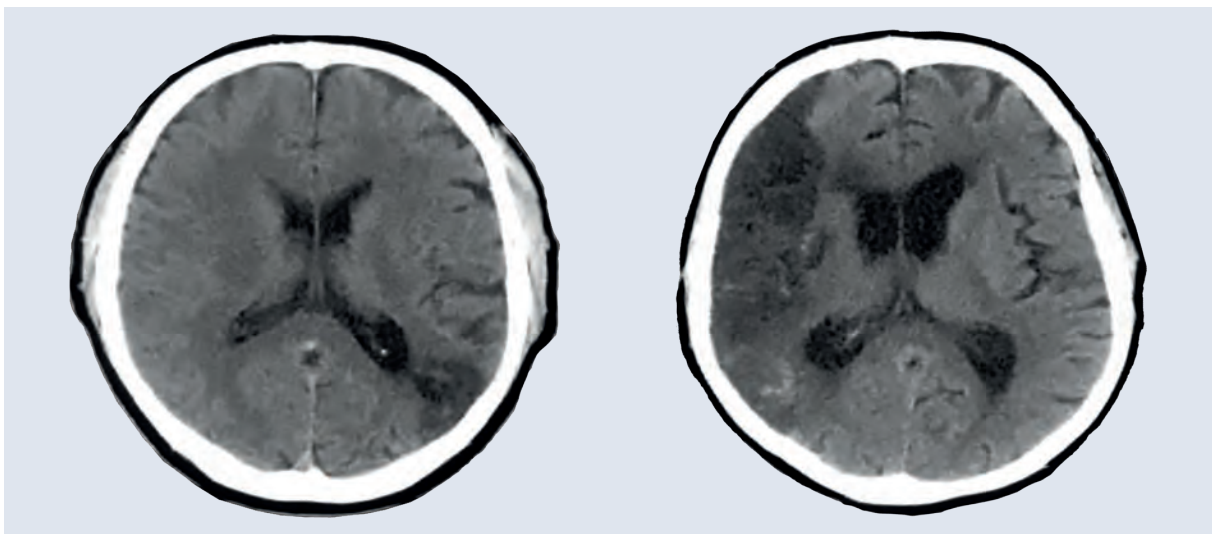


Figure 13: Non-Contrast CT scan showing ischaemic stroke

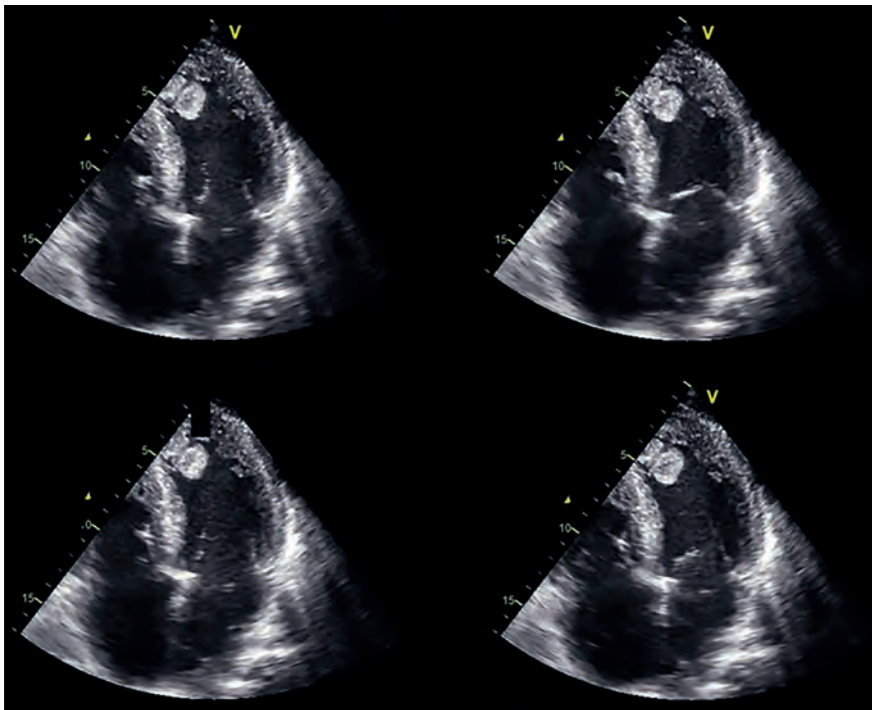


Figure 14: Echocardiogram showing an intracardiac embolus at the apex of the left ventricle

TREATMENT

1. HEAD CT SCAN CONFIRMED INFARCT

If possible, refer to a stroke unit within 4.5 hours after start of symptom for acute treatment of infarctive stroke. The three main principles of acute stroke care are:

- ▶ Achieve timely recanalisation of the occluded artery and reperfusion of the ischaemic tissue
- ▶ Optimise collateral flow
- ▶ Avoid secondary brain injury

ACUTE REPERFUSION TREATMENT (Table 40)

There is enough evidence that IV thrombolysis with rtPA and endovascular thrombectomy with a retrievable stent improves neurologic outcomes in patients with acute ischaemic stroke. Both treatments should be administered as quickly as possible after stroke onset, can be combined, and are safe in appropriately selected candidates.

- ▶ NB: currently this is not widely available in Ghana.

The standard dose of alteplase, if available for acute ischaemic stroke, is 0.9mg/kg, with 10% administered as a bolus and the remainder infused over 1 hour. The total dose should not exceed 90mg. For tenecteplase, the recommended dose is 0.25mg/kg given as a bolus, not to exceed 25mg. Antiplatelet therapy can be started 24 hours after administration of IV thrombolytic therapy. See *table 40* for inclusion and exclusion criteria for IV thrombolysis.

Table 40: Indications and contraindications for IV thrombolysis³³

Indications and contraindications for iv thrombolysis
Eligibility criteria for tPA
<ul style="list-style-type: none"> ▪ Diagnosis of ischaemic stroke causing measurable neurologic deficit ▪ Time from onset of stroke symptoms less than 4.5 hours before tPA administration
Exclusion criteria for tPA
History
<ul style="list-style-type: none"> ▪ History of intracranial haemorrhage in the preceding 6 months ▪ Stroke or serious head or spinal trauma in the preceding 3 months ▪ Major surgery (e.g., cardiac, thoracic, abdominal, orthopaedic) in the previous 14 days ▪ Arterial puncture at a non-compressible site in the preceding 7 days ▪ Any other condition that could increase the risk of haemorrhage after tPA administration
Clinical
<ul style="list-style-type: none"> ▪ Symptoms suggestive of subarachnoid haemorrhage (e.g., sudden onset of severe headache, stiff neck, photophobia, blurred/double vision) ▪ Stroke symptoms due to another non-ischaemic acute neurological condition (e.g., seizure with post-ictal Todd's paralysis, or focal neurological signs due to severe hypo- or hyperglycaemia) ▪ Severe hypertension refractory to antihypertensives such that target blood pressure <185/110 mmHg cannot be achieved
Laboratory
<ul style="list-style-type: none"> ▪ Blood glucose concentration < 2.7 mmol/l or > 22.2 mmol/l ▪ Elevated activated partial thromboplastin time (aPTT) ▪ International Normalized Ratio (INR) >1.7 ▪ Platelet count below 100,000 per cubic millimetre ▪ Current use of direct thrombin inhibitors or direct factor Xa inhibitors with elevated insensitive global coagulation tests or a quantitative test of drug activity (i.e., Hemoclot for Dabigatran♦, specific factor Xa activity assays for Rivaroxaban♦ and Apixaban♦)
CT or MRI findings
<ul style="list-style-type: none"> ▪ Any haemorrhage on brain CT or MRI ▪ CT showing early signs of extensive infarction, or MRI showing an infarct volume > 150 ml on diffusion-weighted imaging

If patient is not a candidate for thrombolysis, then the following should be instituted:

- Start oral Aspirin 50–325mg (LOE A) daily in acute state
 - Clopidogrel is a better option after the acute phase in secondary prevention (LOE B)
 - Other options are available (see pages 87/88 on secondary prevention of stroke)
- Oral Atorvastatin 40–80mg nocte or Rosuvastatin 20–40mg nocte
- ▶ Do not crash the BPs with iv antihypertensives (use iv only in hypertensive emergency, see pages 82–83)
 - Manage blood sugars and maintain sugars between 6–10 mmol/l
 - Manage pyrexia with preferably iv paracetamol and tepid sponging
 - SC Enoxaparin 40mg or Dalteparin 5000 IU daily as thrombo-prophylaxis
 - Start physiotherapy as soon as possible
 - Patients with carotid artery stenosis of more than 50% and symptomatic can be considered for carotid endarterectomy or stenting

For patients with cardioembolic stroke who are already on anticoagulation, withhold the anticoagulant for 10–14 days before restarting.

In patients with ischaemic stroke not receiving re-perfusion treatment and BP of >220/110 mmHg, BP should be carefully lowered by approximately 15% during the first 24 h after stroke onset

2. TRANSIENT ISCHAEMIC ATTACK

The risk stratification tool, the ABCD² score has been developed to help identify patients at high risk of recurrent events with the aim of determining the need for urgent hospitalisation and investigation^{17,18}. The total ABCD² score ranges from 0 to 7. A score of 4 or more or 2 or more TIAs in 24 hours is an indication for admission.

Table 41: ABCD² score^{17,18}

Clinical features	Points
Age is 60 years or older	1
Blood pressure >140/90 mmHg	1
Clinical features:	
▪ Unilateral weakness	2
▪ Speech disturbance without weakness	1
Duration:	
▪ >60 minutes	2
▪ 10–60 minutes	1
▪ <10 minutes	0
Diabetes	1

ABCD² score points (Total score 0–7)

There is about 80% reduction in the risk of stroke after TIA with the early implementation of secondary stroke prevention strategies¹⁷, these include:

- Anticoagulation of patients with atrial fibrillation
- Treatment with antiplatelet agent(s)
- Treatment with statins for most patients
- Management of hypertension
- Revascularisation of patients with symptomatic carotid artery stenosis
- Lifestyle modification

Dual antiplatelet therapy (Aspirin 75 and clopidogrel 75) is only recommended for the first 3 weeks and then use only clopidogrel afterward for secondary prevention) for high risk TIA (ABCD2 score >4 or minor stroke (NIHSS < 5)^{1,2}

3. HEAD CT SCAN CONFIRMED HAEMORRHAGE

Intracerebral haemorrhage remains a significant cause of morbidity and mortality. It contributes to severe long-term disability. Treatment includes both medical and surgical options depending on the severity of the clinical state and availability of medical resources.

Medical treatment centres on:

- ▶ Reducing intracranial pressure
- ▶ Preventing haematoma expansion
- ▶ BP control

A. RAISED INTRACRANIAL PRESSURE

Non-pharmacological management

- Elevate the head of the bed by 20-30°
- Hyperventilation for those on ventilatory support

Pharmacological management

- IV Mannitol solution in a dose range of 0.25-1.0g/kg body weight every 6-8 hours over 48 hours; each dose should run over 15-30 minutes; alternatively, 300mls of IV 3% hypertonic saline can be given once daily over 15 to 30 mins. Use hypertonic saline in patients with known CKD or renal impairment^{12,13}
- Oral Acetazolamide 250mg bd can be added if CT scan shows acute hydrocephalus
- Corticosteroids such as Dexamethasone do not have demonstrated efficacy in the treatment of cytotoxic oedema as seen in stroke; routine use of Dexamethasone should be avoided

B. HAEMATOMA EXPANSION

Controlling BPs prevent haematoma expansion. For patients with primary or secondary problems with haemostasis or taking oral anti-coagulants such as Warfarin, replacement of vitamin K (IV vitamin K 10mg daily for 3 days) is recommended. There is an additional benefit in adding prothrombin to correct INR as it is vsuperior to FFPs.

C. HYPERTENSION

When BP is more than 180/110 mmHg, it can lead to re-bleed, haematoma expansion and worsening of the oedema. BP control should aim at maintaining the BP between 130-150/70-90mmHg (140/80mmHg) within 6 hours of onset of symptoms and IV antihypertensives such as continuous IV Labetalol infusion at 5-20mg per hour can be used in the acute control of BP above 180/110 mmHg; IV Hydralazine should be avoided as it causes rebound hypertension and increased intracranial pressure.

E. SEIZURES

Monitor for seizures: if patient has a seizure give oral antiseizure medications (e.g. Carbamazepine 200mg twice daily or Levetiracetam 250mg twice daily).

- ▶ Refer all recurrent seizures in a day or seizures lasting more than 30 minutes to the next level of care

F. ANTICOAGULATION AND DVT PROPHYLAXIS

Prophylactic anticoagulation against venous thromboembolism can be initiated 48 hours after an acute bleed. There is also added benefit to the use of intermittent pneumatic compressions²⁷.

4. SUBARACHNOID HAEMORRHAGE (SAH)

SAH is a neurosurgical emergency. The emergency management of SAH should involve ABC of basic resuscitation. Patients who cannot maintain their airway should be immediately intubated. This includes patients who are in coma, in stupor from hydrocephalus and patients who need to be sedated on account of agitation.

Until patient can have endovascular coiling or surgical clipping, medical management should be instituted to prevent complications of SAH.

General management include headache management, BP control, management of hydrocephalus, prevention of cerebral vasospasms and delayed cerebral infarct.

A. HEADACHE

Use of opioids, e.g. Morphine (IV Morphine 4mg 6 hourly), is preferred. Dexamethasone (IV Dexamethasone 4mg 8 hourly) may also be used.

B. BLOOD PRESSURE CONTROL

When BPs are above 160 mmHg systolic, IV antihypertensive, e.g. Labetalol should be used to maintain a systolic blood pressure below 160mmHg. Continuous IV infusion is preferred at 5-20mg per hour.

▶ IV Hydralazine should be avoided as it causes rebound hypertension.

C. HYDROCEPHALUS

In the event of hydrocephalus, Tab Acetazolamide 250mg three times daily can be used. An external ventricular drainage (EVD), is also a surgical option even though there is increased risk of infection.

In the case of communicating hydrocephalus however, lumbar drainage can be used in place of EVD.

For prophylaxis against raised ICP, straining should be reduced with the use of stool softeners such as lactulose.

D. DELAYED CEREBRAL ISCHEMIA

Tab Nimodipine* 60mg 4 hourly is used in the prevention of delayed cerebral ischemia. Duration of this treatment is on average 21 days. Adequate maintenance of normal blood volume with fluids is recommended. Prophylactic anticoagulation should be avoided. Pneumatic stocking compression can be used instead.

E. HYPONATREMIA

Hyponatremia is a known complication of SAH due to the syndrome of inappropriate ADH secretion (SIADH), or cerebral salt wasting syndrome. Serum sodium should therefore be monitored and replaced appropriately.

F. SEIZURES

Use of antiepileptic medications is mainly limited to the period before surgical treatment of the aneurysm and is not needed after surgical treatment except in cases of ongoing seizures. Levetiracetam and Carbamazepine are preferred. Phenytoin is generally not recommended as it causes neurocognitive decline.

G. PREVENTION OF REBLEED

IV Tranexamic acid, 1g 8 hourly for 72 hours, can be used to avoid rebleeding pending endovascular or surgical intervention. Prolonged use however increases the risk of VTEs, strokes and MI.

▶ After stabilisation, all SAH patients should be referred for clipping or coiling.

NB: Coiling however is the preferred choice as it has a better outcome.

▶ Patients with SAH should be on admission for at least two weeks.

5.2.4 COMPLICATIONS OF STROKE

Medical complications following stroke are common and are associated with poor clinical outcomes, increased length of stay and higher rates of readmission, increased cost of care, delayed time to rehabilitation, and increased mortality¹⁹⁻²¹. While the majority of deaths that occur in the first week of stroke are attributable to ischaemic stroke, mortality beyond the first week is attributable to the complications of stroke¹⁹⁻²¹.

EARLY COMPLICATIONS

- Malignant cerebral oedema
- Haemorrhagic transformation of ischaemic brain tissue
- Infections, eg aspiration pneumonia/lobar pneumonia and urinary tract infection (UTI)
- Venous thromboembolism
- Bed sores
- Seizures

LATE COMPLICATIONS

- Seizures/epilepsy
- Depression
- Falls

5.2.5 REFERRAL

Ideally all stroke cases should be referred to a Stroke Unit immediately for optimal care from a multidisciplinary team (MDT = the medical, neurosurgical, nursing, physiotherapy, clinical psychologist, occupational therapist, dietician, speech and language therapist).

▶ All stroke cases should be referred to a facility with a physician specialist. The physician specialist will have to follow the algorithm below to refer to a stroke unit.

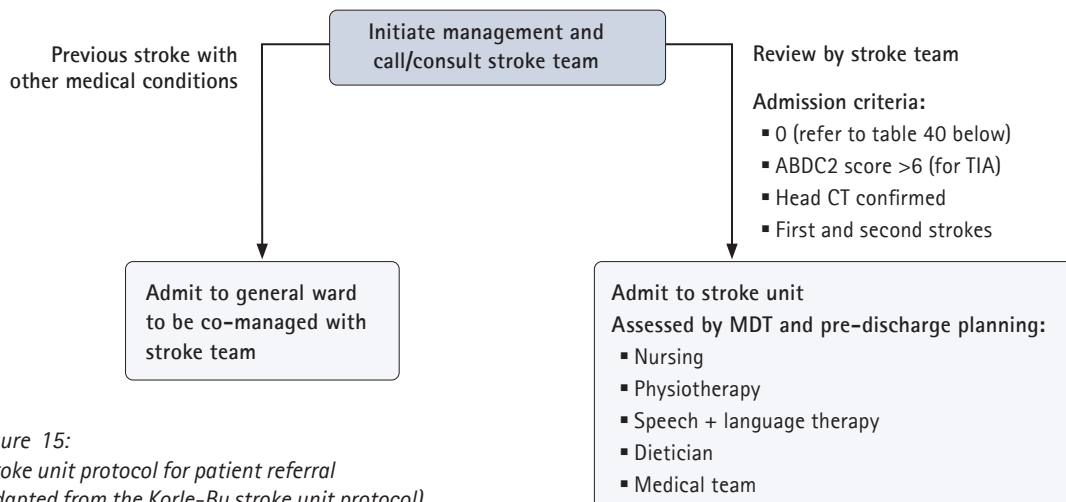


Figure 15:
Stroke unit protocol for patient referral
(Adapted from the Korle-Bu stroke unit protocol)

DISCHARGE PLAN

Discharge plan should be initiated from day one of admission with the MDT.

Below is a table for the scoring system for ROSIER scale:

Table 42: The recognition of stroke in the emergency room (ROSIER) scale³²

ROSIER Scale		
Stroke Assessment		
The aim of this assessment tool is to enable medical and nursing staff to differentiate patients with stroke and stroke mimics.		
Assessment	Date _____	Time _____
Symptom onset	Date _____	Time _____
GCS E = <input type="checkbox"/> M = <input type="checkbox"/> V = <input type="checkbox"/> BP <input type="checkbox"/> *Blood sugar		
▶ *If blood sugar < 3.5 mmol/l treat urgently and reassess once blood glucose is normal		
Has there been loss of consciousness or syncope?	Y (-1)	N (0)
Has there been seizure activity?	Y (-1)	N (0)
Is there a NEW ACUTE onset (or on awakening from sleep)?		
I. Asymmetric facial weakness	Y (+1)	N (0)
II. Asymmetric arm weakness	Y (+1)	N (0)
III. Asymmetric leg weakness	Y (+1)	N (0)
IV. Speech disturbance	Y (+1)	N (0)
V. Visual field defect	Y (+1)	N (0)
*Total score _____ (-2 to +5)		
Provisional diagnosis: <input type="checkbox"/> stroke <input type="checkbox"/> Non-stroke (specify) _____		
*Stroke is likely if total scores are >0		
Scores of </= 0 have a low possibility of stroke but not completely excluded		

5.2.6 PATIENT EDUCATION AND PREVENTION

Some medical conditions and lifestyle choices can predispose anyone to stroke. Persons at risk must therefore be educated about their existing health conditions, the need for healthy lifestyle modification plans and to report for management when they feel unwell.

▶ Refer to *chapter 2* of these guidelines.

PREVENTION OF RECURRENT INFARCTIVE STROKE

About 80% of recurrent ischaemic strokes can be prevented using a combined approach of lifestyle and intensive medical therapy³⁴. However, only about 30% of patients who have ischaemic stroke receive all the appropriate recurrent stroke prevention measures.

In secondary prevention of stroke, the ABCDE approach can be adopted:

- A Antiplatelet/anticoagulation
- B Blood pressure control/blood glucose control
- C Cholesterol medication
- D Diet
- E Exercise and lifestyle modification

A ANTIPLATELET/ANTICOAGULATION

In the general prevention of recurrent ischaemic stroke, it is recommended to maintain patients on antiplatelet medications. Three options are available when deciding on antiplatelet therapy:

- Aspirin 50-300mg daily (Level Of Evidence A)
- Aspirin + extended release Dipyridamole* 25mg/200mg twice daily (Level Of Evidence B)
- Clopidogrel 75mg daily (Level Of Evidence B)

Aspirin plus extended release Dipyridamole* or Clopidogrel is a better secondary prevention option than Aspirin alone^{22,23}.

Long term Aspirin use with Clopidogrel is not recommended as it increases the risk of haemorrhage^{22,23}.

The choice of anti-platelets medications may however be dependent on:

- Patient preference
- Cost
- Comorbidities

For cardioembolic strokes such as atrial fibrillation, the use of anticoagulation is based on the risk stratification scores (e.g. CHA₂DS₂-VASc) and the bleeding risk scores (e.g. HASBLED).

▶ Refer to *chapter 5.9* on arrhythmia.

B BLOOD PRESSURE CONTROL

▶ Refer to *chapter 5.1* on hypertension.

B BLOOD GLUCOSE CONTROL

▶ Refer to *appropriate guidelines*.

C CHOLESTEROL MEDICATIONS

High intensity statin use is recommended in the prevention of recurrent ischaemic stroke. The two medications indicated are

- Atorvastatin 80mg daily⁴³
- Rosuvastatin 20-40mg daily⁴⁴

D DIET CONTROL

▶ Refer to *chapter 2* of these guidelines.

E EXERCISE AND LIFESTYLE MODIFICATION

▶ Refer to *chapter 2* of these guidelines.

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5 DISEASES

5.3 CHEST PAIN, CORONARY ARTERY DISEASE AND MYOCARDIAL INFARCTION

LIST OF ABBREVIATIONS AND ACRONYMS

ACS	ACUTE CORONARY SYNDROMES	IHD	ISCHEMIC HEART DISEASE
ASCVD	ATHEROSCLEROTIC CARDIOVASCULAR DISEASE	LOE	LEVEL OF EVIDENCE
CABG	CORONARY ARTERY BYPASS	MI	MYOCARDIAL INFARCTION
GRAFT		NSTE-ACS	NON-ST ELEVATION ACUTE CORONARY SYNDROME
CAD	CORONARY ARTERY DISEASE	NSTEMI	NON-ST ELEVATION MYOCARDIAL INFARCTION
COPD	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	PAD	PERIPHERAL ARTERY DISEASE
CCS	CHRONIC CORONARY SYNDROME	PCI	PERCUTANEOUS CORONARY INTERVENTION
ECG	ELECTROCARDIOGRAM	STEMI	ST ELEVATION MYOCARDIAL INFARCTION
FBC	FULL BLOOD COUNT	UA	UNSTABLE ANGINA
GERD	GASTRO-OESOPHAGEAL REFLUX DISEASE		

5.3.1 INTRODUCTION

DEFINITION

Atherosclerosis of the coronary arteries leads to clinical conditions, which usually come with varying degrees of chest pain or symptoms equivalent to chest pain due to myocardial ischaemia, injury or infarction. Globally, atherosclerotic cardiovascular disease (ASCVD) is a leading cause of morbidity and mortality¹. Coronary artery atherosclerosis results in plaque formation starting with fatty streaks and gradually leading to overt obstructive plaque. Thus, atherosclerosis of coronary arteries, also referred to as coronary artery disease (CAD), may lead to fixed obstruction of the coronary arteries or dynamic obstruction when there is plaque rupture or erosion resulting in thrombus formation and coronary vasospasm. Fixed severe obstructions usually result in myocardial ischaemia due to reduced blood supply, which if prolonged and severe gives rise to stable ischaemic heart disease. On the other hand, acute coronary vasospasm or dynamic obstructions would usually lead to myocardial injury and if prolonged and severe, results in myocardial infarction or cell death.

Coronary artery disease (CAD), also known as ischaemic heart disease refers to a range of clinical conditions that arise due to structural and/or functional changes related to the coronary arteries and/or microcirculation of the heart. These changes may lead to hypoperfusion of the myocardium due to mismatch between myocardial demand and blood supply. CAD leads to clinical conditions which usually present with varying degrees of chest pain or symptoms equivalent to chest pain due to myocardial ischaemia, injury or infarction. The main underlying cause of coronary artery disease is the accumulation of atherosclerotic plaques in the coronary arteries.

CAD encompasses two syndromes: **chronic coronary syndrome** (formerly known as stable angina pectoris) and **acute coronary syndromes** (ACS).

Chronic coronary syndrome (CCS) is defined by the European Society of Cardiology as a range of clinical presentations or syndromes that arise due to structural and/or functional alterations related to chronic diseases of the coronary arteries and/or microcirculation². The alterations in the coronary arteries may lead to transient and reversible mismatch in myocardial oxygen supply and demand resulting in hypoperfusion and ischaemia of the myocardium. CCS is often provoked by exertion, emotion and stress, and manifests clinically as chest pain (angina pectoris), other chest discomfort or dyspnoea which resolve with rest or nitroglycerine. CCS tends to be stable for long periods but are frequently progressive. The underlying atherosclerosis may destabilize at any time resulting in acute coronary syndromes.

Acute coronary syndromes comprise of a spectrum of conditions characterized by recent onset of chest pain with or without associated symptoms or signs with or without changes on 12-lead electrocardiogram and with or without changes in cardiac troponin concentrations³. ACS is underlined by dynamic obstruction of the affected coronary artery when there is rupture or erosion of atherosclerotic plaque resulting in superimposed thrombus formation and vasospasm. These events result in obstruction of blood flow to the heart muscle (myocardium), which if prolonged and severe, results in myocardial infarction or cell death. Patients usually present with recent unprovoked chest pain and/or related symptoms. Initial electrocardiogram may distinguish patients as having ST elevation myocardial infarction (STEMI) or Non-ST elevation acute coronary syndrome (NSTEMI-ACS). NSTEMI-ACS may eventually receive a diagnosis of non-ST-elevation myocardial infarction (NSTEMI) when cardiac troponin (preferably high sensitive troponin) is elevated or unstable angina (UA) when cardiac troponin is normal (*see figure 19*).

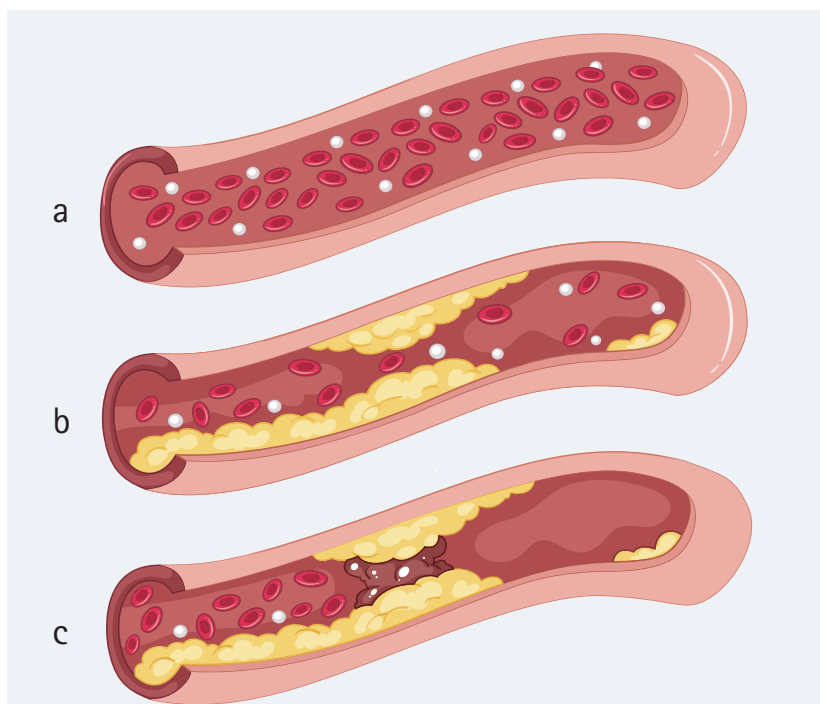


Figure 16: Coronary arteries demonstrating normal artery (a), artery with stable/fixed obstruction in CCS (b) and artery with blood clot on unstable plaque causing dynamic obstruction in ACS (c)

EPIDEMIOLOGY

There are many causes of imbalance between myocardial blood supply and demand, however, CAD due to atherosclerosis is notably the most common. Many preventive and risk factor modifications are geared towards reducing the incidence of CAD. Worldwide, an estimated 17.9 million people died from CVDs in 2019, accounting for 32% of all global deaths⁴. Of these deaths, 85% are due to heart attack and stroke. In 2021, an estimated 9 million people died from coronary heart diseases globally⁵. Over three quarters of these mortalities take place in low-to-middle income countries, underscoring the urgent need for targeted prevention and management strategies in these regions⁶. In the African Region, CVDs are an emerging epidemic, increasingly contributing to the overall burden of disease, accounting for over 11% of total deaths in sub-Saharan Africa as of 2019⁴. Although data on CAD in Ghana is scanty, the consensus among many cardiologists and internists in Ghana is that the prevalence is increasing.

Table 43: Pathological changes affecting myocardial blood supply and demand

Pathological changes in coronary arteries	Clinical presentation
Fixed stenosis	Angina or stable angina
Acute or subacute thrombus formation/spasm	Unstable angina (UA) Non-ST Elevation Myocardial Infarction (NSTEMI) ST Elevation Myocardial Infarction (STEMI)

5.3.2 CHRONIC CORONARY SYNDROME (FORMERLY STABLE CORONARY ARTERY DISEASE)

PATHOPHYSIOLOGY

As described above, a number of pathological mechanisms are involved in CCS. The main cause is atherosclerosis in coronary arteries which begin as fatty streaks and progress to form large atheromatous plaques which obstruct the lumen of the coronary vessels. This is known as coronary artery disease (CAD). When there is increased myocardial oxygen demand provoked by physical exertion, emotion or stress, the obstruction of blood flow by the plaque leads to a mismatch between myocardial oxygen demand and supply causing myocardial ischaemia. In addition, atherosclerosis is a chronic progressive inflammatory condition driven by cardiovascular risk factors such as hypertension, diabetes mellitus, smoking, dyslipidaemia, etc. The plaque can destabilize at any time which it ruptures or its covering is eroded. This leads to acute formation of blood clot/thrombus and resulting acute obstruction of the coronary vessel and associated vasospasm (acute coronary syndrome).

CCS may also be caused by other pathological mechanisms which do not involve identifiable obstructive coronary artery disease. These disorders involve both macro and micro vessels of the coronary circulation. Macro vessels without obstructive lesions may undergo structural and functional alterations which may cause transient myocardial ischaemia. Disorders of the structure and function of the coronary microcirculation (pre-arterioles, arterioles and capillaries) known as coronary microcirculation dysfunction (CMD) are increasingly being recognized as significant causes of cardiovascular disorders including CCS. These disorders lead to impaired vasodilatation and vasospasms of the coronary microvasculature leading to myocardial hypoperfusion and ischaemia⁷. These non-obstructive alterations may lead to angina with non-obstructive coronary arteries (ANOCA) and ischaemia with non-obstructive coronary arteries (INORCA). Other conditions which may cause non-acute myocardial ischaemia and cause or contribute to CCS are anaemia, thyrotoxicosis, tachycardia and myocardial hypertrophy. These conditions may cause CCS alone or in various combinations.

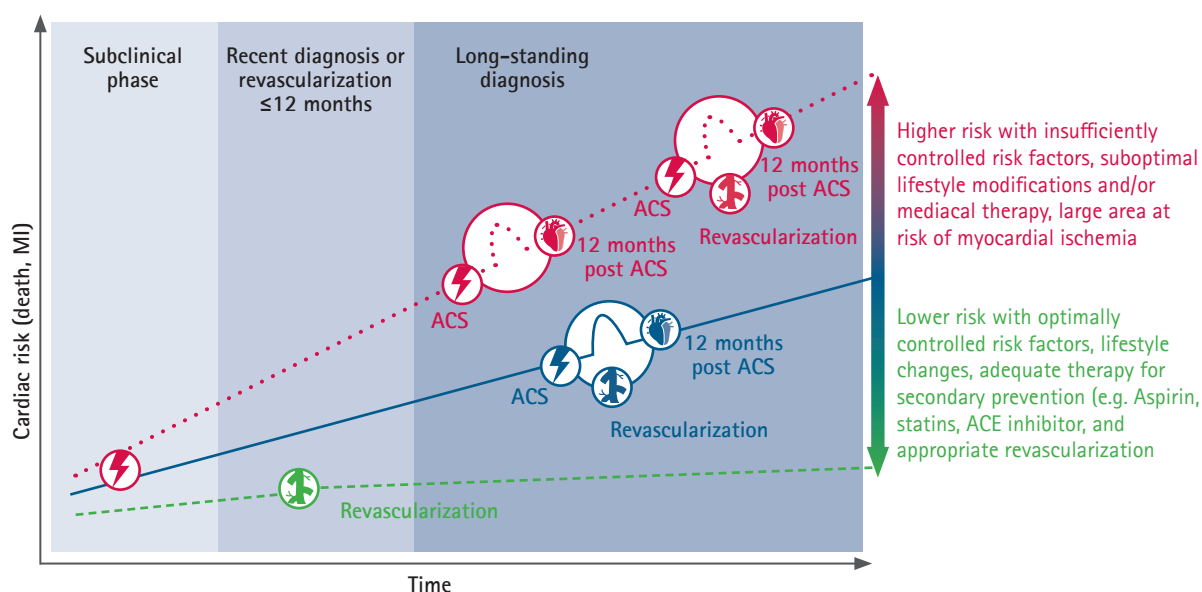


Figure 17:
Progression of chronic coronary syndrome⁸

CLINICAL PRESENTATION

Patients with chronic coronary syndrome may present with different clinical scenarios 2,8

- Angina pectoris and or dyspnea
- Heart failure or LV dysfunction
- Symptomatic or asymptomatic post-ACS <1 yr or recent revascularization.
- Symptomatic or asymptomatic patients after >1 yr of diagnosis or revascularization.
- Symptomatic or asymptomatic patients with spastic or microvascular disease

Asymptomatic patients detected during screening

Commonly, CCS is characterized by angina pectoris, a clinical presentation of chest pain/myocardial ischaemia brought on by exertion or stress and relieved by rest or Nitroglycerin[♦]. There is usually no cardiomyocyte necrosis. Myocardial ischaemia in patients with stable CAD is a result of a mismatch between blood supply and metabolic demand. Reduced blood supply to the heart will result in abnormal myocardial function including regional wall motion abnormalities, ST-T wave changes on the 12-lead ECG (electrocardiogram) and cardiac ischaemic pain (angina)^{2,3}. Patients may also present with non-anginal symptoms including dyspnoea and fatigue.

SYMPTOMS

Angina pectoris - a sensation of “strangling in the chest”², is associated with chest pain:

- which is ‘squeezing’, ‘tight’ or ‘gripping’ or ‘choking’ in character (patient may place clenched fist over precordium to describe the pain – Levine’s sign)
- may radiate to the left arm, neck or jaw

Angina equivalent symptoms (cardiac symptoms other than chest pain):

- dyspnoea on exertion
- exertional nausea
- syncope
- palpitations
- mid-epigastric discomfort or sharp chest pain in women, diabetics and the elderly^{4, 5, 3}

Table 44: Characteristics of angina versus other forms of chest pain

Definition	Characteristics
Typical angina or definite angina	Must meet all three criteria below: <ul style="list-style-type: none"> ▪ Substernal chest pain or discomfort with characteristic duration usually less than 10 min. (2 to 5 min.) ▪ Brought on by exertion or emotional stress ▪ Relieved by rest or Nitroglycerin[♦]/Glyceryl trinitrate
Atypical angina or probable angina	Meets 2 of the above characteristics
Non-anginal chest pain	Meets 1 or none of the typical anginal characteristics

FUNCTIONAL CLASSIFICATION OF ANGINA

The severity of angina is based on the severity of chest pain due to the myocardial ischaemia. One way of documenting the severity of angina is by using the functional classification of angina by the Canadian Cardiovascular Society.

Table 45: Functional classification of angina (Adapted from Canadian Cardiovascular Society⁶)

Functional Class	Description of levels of activity that bring on chest pain/angina
Class I	Ordinary activity such as walking or climbing stairs does not cause angina; angina occurs with strenuous, rapid or prolonged exertion at work or recreation
Class II	Slight limitation of ordinary activity; angina occurs on walking or climbing stairs rapidly, walking or stair climbing after meals, in cold wind or under emotional stress
Class III	Marked limitation of ordinary physical activity; walking one or two blocks (e.g. walking 50-300) metres on the flat on the level and climbing one flight of stairs in normal conditions and at normal pace
Class IV	Inability to carry on any physical activity without discomfort, anginal syndrome may be present at rest

PRE-TEST RISK ASSESSMENT OF PATIENTS PRESENTING WITH CHEST PAIN

There are three variables important in predicting risk of presence of CAD in a patient presenting with symptoms of chest pain/angina, angina or angina equivalents:

1. **Age:** The older the patient, the more likely the patient has significant coronary artery disease
2. **Type of Pain:** Typical angina presentation is more likely to be due to CAD. Non anginal chest pain, fleeting chest pain, pins and needles are less likely due to CAD
3. **Gender:** Males are more likely to have coronary artery disease compared to females below menopausal age

Table 46 below should be used to assess a patient’s pretest probability of having coronary artery disease should they present with chest pain⁷.

Table 46: CAD pretest probabilities (%) in patients with stable chest pain symptoms

Age	Typical angina		Atypical angina		Non-anginal pain	
	Men	Women	Men	Women	Men	Women
30-39	59	28	29	10	18	5
40-49	69	59	38	14	25	8
50-59	77	69	49	20	34	12
60-69	84	77	59	28	44	17
70-79	89	84	69	37	54	24
>80	93	76	78	47	65	32

■ (>85%) - Very high-risk patients ■ (66-85%) - High-risk patients ■ (15-65%) - Medium-risk patients

An updated pretest probability (PTP) assessment has been introduced which considers age, sex, and symptoms as well as the presence or absence of dyspnea. The updated PTP for obstructive coronary artery disease prevents overestimation of the pretest probability with a percentage of less than 15% indicating a low pretest probability². It is safe to defer routine testing in patients with PTP <15%, thus reducing unnecessary procedures and costs. Below is a diagram of the updated pretest probability². Modifiers of the PTP estimate including ECG changes, LV dysfunction suggestive of ischemia, and coronary calcium by CT scan can be used to improve estimations of the PTP of obstructive CAD.

Age	Chest Pain						Dyspnea	
	Typical		Atypical		Non-anginal		Men	Women
	Men	Women	Men	Women	Men	Women		
30-39	3%	5%	4%	3%	1%	1%	0%	3%
40-49	22%	10%	10%	6%	3%	2%	12%	3%
50-59	32%	13%	17%	6%	11%	3%	20%	9%
60-69	44%	16%	26%	11%	22%	6%	27%	14%
70+	52%	27%	34%	19%	24%	10%	32%	12%

In addition to the classic Diamond and Forester classes, patients with dyspnoea only or dyspnoea as the primary symptom are included. The dark green shaded regions denote the groups in which non-invasive testing is most beneficial (pre-test probability >15%). The light green shaded regions denote the group with pre-test probability of CAD between 5-15% in which the testing for diagnosis may be considered after assessing the overall clinical likelihood based on modifiers of pre-test probability.

Thus, a 35-year-old woman with atypical angina has only a 3% PTP of having obstructive CAD and further diagnostic testing – besides a good history, basal blood tests, an ECG and possibly an echo exam – is not necessary. Some CAD patients have dyspnoea as the only symptom and in this new version of the Table, there is a new column for this group.

This pre-test probability can be further modified by applying other known clinical risk markers such as smoking and lipid status, ECG changes, coronary CT, carotid ultrasound, etc., and can be correspondingly diminished or augmented to give a clinical likelihood ratio (*figure 3*) for obstructive CAD.

COMMON CAUSES OF CHEST PAIN

Chest pain can have several causes. As opposed to chronic recurrent chest pain, all patients with new onset chest pain should be evaluated under the differential diagnosis of myocardial infarction/heart attack as discussed below⁸.

Table 47: Mimics of angina/other causes of chest pain

Causes of chest pain	Features
Angina	<ul style="list-style-type: none"> ▪ Substernal chest pain or discomfort with characteristic duration usually less than 10 minutes (2 to 5 minutes) ▪ Brought on by exertion or emotional stress ▪ Relieved by rest or Nitroglycerin[*]/Glyceryl trinitrate
GERD (Gastro-oesophageal reflux disease)	<ul style="list-style-type: none"> ▪ Symptoms worse at night, early morning, may have chronic nocturnal cough ▪ Symptoms usually abate with avoidance of certain foods and late eating
Cholelithiasis	Worse after eating, especially fatty food
Peptic ulcer disease	May be worse with hunger and relieved with antacids
Musculoskeletal	Worse with movement and reproducible with palpation
Radiculopathy/cervical spondylosis	Associated with numbness, neuropathic pain and neck pain
Herpes zoster	Very painful superficial blisters along dermatome; may not have rash
Psychiatric	Usually there is a precipitant and exaggerated description of detailed symptoms
Mild chronic heart failure	Patients may have exertional dyspnea due to heart failure and may present as angina equivalent; usually, they will have leg swelling and nocturnal symptoms of congestion
Pneumonia	Associated with pleurisy, cough and fever

SIGNS

- Most patients may have no signs
- Diaphoresis (excessive sweating)
- Pulse rate may be increased or decreased
- Blood pressure may be increased or decreased
- Skin signs of hyperlipidaemia such as the presence of xanthelasma may be a pointer to atherosclerosis

Other clinical presentations of CCS include:

- Symptomatic or asymptomatic post-ACS <1 yr or recent revascularization
- Symptomatic or asymptomatic patients after >1 yr of diagnosis or revascularization
- Symptomatic or asymptomatic patients with spastic or microvascular disease
- Asymptomatic patients detected during screening

5.3.3 MANAGEMENT OF CCS

TREATMENT OBJECTIVES

- Relieve chest pain and any other symptoms
- Improve quality of life
- Prevent complications of CAD such as acute myocardial infarction or heart failure
- Identify and manage modifiable risk factors
- Prevent cardiovascular related death

STRATEGIES FOR ACHIEVING TREATMENT OBJECTIVES

- Educate patients about the aetiology, clinical manifestations, treatment options and prognosis of ischaemic heart disease (IHD); encourage active participation of patients in their treatment decisions
- Identify and treat conditions that contribute to, worsen, or complicate IHD
- Effectively modify risk factors for IHD by both pharmacological and nonpharmacological methods
- Use evidence-based pharmacological treatments to improve patients' health status and survival, with attention to avoiding drug interactions and side effects

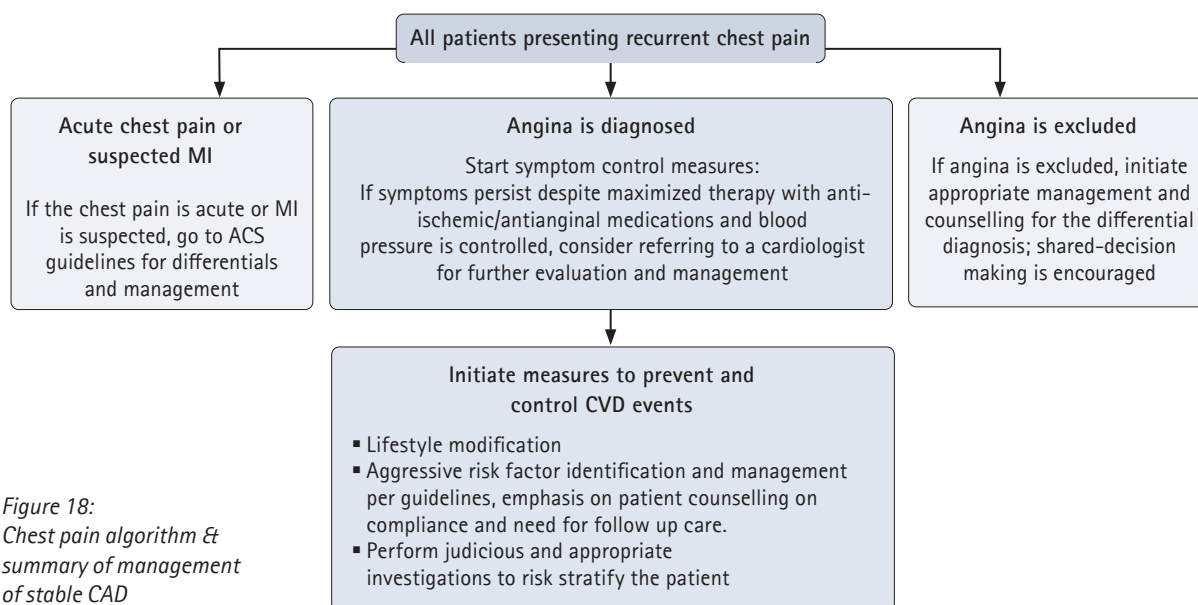


Figure 18:
Chest pain algorithm &
summary of management
of stable CAD

MANAGEMENT ACCORDING TO LEVEL OF CARE^{10,4}

PRIMARY HEALTH FACILITY

INITIAL ASSESSMENT

- Blood Pressure
- Oxygen saturation (SPO₂)

LABORATORY INVESTIGATION

- Full blood count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)
- Glycated Haemoglobin (HBA1C)
- Lipid profile

NON-PHARMACOLOGICAL TREATMENT

- ▶ Educate the patient by the patient education/information guide below.

HEALTHY LIFESTYLE MODIFICATIONS:

- Weight control - maintenance of a BMI of 18.5 to 24.9 kg/m², maintenance of a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women
- Lipid management
- Dietary management
- Ensure compliance with BP control
- Smoking cessation and avoidance of exposure to second-hand smoke

- ▶ Refer patient to a secondary health facility

SECONDARY HEALTH FACILITY

INITIAL ASSESSMENT

- Blood pressure
- ECG
- Chest X-ray
- Oxygen saturation (SPO₂)

LABORATORY INVESTIGATION

- Full blood count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)

- Glycated Haemoglobin (HBA1C)
- Lipid profile

NON- LABORATORY INVESTIGATION

- Echocardiogram

NON-PHARMACOLOGICAL TREATMENT

- ▶ Educate the patient by the patient education/information guide below.

HEALTHY LIFESTYLE MODIFICATIONS:

- Weight control - maintenance of a BMI of 18.5 to 24.9 kg/m², maintenance of a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women (less for certain racial groups)
- Lipid management
- BP control: ensure compliance with BP control
- Sugar control: ensure compliance with sugar control
- Smoking cessation and avoidance of exposure to second-hand smoke
- Dietary management

RISK FACTOR MANAGEMENT (LOE A)

Identify and manage risk factors such as hypertension, diabetes and hyperlipidaemias

- Optimise or initiate treatment for hypertension (*refer to chapter 5.1 of these guidelines*)
- Optimise or initiate treatment for diabetes mellitus
- Optimise cholesterol treatment (*refer to chapter 2 of these guidelines*)
- Identify heart failure (*refer to chapter 5.4 of these guidelines*)

PHARMACOLOGICAL TREATMENT

ANTI-ANGINAL THERAPY (LOE A)

- Bisoprolol, oral 2.5-10mg daily depending on BP and response
or
 - Carvedilol, oral 3.125-25mg 12 hourly depending on BP and response
or
 - Metoprolol, oral 50-100mg 8-12 hourly depending on BP and response
or
 - Metoprolol XL, oral 25-50mg daily
or
 - Atenolol, oral 50-100mg daily depending on BP and response
- ▶ NOTE: Avoid Beta-blockers in bronchial asthma, bradycardia and hypotension; avoid Atenolol in heart failure. Patients with Asthma may be given bisoprolol or metoprolol which are B1-selective B-blockers and relatively safe (Bennett M. et al, 2021). These medications should be prescribed by specialists and such patients should be monitored while on the medication.

If patient is asthmatic or requires further antianginal medication, consider Verapamil and Diltiazem* (LOE A)

- Diltiazem*, oral 60-120mg 12 hourly or extended release preparations.
or
- Verapamil, oral 80mg to 160mg 8hrly or extended release preparations.
or
- Amlodipine, oral 5-10mg daily
or
- Nifedipine XL, oral 30-60mg daily
or
- Nifedipine Retard, oral 10-40mg 12 hourly
or
- Felodipine*, oral 5-10mg daily

- ▶ Avoid in bradycardia, hypotension and in patients with heart failure; for Verapamil and Diltiazem*, avoid if patient is already on Beta-blockers.

ANTI-PLATELET THERAPY (LOE A)

- Aspirin, oral 75mg daily
or
- Clopidogrel, oral 75mg daily if allergic to Aspirin or GI intolerance

- ▶ Dual antiplatelet is not indicated unless high risk patient (new onset, severe angina).

If further antianginal therapy is needed, or if Beta-blockers or Verapamil are contraindicated, then use:

- Isosorbide Dinitrate, oral 10mg 8-12 hourly
or
- Isosorbide Mononitrate, oral 30-120mg daily

- ▶ Patients on Sildenafil or other phosphodiesterase 5 inhibitors should not be placed on nitrates.
 - Consider: Trimetazidine*, oral 35mg 12hrly or once daily
or
 - Consider: Ranolazine*, oral 500mg 12hrly
- ▶ Refer patient to a health facility with a physician specialist, if there is no significant improvement in symptoms after the initial treatment above or the patient has worsening signs.

TERTIARY HEALTH FACILITY

INITIAL ASSESSMENT

- Blood pressure
- ECG
- Stress ECG
- Echocardiography
- Chest X-ray
- Oxygen saturation

LABORATORY INVESTIGATION

- Full blood count
- Blood urea, electrolytes and creatinine (kidney function tests)
- Blood sugar (random blood sugar or fasting blood sugar)
- Glycated Haemoglobin (HBA1C)
- Lipid profile

NON-PHARMACOLOGICAL TREATMENT

- ▶ Educate the patient by the patient education/information guide below.

HEALTHY LIFESTYLE MODIFICATIONS:

- Weight control - maintenance of a BMI of 18.5 to 24.9 kg/m², maintenance of a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women
- Lipid management
- BP control: Ensure compliance
- Smoking cessation and avoidance of exposure to second-hand smoke
- Dietary management

RISK FACTOR MANAGEMENT (LOE A)

Identify and manage risk factors such as hypertension, diabetes and hyperlipidaemias.

- Optimise or initiate treatment for hypertension (*refer to chapter 5.1 of these guidelines*)
- Optimise or initiate treatment for diabetes mellitus
- Optimize cholesterol treatment (*refer to chapter 2 of these guidelines*)
- Identify heart failure (*refer to chapter 5.4 of these guidelines*)

PHARMACOLOGICAL TREATMENT

ANTI-ANGINAL THERAPY (LOE A)

- Glyceryl trinitrate, sublingual 500micrograms, then as required for the relief of chest pain; instruct patient to report if pain is not resolving.
Avoid in patients with hypotension (systolic BP < 100mmHg), patients on sildenafil or other phosphodiesterase 5 inhibitors, and patient with right ventricular infarction (on ECG)
and
- Bisoprolol, oral 2.5-10mg daily depending on BP and response
or
- Carvedilol, oral 3.125-25mg 12 hourly depending on BP and response
or
- Metoprolol, oral 50-100mg 8-12 hourly depending on BP and response
or
- Metoprolol XL, oral 25-50mg daily
or
- Atenolol, oral 50-100mg daily depending on BP and response

- ▶ **NOTE:** Avoid Beta-blockers in bronchial asthma, bradycardia and hypotension; avoid Atenolol in heart failure. Patients with Asthma may be given bisoprolol or metoprolol which are B1-selective B-blockers and relatively safe (Bennett M. et al, 2021). These medications should be prescribed by specialists and such patients should be monitored while on the medication

If patient is asthmatic or requires further antianginal medications consider Verapamil and Diltiazem[♦] (LOE A)

- Diltiazem[♦], oral 60-120mg 12 hrly or extended release preparations
or
- Verapamil, oral 80-160mg 8 hrly or extended release preparations
or
- Amlodipine, oral 5-10mg daily
or
- Nifedipine XL, oral 30-60mg daily
or
- Nifedipine, oral 10-40mg 12hourly
or
- Felodipine[♦], oral 5-10mg daily

- ▶ Avoid in bradycardia, hypotension and in patients with heart failure; for Verapamil and Diltiazem[♦], avoid if patient is already on Beta-blockers.

ANTI-PLATELET THERAPY (LOE A)

- Aspirin, oral, 75mg daily
or
- Clopidogrel, oral 75mg daily if allergic to Aspirin or GI intolerance
- ▶ Dual antiplatelet is not indicated except high risk patient (new onset, severe angina).

If further antianginal therapy needed or if beta-blockers or Verapamil are contraindicated:

- Isosorbide Dinitrate, oral 10mg 8-12 hourly
or
- Isosorbide Mononitrate, oral 30-120mg daily
- ▶ Patients on Sildenafil or other phosphodiesterase 5 inhibitors should not be placed on nitrates.
- Consider: Trimetazidine[♦], oral 35mg 8hourly
or
- Consider: Ranolazine[♦], oral 500mg 12hourly
- ▶ Refer patient to a specialised centre or a cardiologist, if there is no significant improvement in symptoms after the initial treatment above or the patient has worsening signs.
- ▶ After initial stabilization, patient should be referred to cardiologist for further investigation and management. Thereafter, patient should be referred back to primary physician for continuation of care.

SPECIALISED CENTRE WITH A CARDIOLOGIST

NON-LABORATORY INVESTIGATION

Additional to investigation undertaken at the level of care with a physician specialist:

Coronary artery calcium score (CACs) (for those with CCS with intermediate risk)

CT Coronary angiogram with

- Fractional flow reserve if available
- Intravascular ultrasound if available

LABORATORY INVESTIGATION

▶ Same as in a healthy facility with a physician specialist.

TREATMENT

- Confirm diagnosis
- Ensure guideline medical therapy/optimal medical therapy with adequate doses
- Coronary angioplasty with or without stent for severe obstructive CAD with moderate to severe symptoms or ischaemia while on optimal medical therapy
- CAD is significant if stenosis is >70% (>50% left main CAD) or there is significant functional testing (Fractional Flow Reserve (FFR)<0.80)
- Consider CABG for multiple vessel disease and SYNTAX score >22, left main disease and young diabetic with multivessel disease

NB: CT coronary angiogram is recommended for patients with intermediate pretest probability in whom CAD cannot be excluded by clinical assessment alone⁴⁸.

Modifiers including coronary calcium burden by CT scan, Ischaemic ECG changes, and LV dysfunction due to ischaemia can be used to determine the clinical likelihood of obstructive coronary artery disease.

5.3.4 PATIENT EDUCATION/INFORMATION

- The importance of medication adherence for managing symptoms and retarding disease progression
- How to recognize worsening cardiovascular symptoms and the need to rush to a medical facility once such symptoms occur
- How to recognise worsening cardiovascular symptoms
- Adherence to a diet that is low in saturated fat, cholesterol, and trans-fat; high in fresh fruits, whole grains, and vegetables
- Importance of healthy lifestyle modification

5.3.5 PREVENTION OF STABLE CAD

Stable CAD is prevented by the modification of its risk factors (refer to *chapter 2* of these guidelines).

5.3.6 ACUTE CORONARY SYNDROMES (ACS)

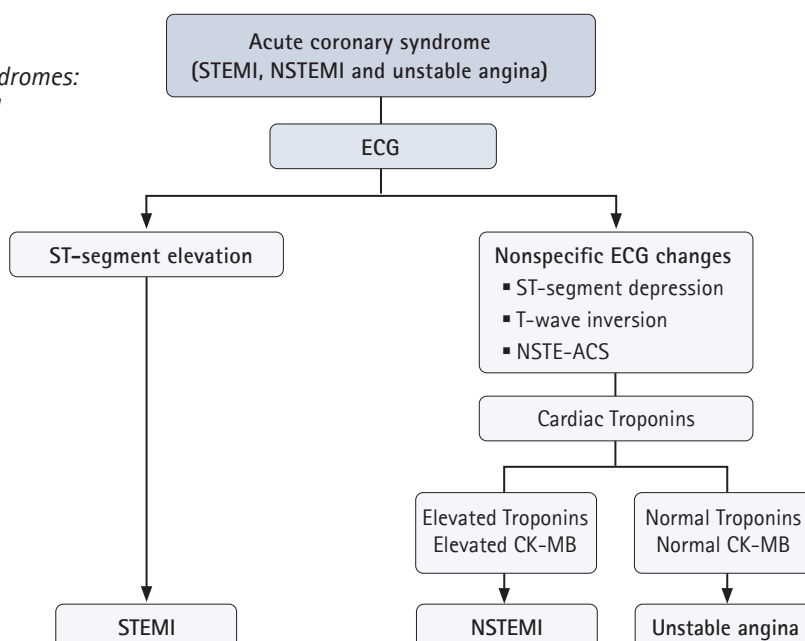
INTRODUCTION

Acute coronary syndromes (ACS) are caused by acute to subacute lack of myocardial blood supply and/or increased myocardial demand leading to cardiomyocyte injury and necrosis. Unlike the pain of stable angina (fixed chronic stenosis), acute coronary syndromes usually present acutely with severe chest pain, which may wax and wane depending on the severity of coronary occlusion. All patients presenting with acute to subacute chest pain suspected to have ACS must have an initial ECG within 10 min of presentation. The rapid initial assessment of these patients should consider the type of ECG abnormality whether there is ST segment elevation or not, clinical presentation of the patient, and the hemodynamic stability of the patient. The decision for revascularization needs to be taken early if there are indications to salvage the myocardium because time is muscle to prevent complications.

ECG changes during severe myocardial ischaemia and/or injury may suggest ST elevation Myocardial Infarction (STEMI) or Non-ST elevation acute coronary syndrome (NSTEMI-ACS). Patients with NSTEMI-ACS must have cardiac troponins done. Elevated cardiac troponins indicate myocardial necrosis. Those with elevated cardiac troponins, preferably high sensitive troponins are diagnosed with Non-ST elevation myocardial infarction (NSTEMI). Those with normal cardiac troponins are diagnosed with unstable angina. Thus, there are three clinical entities making up the acute coronary syndromes based on the pathophysiology, electrocardiographic (ECG) features at presentation and cardiac troponins². The three types of ACS as seen in *figure 19* below include:

- Unstable Angina (UA)
- Non-ST Segment Elevation Myocardial Infarction (NSTEMI)
- ST Segment Elevation Myocardial Infarction (STEMI)

Figure 19:
Acute coronary syndromes:
STEMI, NSTEMI and
unstable angina



AETIOLOGY

The leading cause of ACS is coronary atherosclerosis. However, there are other less prevalent causes, which need to be mentioned. The *table next page* shows the aetiology and possible mechanisms of ACS.

Table 48: Causes of acute coronary syndrome

Aetiology of ACS	Mechanism
ASCVD* = atherosclerotic cardiovascular disease	Plaque rupture resulting in sub-totally occlusive thrombus on pre-existing plaque and distal microvascular thromboembolism from plaque-associated thrombus
ASCVD	Plaque Erosion resulting in sub-totally occlusive thrombus on pre-existing plaque and distal microvascular thromboembolism from plaque-associated thrombus
ASCVD	Progressive mechanical obstruction to coronary flow
Coronary spasm or vasoconstriction	Dynamic obstruction of epicardial and/or microvascular obstruction to coronary flow
Coronary artery dissection	Arteritis and thrombus formation
Thromboembolism from plaque erosion	Plaque-associated coronary thromboembolism
Secondary unstable angina	Anaemia, hyperthyroidism

Platelet aggregation and recruitment is key to propagation of the thrombus. The sequelae of coronary artery occlusion, irrespective of the cause depends on the territory supplied by the vessel, the presence or absence of collaterals (new vessel formation due to the chronic ischaemia), duration of the occlusion as well as the metabolic state of the at-risk myocardium, i.e. the adaptation of the myocardial cells to chronic ischaemia prior to the acute or subacute occlusion².

SYMPTOMS

CHEST PAIN/DISCOMFORT – THE DESCRIPTION OF THIS PAIN/DISCOMFORT MAY BE VAGUE.

Usually, it is a left substernal pain but can be from any part of the chest; the pain may or may not radiate to the jaw and arm. In STEMI and NSTEMI, the pain is usually associated with other features such as shortness of breath, syncope/pre-syncope nausea, vomiting, palpitations, diaphoresis and anxiety.

ATYPICAL PRESENTATIONS (WITH ABSENCE OF CHEST PAIN):

- Shortness of breath
- Excessive belching
- Nausea
- Vomiting
- Epigastric discomfort
- Easy fatigability
- Loss of consciousness
- Cardiac arrest
- Delirium or confusion

► NOTE: These atypical symptoms are common among diabetics, women, the elderly and patients with deformed chest wall and patients with COPD.

DIFFERENTIAL DIAGNOSES OF ACS

As opposed to stable CAD, ACS patients should not be evaluated based on the triad of gender, age and type of chest pain. All patients presenting with acute chest pain should be presumed to be experiencing one form of ACS or another until proven otherwise. The OPQRST is a mnemonic used to help differentiate the aetiology of acute chest pain.

Table 49: How to use the mnemonic "OPQRST"

Historical aspects of chest pain: The OPQRST approach	
Onset	What the patient was doing when it started (active, inactive, stressed), whether the patient believes that activity prompted the pain, and whether the onset was sudden, gradual or part of an ongoing chronic problem?
Provocation + Palliation	What provoked the pain or what relieved the pain?
Quality	What is the quality of the pain: burning, aching, squeezing, or stabbing?
Region + Radiation	Where is the pain located? Is there any radiation of the pain; does it go to the neck, jaw, arm, or back?
Severity	How severe is the pain? On a scale of 1 to 10, with 10 being the worse pain in one's life, what is the pain now, and how has it changed?
Timing	What are the temporal aspects of the pain? How long has it been present? Has it occurred before? When?

Table 50: Clinical characteristics of acute coronary syndrome compared with other causes of acute chest pain using the mnemonic "OPQRST"

Chest pain Aetiology	O Onset	P Provocation and Palliation	Q Quality	R Region and Radiation	S Severity	T Timing
Acute coronary syndrome	Rapid over a few minutes, escalating or recurring	Usually spontaneous; not relieved by rest or nitrates	Crushing, tight, heavy or band-like	Central anterior chest; radiates to throat, jaw, arms or no radiation	Usually severe	Minutes to few hours, may resolve after completion of infarct
Thoracic aortic dissection	Sudden, severe	Maybe worse with straining	Tearing, sharp, lancinating	Central; radiates to the back	Severe	Minutes to hours
Tension Pneumothorax	Sudden, severe	Relieved by sitting still and breath holding or hypopnoea	Lancinating, tearing, sharp	Unilateral on the side of the pneumothorax	Severe	Minutes to few hours
Pulmonary Embolism	Sudden or gradual	Pleuritic, if pulmonary infarction	Pleuritic, if pulmonary infarction	Unilateral on the side of the PE	Dull ache or sharp pleuritic	Hours to days
Acute Pericarditis with/without effusion	Gradual onset may follow a febrile illness	Worse lying supine; better sitting forward	Sharp, "pleuritic-like"	Central anterior; usually no radiation	Severe	Hours to days
Musculoskeletal pain eg: intercostal muscle spasm	Sudden (e.g. intercostal muscle spasm) or gradual (e.g. costochondritis)	Worse with movement or activity involving the muscle group or joint, reproducible by palpation; relieved by restriction of movement	Sharp, restricting or dull	Anywhere on chest wall; radiates to arms, around the chest to the back	Variable intensity: mild to severe	Hours to days, usually chronic, recurrent and reproducible
Ruptured/perforated Oesophagus	Sudden, following retching and or vomiting	Worse with swallowing	Sharp, tearing	Central	Severe	Minutes to hours
Oesophageal spasm	Sudden, recurrent	Lying flat may provoke pain; sometimes relieved by nitrates but not by rest	Burning, gripping	Central anterior or epigastric; radiates often to the back	Usually mild but can mimic MI	Night-time common, variable duration

MANAGEMENT

Patients with myocardial infarct (MI) may present with cardiac arrest (fast ventricular tachycardia or ventricular fibrillation). In such cases, refer to *chapter 4 Cardiac arrest* for management (see page 58).

Figure 20 is a pathway for decision making based on the symptoms and availability of ECG.

- All facilities without ECG should immediately refer any patient with acute typical chest pain to the facility with ECG.

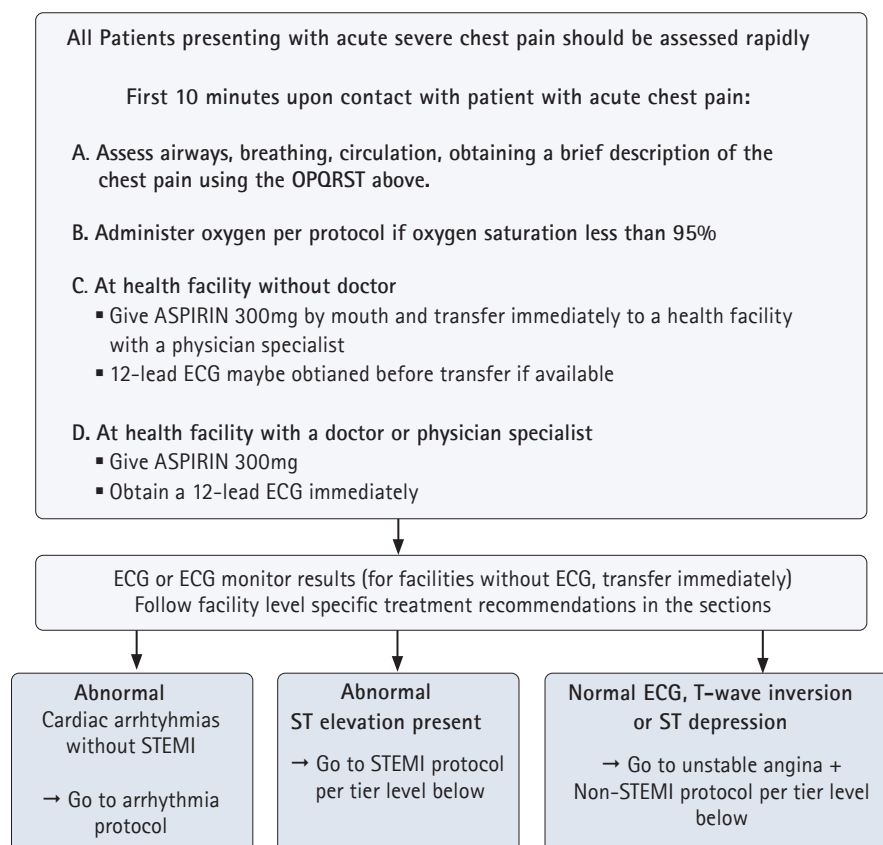


Figure 20: Pathway for triaging and managing a patient presenting acute Chest Pain

TREATMENT OBJECTIVES

- Relief of pain, shortness of breath and anxiety
- Prevent myocardial cell death
- Prevent complications
- Improve prognosis

The above are achieved using the following 5 modalities of treatment depending on the level of care:

- Anti-ischaemic therapy (e.g.; oxygen, nitrates, Beta-blockers)
- Anti-platelet therapy (e.g.; Aspirin, Clopidogrel, Ticagrelor*)
- Anti-coagulation therapy (e.g.; Heparin, Enoxaparin)
- Disease modification therapy (e.g.; statins, ACEI)
- Revascularisation (reserved for specialized centres, depending on capacity of trained cardiologists)

MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

INITIAL ASSESSMENT

- Blood pressure
- ECG within 10 min, if available
- Oxygen saturation (SpO₂)

LABORATORY INVESTIGATION

- Cardiac biomarkers (Troponins)
 - Full blood count
 - Blood urea, electrolytes and creatinine (kidney function tests)
 - Blood sugar (random blood sugar or fasting blood sugar)
 - Glycated Haemoglobin (HbA_{1c})
 - Lipid profile
 - Sickling test
- ▶ NB: Acquisition of the laboratory investigation should not delay institution or initial management or referral

PHARMACOLOGIC TREATMENT

Aspirin, oral 300mg stat (LOE A)

- ▶ Refer immediately to the nearest hospital with a doctor or to a physician specialist (if immediately accessible).

SECONDARY AND TERTIARY HEALTH FACILITY

INITIAL ASSESSMENT

- 12-lead ECG
- Blood pressure in both arms
- Chest Xray
- Oxygen saturation

LABORATORY INVESTIGATION

- Blood sugar (random blood sugar or fasting blood sugar)
- Glycated haemoglobin (HbA_{1c})
- Cardiac biomarkers (Troponins)
- Blood lipid profile
- BUE/creatinine

PHARMACOLOGICAL THERAPY

ANTI-ISCHAEMIA (LOE A)

- Give oxygen if oxygen saturation is <95%
- IV Morphine 5mg-10mg should be given to relieve the chest pain. Co-administer morphine with
- IV Metoclopramide 10mg to mitigate the negative effects of morphine
- Glyceryl trinitrate, sublingual 500mg then as required for the relief of chest pain; instruct patient to report if pain is not resolving
- ▶ NOTE: Avoid nitrates if hypotensive (systolic BP <100 mmHg) or inferior wall infarct or if phosphodiesterase inhibitor has been used by the patient in the last three days.

Add any Beta-blocker below:

- ▶ NOTE: Beta-blockers should be avoided in bronchial asthma, bradycardia and hypotension; avoid Beta-blockers in patients with fulminant heart failure.
- Bisoprolol, oral 2.5-10mg daily depending on BP and response
or
- Carvedilol, oral 3.125-25mg 12 hourly depending on BP and response
or
- Metoprolol, oral 25-100mg 8-12 hourly depending on BP and response
or
- Metoprolol XL, oral 25-200mg daily
or
- Atenolol, oral 50-100mg daily depending on BP and response (Level of evidence A)

If patient is asthmatic or requires further antianginal medications consider Verapamil and Diltiazem*:

- Diltiazem*, oral 60-120mg 12 hourly or extended release preparations
or
- Verapamil, oral 80-160mg 8 hourly or extended release preparations
- ▶ Avoid in bradycardia, hypotension and in patients already on Beta-blockers.

ANTIPLATELET (LOE A)

- Aspirin, oral 300mg stat then 75mg daily
and
- Clopidogrel, oral 600mg stat then 75mg daily
or
- Ticagrelor*, oral 180mg stat then 90mg BD

ANTICOAGULATION (LOE A)

- Heparin 4,500 to 5,000 units IV bolus or 60-80 units per kg IV bolus followed by 18 units per kg per hour infusion for 72 hours
- UFH bolus (weight-adjusted IV bolus during PCI of 70-100 IU/kg) is recommended in patients undergoing PCI.
- Enoxaparin should be considered as an alternative to UFH in patients with STEMI undergoing Primary PCI.
- Bivalirudin with a full-dose post-PCI infusion should be considered as an alternative to UFH in patients with STEMI undergoing primary PCI.
- Enoxaparin should be considered for patients with NSTEMI ACS in whom early invasive angiography (i.e. within 24 h) is likely.

- Fondaparinux is recommended for patients with NSTEMI-ACS in whom early invasive angiography (i.e. within 24 h) will not be carried out.
- Cessation of parenteral anticoagulation should be considered immediately after an invasive procedure

CONTINUATION OF CARE

- Optimise or initiate treatment for hypertension (refer to *chapter 5.1* of these guidelines)
- Optimise or initiate treatment for diabetes mellitus per appropriate guideline
- Optimise cholesterol treatment (refer to *chapter 2* of these guidelines)
- Identify heart failure early and manage (refer to *chapter 5.4* of these guidelines)
- Maximize optimal medical therapy before stress testing in patients with unstable angina

NB: Discharge after Primary PCI

Low-risk patients should be considered for discharge home 48–72 h after uncomplicated primary PCI in acute coronary syndrome

- ▶ Refer patient to a cardiologist if there is no significant improvement in symptoms after the initial treatment above or the patient has worsening signs.

SPECIALISED CENTRE WITH A CARDIOLOGIST

NON-LABORATORY INVESTIGATION

- 12-lead ECG
- Blood pressure in both arms
- Chest X-ray
- Stress test in the case of unstable angina
- Coronary angiography
- Fractional flow reserve
- Intravascular ultrasound

LABORATORY INVESTIGATION

- Blood sugar
- Cardiac biomarkers (Troponin/CKMB)
- Blood lipid profile
- BUN/creatinine

PHARMACOLOGICAL AND INVASIVE TREATMENT (LOE A)

Confirm diagnosis: Ensure guideline medical therapy/optimal medical therapy with adequate doses.

- UFH bolus (weight-adjusted IV bolus during PCI of 70–100 IU/kg) is recommended in patients undergoing PCI.
- Enoxaparin should be considered as an alternative to UFH in patients with STEMI undergoing Primary PCI.
- Bivalirudin with a full-dose post-PCI infusion should be considered as an alternative to UFH in patients with STEMI undergoing primary PCI.

- Enoxaparin should be considered for patients with NSTEMI ACS in whom early invasive angiography (i.e. within 24 h) is likely.
- Fondaparinux is recommended for patients with NSTEMI-ACS in whom early invasive angiography (i.e. within 24 h) will not be carried out.
- Cessation of parenteral anticoagulation should be considered immediately after an invasive procedure

Consider emergent revascularisation:

- Fibrinolytic therapy (maximum benefit obtained when given within 3 hours after onset of chest pain but can be given up to 6 hours after onset)
- Coronary angioplasty with or without stenting for obstructive CAD with moderate to severe symptoms or ischaemia while on optimal medical therapy

- ▶ If patient cannot afford any of these therapies, maximise medical therapy.
- ▶ **Always call for a second opinion when in doubt or refer.**

REVASCULARIZATION IN ACS

A critical step in the management of patient with high-risk unstable angina, Non-STEMI and STEMI is revascularisation. Revascularisation is reserved for facilities with trained interventional cardiologist.

The flow diagram extracted from ESC guidelines gives a step-by-step approach to managing patients with acute coronary syndrome (unstable angina and NSTEMI). Due to accessibility and socioeconomic factors, intensification of medical therapy is recommended for all patients. And only those capable should be offered an invasive strategy.

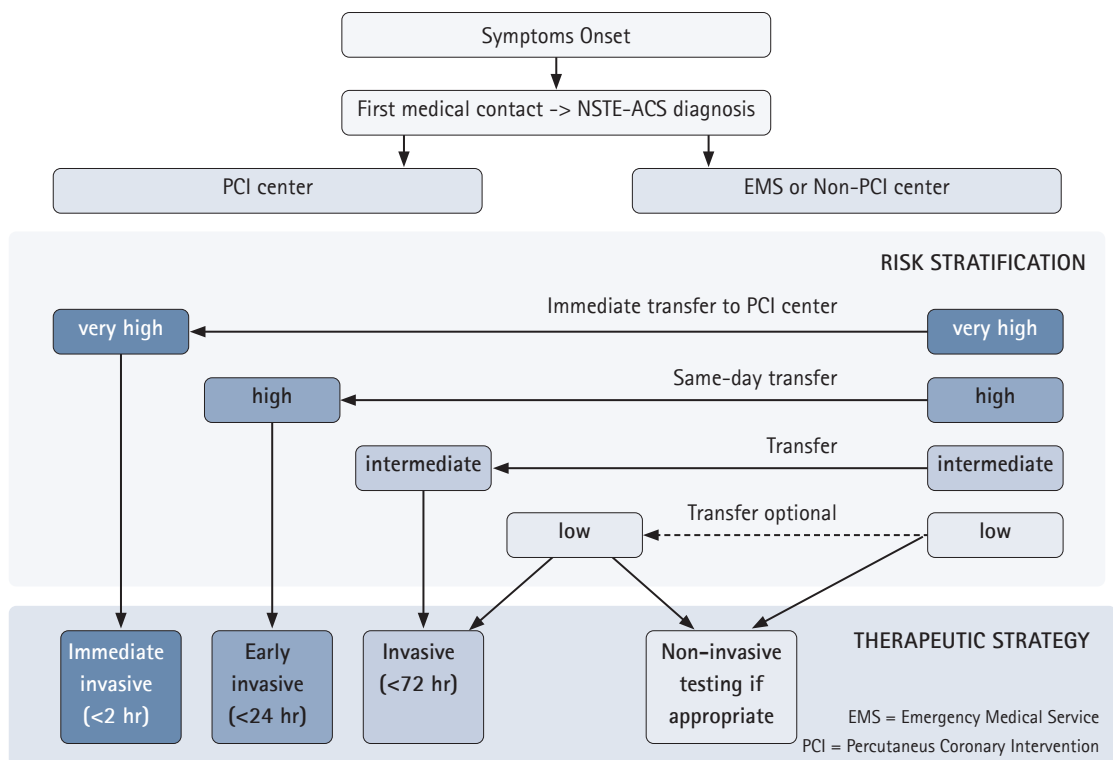


Figure 21: Selection of non-ST-elevation acute coronary syndrome (NSTEMI-ACS) treatment strategy and timing according to initial risk stratification⁸

ST ELEVATION MYOCARDIAL INFARCTION (STEMI)

INITIAL INTERVENTIONS

All patients with STEMI are eligible for reperfusion therapy and should be transferred immediately to the next level of care preferably to the chest pain centres of excellence with experienced cardiologist and/or interventional cardiologist to be evaluated for revascularisation using fibrinolytic therapy or percutaneous coronary angioplasty and stent placement.

Patients for fibrinolytic therapy should be carefully evaluated and contraindications cross-checked and documented.

Table 51: Contraindications to fibrinolytic therapy

Contraindications to fibrinolytic therapy	
Absolute	Relative
Previous intracranial haemorrhage or stroke or stroke of unknown origin	Transient ischaemic attack in the preceding 6 months
Ischaemic stroke in preceding 6 months	Oral anticoagulant therapy
Central nervous system damage or neoplasms or arteriovenous malformation	Pregnancy or within 1 week postpartum
Recent major trauma/surgery/head injury (within the preceding month)	Refractory hypertension (SBP >180 mmHg and/or DBP >110 mmHg)
Gastrointestinal bleeding within the past month	Advanced liver disease
Known bleeding disorder (excluding menses)	Infective endocarditis
Aortic dissection	Active peptic ulcer
Non-compressible punctures in the past 24 hours (e.g. liver biopsy, lumbar puncture)	Prolonged or traumatic resuscitation

Table 52: Commonly used fibrinolytics and their doses

Commonly used fibrinolytics and their doses		
Drug	Initial treatment doses	Specific contraindication
Streptokinase*	1.5 million units over 30-60 minutes IV	Previous treatment with Streptokinase or Anistreplase
Alteplase* (tPA)	15mg bolus IV 0.75mg/kg iv over 30 minutes (maximum 50mg) then 0.5mg/kg iv over 60 minutes (up to 35mg)	
Retepase* (rPA)	10 units iv bolus followed by 10 units I.V. bolus 30 minutes apart	
Tenecteplase* (TNK-tPA)	Single iv bolus based on body weight: If < 60 kg give 30mg (6000 units) If 60 to 70 kg, give 35mg (7000 units) If 70 to <80 kg, give 40mg (8000 units) If 80 to <90 kg, give 45mg (9000 units) If >90 kg, give 50mg (10000 units) It is recommended to reduce to half-dose in patients >75 years of age	

Consult an interventional cardiologist before therapy for possible rescue PCI

The decision to either have patient undergo reperfusion therapy using primary percutaneous coronary intervention (PCI) depends on time of presentation and availability of either therapies. Fibrinolytic therapy is given an equal rating to primary PCI in Ghana.

PCI may be performed hours after the onset of chest pain. It is recommended that patients be referred to see an interventional cardiologist for discussions on whether to pursue an invasive strategy for risk stratification and opening of the affected vessel.

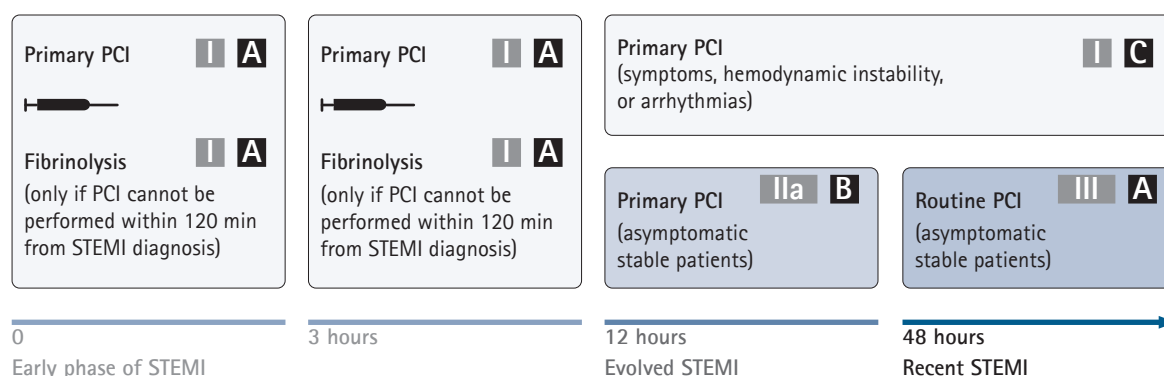


Figure 22: Reperfusion strategies in the infarct-related artery according to time from symptoms onset
PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction

NB: Discharge after Primary PCI

Low-risk patients should be considered for discharge home 48–72 h after uncomplicated primary PCI in acute coronary syndrome

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5 DISEASES

5.4 HEART FAILURE

LIST OF ABBREVIATIONS AND ACRONYMS

ACC	AMERICAN COLLEGE OF CARDIOLOGY	HFREF	HEART FAILURE WITH REDUCED EJECTION FRACTION
AF	ATRIAL FIBRILLATION		
AHA	AMERICAN HEART ASSOCIATION	LOE	LEVEL OF EVIDENCE
FBC	FULL BLOOD COUNT	LVEF	LEFT VENTRICULAR EJECTION FRACTION
FBS	FASTING BLOOD SUGAR		
HF	HEART FAILURE	NYHA	NEW YORK HEART ASSOCIATION
HFPEF	HEART FAILURE WITH PRESERVED EJECTION FRACTION		

5.4.1 INTRODUCTION

DEFINITION

Heart failure (HF) is a clinical syndrome characterized by abnormal function of the heart leading to dyspnoea and oedema. The abnormal function of the heart may be due to structural or functional impairment of ventricular filling or ejection/pumping of blood. This leads to inadequate cardiac output to meet the requirements of tissue metabolism¹.

Acute heart failure (AHF) develops when there is rapid onset or deterioration of typical symptoms and/or signs of HF leading to hospital admission. When an AHF occurs for the first time, it is described as a 'de novo' AHF. More commonly, AHF develops as a consequence of acute decompensation of chronic HF^{1,2}.

PHENOTYPES OF HEART FAILURE^{1,2}

Heart failure may be categorized into the following clinical phenotypes/subtypes:

- HF with reduced ejection fraction (HFrEF) – symptomatic HF with LVEF \leq 40%
- HF with mildly reduced ejection fraction (HFmrEF) – symptomatic HF with LVEF 41-49%
- HF with preserved ejection fraction (HFpEF) – symptomatic HF with LVEF \geq 50%
- HF with improved ejection fraction (HFimpEF) – a new classification which is distinctly defined by a symptomatic HF with a baseline LVEF less than or equal to 40%, with a 10-point increase from baseline LVEF, and a second measurement of LVEF $>$ 40%¹⁻³

EPIDEMIOLOGY

HF has a prevalence rate of 1-2% of the adult population is reported, rising to \geq 10% among people $>$ 70 years of age in most developed countries².

Heart failure is a common CVD in Ghana⁴. The lifetime risk of HF at age 55 years is 33% for men and 28% for women. The proportion of patients with HFpEF ranges from 22% to 73%, depending on the definition applied. Compared with HFrEF, patients with HFpEF are older, more often women and more commonly have a history of hypertension, atrial fibrillation (AF) and obesity, while a history of myocardial infarction is less common².

In sub-saharan Africa, unlike in high-income countries, HF is predominantly caused by hypertensive heart disease, dilated cardiomyopathies and rheumatic heart disease (a form of heart valve disease).⁵ Right heart failure due to pulmonary hypertension secondary to non-smoking related chronic lung disease and HIV-related disease remain other significant causes of heart failure in the region⁵. HF has a prognosis worse than most cancers with a 5-year mortality up to 50%^{1,2}.

CLASSIFICATION OF HEART FAILURE

The NYHA classification is based on the individual's functional limitation (dyspnoea) due to the heart failure.

The ACC/AHA staging of HF is based on pathological changes causing heart failure. This ranges from risk factors of HF to structural abnormalities of the heart and its limitations.

NEW YORK HEART ASSOCIATION (NYHA) CLASSIFICATION OF HF⁴

- Class I: No symptoms and no limitation of ordinary physical activity
- Class II: No symptoms at rest but slight limitation of ordinary activity
- Class III: No symptoms at rest but marked limitation of ordinary physical activity (activity of daily living)
- Class IV: Symptoms at rest and worse during any physical activity

THE AMERICAN COLLEGE OF CARDIOLOGY/AMERICAN HEART ASSOCIATION (ACC/AHA) STAGING SYSTEM IN HF⁵

- Stage A: High risk of heart failure but no structural heart disease or symptoms of heart failure
- Stage B: Structural heart disease but no symptoms of HF
- Stage C: Structural heart disease and symptoms of HF
- Stage D: Refractory heart failure requiring specialized therapy

5.4.2 AETIOLOGY

Causes of heart failure include:

- Hypertension (most common cause in Sub-Saharan Africa)
- Valvular heart disease; especially rheumatic heart disease
- Dilated cardiomyopathy; usually non-ischaemic
- Arrhythmias; most commonly atrial fibrillation
- Peripartum cardiomyopathy
- Ischaemic heart disease commonly due to CAD
- Pericardial disease
- Endomyocardial fibrosis
- Infective endocarditis
- Congenital heart disease
- Cor pulmonale (right HF due to lung disease)

5.4.3 CLINICAL PRESENTATION

SYMPTOMS AND SIGNS

Table 53: Symptoms and signs

Symptoms and signs of heart failure	
Symptoms	Signs
<p>Typical</p> <ul style="list-style-type: none"> ▪ Breathlessness ▪ Orthopnoea ▪ Paroxysmal nocturnal dyspnoea ▪ Fatigue ▪ Reduced exercise tolerance 	<p>Specific</p> <ul style="list-style-type: none"> ▪ Elevated jugular venous pressure ▪ Hepatojugular reflux ▪ Third heart sound with or without gallop rhythm ▪ Laterally displaced apical impulse
<p>Atypical</p> <ul style="list-style-type: none"> ▪ Wheezing ▪ Bloating feeling ▪ Loss of appetite ▪ Confusion (usually in the elderly) ▪ Palpitations ▪ Syncope ▪ Bendopnea (shortness of breath when bending forward) 	<p>Less specific</p> <ul style="list-style-type: none"> ▪ Cardiac murmur ▪ Peripheral oedema (ankle, sacral, scrotal) ▪ Pulmonary crepitations ▪ Reduced air entry and dullness to percussion at lung bases (pleural effusion) ▪ Tachycardia ▪ Irregular pulse ▪ Tachypnoea ▪ Cheyne-Stokes respiration ▪ Hepatomegaly ▪ Ascites ▪ Cold extremities ▪ Narrow pulse pressure

5.4.4 ASPECTS OF MANAGEMENT RELEVANT FOR ALL LEVELS OF CARE

The diagnosis of heart failure with reduced ejection fraction requires 3 conditions to be satisfied:

- Typical symptoms of HF
- Typical signs of HF
- LVEF below 50% on Echocardiogram

The diagnosis of heart failure with preserved ejection fraction requires 4 conditions to be satisfied:

- Typical symptoms of HF
- Typical signs of HF
- LVEF of 41-49% on echocardiogram

The diagnosis of heart failure with preserved ejection fraction requires 5 conditions to be satisfied:

- Typical symptoms of HF
- Specific signs of HF
- LVEF 50% or more on echocardiogram
- Elevation of BNP (greater than or equal to 35pg/ml) or NT-proBNP of greater than or equal to 125pg/ml)
- Presence of structural heart disease and/or diastolic dysfunction

NON-PHARMACOLOGICAL TREATMENT RELEVANT FOR ALL LEVELS

- Diet and nutrition
- Decrease salt intake
- Smoking cessation
- Avoidance of alcohol
- Fluid intake
 - Fluid restriction in severe HF to not more than 1500mls/day carried out in accordance with daily weighing
- Exercise training based on the patient's exercise tolerance level under the supervision of a trained physiotherapist

5.4.5 MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

A. ACUTE HEART FAILURE

LABORATORY INVESTIGATION

- Full blood count
- Blood sugar (random blood sugar, fasting blood sugar)
- Renal function tests
- Liver function test
- Lipid profile

OTHER INVESTIGATION

CHEST X-RAY

- Possible findings: upper lobe venous blood diversion, pulmonary oedema or Kerley B lines, cardiomegaly-CTR (cardio-thoracic ratio) of > 0.5 , pleural effusions; usually right sided
- Chest X-ray may also rule out differential diagnoses such as pneumonia, chronic obstructive pulmonary disease or pulmonary tuberculosis

ELECTROCARDIOGRAPHY (ECG)

The ECG is usually abnormal. However, a normal ECG does not exclude HF.

- Possible findings: sinus tachycardia, sinus bradycardia, atrioventricular blocks, a bundle branch block pattern, atrial fibrillation, left ventricular hypertrophy, atrial abnormality, right ventricular hypertrophy, among others

NON-PHARMACOLOGICAL TREATMENT

In acute situation:

- Admit patient and prop up in bed
- Give oxygen 4-10L/minute in case of hypoxaemia ($SpO_2 < 92\%$) (oxygen should not be given routinely in the absence of hypoxaemia)

PHARMACOLOGICAL TREATMENT

Diuretics:

- IV Furosemide 40-80mg 8-12 hourly
- ▶ Refer patient to a secondary health facility for further evaluation and management.

B. CHRONIC HEART FAILURE

- ▶ Refer patient to a secondary health facility for further evaluation and management.

C. ATRIAL FIBRILLATION

- ▶ Refer patient to a secondary health facility for further evaluation and management.

SECONDARY HEALTH FACILITY

A. ACUTE HEART FAILURE

LABORATORY INVESTIGATION

- Full blood cell count
- Renal function tests
- Blood sugar (random blood sugar, fasting blood sugar)
- Glycated haemoglobin (HbA1c)
- Thyroid function test (TSH)

OTHER INVESTIGATION

CHEST X-RAY

- Possible findings: upper lobe venous blood diversion, pulmonary oedema or Kerley B lines, cardiomegaly-CTR (cardio-thoracic ratio) of > 0.5, pleural effusions; usually right sided
Chest X-ray may also rule out differential diagnoses such as pneumonia, chronic obstructive pulmonary disease or pulmonary tuberculosis

ELECTROCARDIOGRAPHY (ECG)

- Possible findings: sinus tachycardia, sinus bradycardia, atrioventricular blocks, a bundle branch block pattern, atrial fibrillation, left ventricular hypertrophy, atrial abnormality, right ventricular hypertrophy, among others

NON-PHARMACOLOGICAL TREATMENT

- Admit patient and prop up in bed
- Give oxygen 4-10L/minute in case of hypoxaemia (SpO₂ <92%) (oxygen should not be given routinely in the absence of hypoxaemia)

PHARMACOLOGICAL TREATMENT

DIURETICS

- IV Furosemide 40-80mg 8-12 hourly

Cardiogenic shock. This may be diagnosed in patients with acute heart failure with a systolic blood pressure below 90mmHg with signs of shock.

For these patients, IV **Dobutamine** 0.5-1mg/kg/min as a continuous infusion via a perfuser (short-term, i.e. 24-48hrs) should be administered

- ▶ Patients receiving more than 120mg per day of Furosemide, with satisfactory urine output, require potassium supplementation to prevent hypokalaemia. Give Potassium Chloride (slow K) 600mg 8-12 hourly orally.

DIGOXIN – LEVEL OF EVIDENCE B

- In patients with symptomatic HF and atrial fibrillation, digoxin may be used to slow down a rapid ventricular rate.
- Digoxin may also be used in patients with HFrEF or HFmrEF in sinus rhythm, who are symptomatic despite full tolerated doses of HF standard medical therapy to reduce heart rate.
 - Digoxin is potentiated in the presence of hypokalemia (K+ <3.5mmol/L) or hypomagnesaemia and may cause fatal cardiac arrhythmias due to toxicity. Caution must also be taken when used among patients with chronic kidney disease and the elderly.

B. CHRONIC HEART FAILURE

PHARMACOLOGICAL TREATMENT

DIURETICS – LEVEL OF EVIDENCE B

- In patients with resistant oedema (and ascites), a combination of a loop and a thiazide (e.g. Bendroflumethiazide 2.5–10mg daily orally) or thiazide-like diuretic (Furosemide with Metolazone 2.5–10mg daily orally) may be needed to achieve adequate diuresis.

Table 54: Diuretics used in heart failure

Diuretics used in heart failure		
Diuretic	Initial dose (mg)	Usual daily dose (mg)
Loop diuretic		
▪ Furosemide (oral/iv)	▪ 20–80mg 8-12 hourly	▪ 20–420mg 8-12 hourly
▪ Bumetanide* (oral)	▪ 0.5–1.0mg b.d.	▪ 1–5mg b.d.
▪ Torasemide* (oral)	▪ 5–10mg o.d.	▪ 10–20mg o.d.
Thiazide/thiazide-like diuretic		
▪ Metolazone (oral)	▪ 5mg o.d.	▪ 2.5–10mg o.d.
▪ Hydrochlorothiazide (oral)	▪ 25mg o.d.	▪ 12.5–100mg o.d.
▪ Bendroflumethiazide (oral)	▪ 2.5mg o.d.	▪ 2.5–10mg o.d.

DIGOXIN – LEVEL OF EVIDENCE B

- In patients with symptomatic HF and atrial fibrillation, digoxin may be used to slow down a rapid ventricular rate.
- Digoxin may also be used in patients with HFrEF or HFmrEF in sinus rhythm, who are symptomatic despite full tolerated doses of HF standard therapy to reduce heart rate.
 - Digoxin is potentiated in the presence of hypokalemia (K+ <3.5mmol/L) or hypomagnesaemia and may cause fatal cardiac arrhythmias due to toxicity. Caution must also be taken when used among patients with chronic kidney disease and the elderly.

DISEASE MODIFYING DRUGS

Heart failure with reduced/mildly reduced ejection fraction

Four foundation medication groups have been shown to improve survival in patients with HFrEF and HFmrEF by reducing the risk of death and/or hospitalisation.

They include renin-angiotensin-aldosterone system (RAAS) blockers (ACEI, ARB, ARNI), Beta-blockers, mineralocorticoid receptor antagonists (MRAs) and sodium glucose-like cotransporter-2 (SGLT-2) inhibitors:

- **Angiotensin converting enzyme inhibitors (ACEI) - Level of evidence A**
An ACEI is recommended for all patients with symptomatic HFrEF to reduce the risk of death and hospitalisation
- **Angiotensin receptor blockers (ARB)**
ARBs are recommended as an alternative to ACE-Is for patients with HFrEF or HFmrEF who are unable to tolerate an ACEI because of cough or angioedema
- **Angiotensin receptor neprilysin inhibitor (ARNI) - Level of evidence B**
An ARNI is recommended to all patients with symptomatic HFrEF to reduce the risk of death and hospitalization
- **Beta-blockers - Level of evidence A**
A Beta-blocker is recommended for all patients with symptomatic HFrEF to reduce the risk of death and hospitalisation
- **Mineralocorticoid receptor antagonists (MRA) – Level of evidence A**
An MRA is recommended for all patients with HFrEF and persisting symptoms (NYHA class II - IV) despite treatment with an ACEI (or an ARB if an ACEI is not tolerated) and a Beta-blocker; mineralocorticoid receptor antagonists block receptors that bind aldosterone and other corticosteroids; they have been shown to improve survival in patients with HFrEF
- **Sodium glucose-like cotransporter-2 (SGLT-2) inhibitors– Level of evidence A**
An SGLT-2 inhibitor is recommended to all patients with HFrEF or HFmrEF to reduce the risk of death and hospitalization

For patients who are symptomatic despite optimal medical therapy, or those who cannot tolerate optimal medical therapy, or those with chronic kidney disease, a low dose combination of hydralazine and isosorbide dinitrate combination therapy is recommended.

See *table 53: Disease modifying medication in heart failure and their doses on next page.*

Thrombo-embolism prophylaxis is recommended in all patients with no contra-indication to anti-coagulation, to reduce the risk of deep vein thrombosis during admission. Long term anticoagulation is not recommended for chronic HF unless there is a cardiac thrombus, embolic event or atrial fibrillation.

Table 55: Disease modifying medication in heart failure and their doses

Disease modifying medication in heart failure and their doses		
Drug	Initial dose	Target dose
ACE-inhibitor		
▪ Lisinopril	▪ 2.5–5.0mg OD.	▪ 20–35mg OD
▪ Captopril [♦]	▪ 6.25mg TDS	▪ 50mg TDS
▪ Ramipril	▪ 2.5mg OD	▪ 5mg BD
▪ Enalapril	▪ 2.5mg BD	▪ 10–20mg BD
ARB		
▪ Candesartan	▪ 4–8mg OD	▪ 32mg OD
▪ Valsartan	▪ 40mg BD	▪ 320mg OD
▪ Losartan	▪ 25mg OD	▪ 150mg OD
ARNI		
▪ Sacubitril [♦] /Valsartan	▪ 24/26mg BD	▪ 97mg/103mmHg BD
Beta-blocker		
▪ Bisoprolol	▪ 1.25mg OD	▪ 10mg OD
▪ Carvedilol	▪ 3.125mg BD	▪ 25–50mg BD
▪ Metoprolol succinate (CR/XL)	▪ 12.5–25mg OD	▪ 200mg OD
▪ Nebivolol	▪ 1.25mg OD	▪ 10mg OD
MRA		
▪ Spironolactone	▪ 25mg OD	▪ 50mg OD
SGLT-2 inhibitor		
▪ Dapagliflozin	▪ 10mg OD	▪ 10mg OD
▪ Empagliflozin	▪ 10mg OD	▪ 10mg OD
Others		
▪ Digoxin	▪ 62.5mcg OD	▪ 250mcg OD
▪ Ivabradine	▪ 5mg BD	▪ 7.5mg BD
▪ Hydralazine	▪ 25mg TDS	▪ 50mg TDS
▪ Isosorbide dinitrate	▪ 5mg BD	▪ 10mg BD

DISEASE MODIFYING DRUGS

Heart failure with preserved ejection fraction (HFpEF)

For patients with HFpEF, it is recommended to start patients on

- SGLT-2 inhibitors (dapagliflozin or empagliflozin)
- Diuretics, e.g. furosemide, if fluid overloaded
- Manage attendant comorbidities per respective guidelines

Intravenous iron supplementation is recommended in symptomatic patients with HFrEF and HFmrEF, and iron deficiency (Ferritin <100ng/ml or 100–300ng/ml if transferrin saturation is <20%), to alleviate HF symptoms and improve quality of life^{7,8}.

Intravenous Ferric carboxymaltose / Ferric derisomaltose may be used in the management of iron deficiency anaemia⁷.

C. ATRIAL FIBRILLATION

PHARMACOLOGICAL TREATMENT

- Digoxin (125–250 micrograms daily orally) and/or Beta-blocker should be considered
- Refer to *section on arrhythmias* for further information

TERTIARY HEALTH FACILITY

A. ACUTE HEART FAILURE

LABORATORY INVESTIGATION

- Full blood cell count
- Kidney function test
- Liver function test
- Thyroid function test
- B-type natriuretic peptides (BNPs) and N-terminal pro-B-type natriuretic peptide (NT-ProBNP) assays (BNP >100pg/ml or NT-ProBNP >300pg/ml in patients who present acutely and BNP >35pg/ml or NT-ProBNP >125pg/ml in patients who present with chronic symptoms virtually exclude the diagnosis of HFrEF.)

For some patients there may be the need to screen for the precipitant of the acute heart failure. These include:

- Infection screen: urine routine examination and culture
- Blood culture
- BUE/Cr for CKD
- Markers for acute coronary syndrome: Troponin and CK-MB
- D-Dimer for pulmonary embolism

OTHER INVESTIGATION

- Chest X-ray (possible findings: upper lobe venous blood diversion, pulmonary oedema or Kerley B lines, cardiomegaly-CTR of >0.5, pleural effusions; usually right sided.) CXR may also rule out differential diagnoses such as pneumonia, chronic obstructive pulmonary disease or pulmonary tuberculosis.
- ECG (possible findings: sinus tachycardia, sinus bradycardia, atrioventricular blocks, a bundle branch block pattern, atrial fibrillation, left ventricular hypertrophy, atrial abnormality)⁶.
- Echocardiogram to assess structural heart changes (e.g. valvular defects, congenital defects, ischaemic changes) as the cause of the heart failure. The overall systolic and diastolic function of the ventricles could also be assessed.

NON-PHARMACOLOGICAL TREATMENT

- Admit patient and prop up in bed
- Give oxygen in case of hypoxaemia (SPO₂ <90%) (oxygen should not be given routinely in the absence of hypoxaemia)
- Give oxygen from 4L to 15L per minute until SPO₂ >92% in a propped-up position
- Non-invasive positive pressure ventilation (e.g. CPAP) is recommended in patients with respiratory distress (respiratory rate >30-35 breaths/minute and SpO₂ <90% in spite of intranasal O₂ or rebreather mask); non-invasive positive pressure ventilation reduces blood pressure and should be used with caution in hypotensive patients
- Intubation should be considered if hypoxaemia, hypercapnia and/or acidosis cannot be managed non-invasively and also when patient is fatigued

PHARMACOLOGICAL TREATMENT

- Diuretic therapy important to reduce congestion. This include **Furosemide** and for resistant cases **Metolazone** may be combined; **Bumetanide***, **Torasemide*** are other options
- ▶ Refer to *table 54* for the doses of diuretics.
- Treatment of the precipitant such as infections, arrhythmia, acute coronary syndrome and pulmonary embolism
- Patients in cardiogenic shock with no evidence of coronary artery disease, pulmonary embolism or hypovolaemia, short-term intravenous inotropic support with **Dobutamine** 0.5-1mg/kg/min should be given as continuous infusion

B. CHRONIC HEART FAILURE

PHARMACOLOGICAL TREATMENT

DIURETICS – LEVEL OF EVIDENCE B

They are recommended to patients with symptoms and signs of fluid overload. Loop diuretics are preferred in HFrEF. In patients with marked fluid overload, intravenous loop diuretics should be given as bolus doses or continuous infusion using syringe pump. A combination of loop diuretic and **Metolazone** (a thiazide-like diuretic) is recommended for resistant oedema.

- ▶ Example of diuretics used in HF and their doses are shown in *table 54*:

Table 56: Diuretics used in heart failure

Diuretics used in heart failure		
Diuretic	Initial dose	Usual daily dose
Loop diuretic		
▪ Furosemide (oral/iv)	▪ 20–80mg 8–12 hourly	▪ 20–420mg 8–12 hourly
▪ Bumetanide* (oral)	▪ 0.5–1.0mg b.d.	▪ 1–5mg b.d.
▪ Torasemide* (oral)	▪ 5–10mg o.d.	▪ 10–20mg o.d.
Thiazide/thiazide-like diuretic		
▪ Metolazone (oral)	▪ 5mg o.d.	▪ 2.5–10mg o.d.
▪ Hydrochlorothiazide (oral)	▪ 25mg o.d.	▪ 12.5–100mg o.d.
▪ Bendroflumethiazide (oral)	▪ 2.5mg o.d.	▪ 2.5–10mg o.d.

DIGOXIN – LEVEL OF EVIDENCE B

In patients with symptomatic HF and atrial fibrillation, digoxin may be used, in addition to a Beta-blocker to slow down a rapid ventricular rate.

Digoxin may also be used in patients with HFrEF in sinus rhythm, who are symptomatic despite full tolerated doses of HF standard therapy; digoxin is less effective in the presence of hypokalemia or hypocalcaemia. However avoid in hypercalcaemia or hypomagnesaemia which may predispose to serious arrhythmias.

DISEASE MODIFYING DRUGS

These are medications, which have been shown to improve survival in patients with HFrEF; by reducing the risk of death and/or hospitalization.

They include:

- **Angiotensin converting enzyme inhibitors (ACEI) – Level of evidence A**
An ACEI is recommended for all patients with symptomatic HFrEF to reduce the risk of death and hospitalisation.
- **Angiotensin receptor blockers (ARB)**
An ARBs is recommended for patients with HFrEF who are unable to tolerate an ACEI because of cough (patients should also receive a BB and an MRA). It is also recommended in patients with HFrEF who have persisting symptoms (NYHA class II - IV) despite treatment with an ACEI and a BB, and who are unable to tolerate an MRA. ARBs have not been consistently proven to reduce mortality in patients with HFrEF.
- **Angiotensin receptor neprilysin inhibitor (ARNI) – Level of evidence B**
An ARNI is recommended to all patients with symptomatic HFrEF to reduce the risk of death and hospitalization.
- **Beta-blockers – Level of evidence A**
A Beta-blocker is recommended for all patients with symptomatic HFrEF to reduce the risk of death and hospitalisation. Patients should be on an ACEI (or ARB if an ACEI is not tolerated).
- **Mineralocorticoid Receptor Antagonists (MRA) – Level of evidence A**
An MRA is recommended for all patients with HFrEF and persisting symptoms (NYHA class II - IV) despite treatment with an ACEI (or an ARB if an ACEI is not tolerated) and a Beta-blocker. MRAs block receptors that bind aldosterone and other corticosteroids. They have been shown to improve survival in patients with HFrEF.
- **Sodium glucose-like cotransporter-2 (SGLT-2) inhibitors – Level of evidence A**
An SGLT2-I is recommended for all patients with symptomatic HFrEF to reduce the risk of death and hospitalisation. Patients should be on a beta-blocker, an ACEI (or ARB if an ACEI is not tolerated), and an MRA- Level of evidence A
- **Combination of Hydralazine and nitrates – Level of evidence B**
A combination of Hydralazine and nitrates is recommended for patients with symptomatic HFrEF who are intolerable to an ACEI or ARB to reduce the risk of death and hospital admission. Patients should be on a Beta-blocker and an MRA. Recommended doses of the combinations are:
 - Hydralazine 10-25mg 3 times daily orally, increased to 75mg 3 times daily, orally
 - Isosorbide dinitrate 10mg 3 times daily, orally, increased to 40mg 3 times daily, orally
- **Ivabradine – Level of evidence B**
Ivabradine* slows the heart rate in sinus rhythm by inhibiting the *If* channel in the sinus node. It is recommended for patients with symptomatic HFrEF in sinus rhythm with heart rate >70 bpm despite maximum doses of Beta-blocker, and, an ACEI (or ARB) and an MRA (or ARB). It has been shown to reduce heart failure hospital admissions in these patients.

Table 57: Disease modifying medication in heart failure and their doses

Disease modifying medication	Initial dose	Target dose
ACEI		
▪ Lisinopril	▪ 0.2.5–5.0mg o.d.	▪ 20–35mg o.d.
▪ Captopril*	▪ 6.25mg t.i.d.	▪ 50mg t.i.d.
▪ Ramipril	▪ 2.5mg o.d.	▪ 5mg b.d.
▪ Enalapril	▪ 2.5mg b.d	▪ 10–20mg b.d.
Beta-blocker		
▪ Bisoprolol	▪ 1.25mg o.d.	▪ 10mg o.d.
▪ Carvedilol	▪ 3.125mg b.i.d.	▪ 25–50mg b.d.
▪ Metoprolol succinate (CR/XL)	▪ 2.5–25mg o.d.	▪ 200mg o.d
ARB		
▪ Candesartan	▪ 4–8mg o.d.	▪ 32mg o.d.
▪ Valsartan	▪ 40mg b.d.	▪ 160mg o.d.
▪ Losartan	▪ 25mg o.d	▪ 150mg o.d
MRA		
▪ Spironolactone	▪ 25mg o.d.	▪ 50mg o.d.
ARNI		
▪ Sacubitril*/Valsartan	▪ 49/51mg b.d.	▪ 97mg/103mg b.d.

TERTIARY HEALTH FACILITY

ADDITIONAL NON-LABORATORY INVESTIGATION

- Echocardiography
- Coronary angiography
- Left and right heart haemodynamic evaluation
- Ambulatory ECG monitoring (Holter)
- Ambulatory blood pressure monitoring
- Cardiac magnetic resonance imaging (CMR)
- Genetic testing

DEVICE/INTERVENTIONAL THERAPY

IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR – LOE B

An implantable cardioverter defibrillator is recommended to reduce sudden cardiac death in patients with symptomatic HFrEF and a LVEF $\leq 35\%$, who are expected to survive for >1 year with good functional status.

CARDIAC RESYNCHRONIZING THERAPY (CRT)

CRT is recommended to reduce hospital admissions and premature deaths in patients with HFrEF in sinus rhythm with a QRS duration of ≥ 120 ms, LBBB QRS morphology, and a LVEF $\leq 35\%$, who are expected to survive with good functional status for >1 year.

CRT should be considered to reduce hospital admissions and premature deaths in patients with HFrEF in sinus rhythm with a QRS duration of ≥ 150 ms, irrespective of QRS morphology, and an LVEF $\leq 35\%$ who are expected to survive with good functional status for >1 year.

MANAGEMENT OF PATIENTS WITH HYPERTENSION AND HEART FAILURE WITH REDUCED EJECTION FRACTION (HFrEF)

Calcium channel blockers with negative inotropic effects such as **Diltiazem** and **Verapamil** should not be used to treat hypertension in patients with HFrEF, and **Moxonidine** should also be avoided in patients with HFrEF as it is associated with increased mortality. Short-acting **Nifedipine** is contraindicated in HFrEF.

MANAGEMENT OF PATIENTS WITH ANAEMIA AND HEART FAILURE

In patients with NYHA class II and III HF and iron deficiency (**Ferritin** <100ng/ml or 100-300ng/ml if transferrin saturation is <20%), intravenous iron replacement given cautiously might be reasonable to improve functional status.

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5 DISEASES

5.5 VENOUS THROMBOEMBOLISM

LIST OF ABBREVIATIONS AND ACRONYMS

ANA	ANTINUCLEAR ANTIBODY	LMWH	LOW-MOLECULAR-WEIGHT
CEA	CARCINOEMBRYONIC ANTIGEN		HEPARIN
CRP	C-REACTIVE PROTEIN	NOAC	NOVEL ORAL ANTICOAGULANT
CTEPH	CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION	PE	PULMONARY EMBOLISM
CTPA	CT PULMONARY ANGIOGRAPHY	PSA	PROSTATE SPECIFIC ANTIGEN
DTV	DEEP VEIN THROMBOSIS	PTS	POST THROMBOTIC SYNDROME
FBC	FULL BLOOD COUNT	USG	ULTRA SONOGRAPHY
IPC	INTERMITTENT PNEUMATIC COMPRESSION	VTE	VENOUS THROMBOEMBOLISM
		WBC	WHITE BLOOD CELL COUNT

5.5.1 INTRODUCTION

DEFINITION

Venous thromboembolism (VTE) has two major clinical manifestations. The first and more common manifestation is deep vein thrombosis (DVT), which usually arises in the deep veins of the lower extremities. DVT may less commonly affect other sites, including the upper limbs, subclavian, superior vena cava, intracranial and splanchnic veins.

EPIDEMIOLOGY

Despite the increasing burden of CVDs in African populations, there is no available estimate of the burden of VTE at the continental level¹. VTE has been shown to be predominantly a disease of older people in the developed world with incidence rate being somewhat higher among women of childbearing age, while incidence rate after age 45 are generally higher in men². The prevalence of DVT in Africa varies between 2.4% and 9.6% in patients after surgery, and incident rate between 380 and 448 per 100,000 births per year in pregnant and postpartum women¹.

The clinical course of DVT may be complicated acutely by the potentially fatal conditions of pulmonary embolism (PE), and in the long term by recurrent DVT and the debilitating post thrombotic syndrome (PTS).² Pulmonary embolism as a component of venous thromboembolism (VTE) is the third most common cause of death among cardiovascular diseases after acute coronary syndrome and stroke^{3,4}. The incidence of chronic thromboembolic pulmonary hypertension (CTEPH) among survivors of pulmonary embolism is about 3%^{2,4}.

RISK FACTORS

VTE is considered to be a consequence of the interaction between patient-related (usually permanent) risk factors, and setting-related (usually temporary) risk factors³. VTE may be provoked (i.e. when it occurs in the presence of an identifiable risk factor within the prior 6 weeks to 3 months before diagnosis) or unprovoked (when there is no such identifiable risk factor)⁷.

Table 58: Risk factors for VTE³

Weak risk factors	Moderate risk factors	Strong risk factors
Bed rest for 3 days	Arthroscopic knee surgery	Fracture (hip or leg)
Immobility due to sitting (e.g. prolonged car or air travel)	Central venous lines	Major orthopaedic surgery
Increasing age	Chemotherapy	Major general surgery
Laparoscopic surgery (e.g. cholecystectomy)	Congestive heart failure or chronic respiratory disease	Trauma with multiple injuries
Obesity	Hormone replacement therapy	Spinal cord injury (paralysis/quadriplegia)
Pregnancy/antepartum	Malignancy	
Varicose veins	Oral contraceptive therapy	
	Stroke (hemiparesis or hemiplegia)	
	Pregnancy/postpartum	
	Previous venous thromboembolism	
	Thrombophilia	

5.5.2 DEEP VEIN THROMBOSIS

CLINICAL PRESENTATION

SYMPTOMS (USUALLY UNILATERAL)

- Leg swelling - most specific symptom
- Leg pain
- Warmth or reddening of the skin over the area of thrombosis
- Clinical symptoms of PE as the primary manifestation (refer to *PE paragraph* of this chapter)

SIGNS

- Low grade fever
- Unilateral lower limb swelling with tenderness
- Variable discoloration of the lower extremity
- Differential warmth

Table 59: Two-level DVT Well's score

Clinical feature	Points	Patient score
Active cancer (diagnosed within the last 6 months or undergoing treatment)	1	
Paralysis, paresis or recent plaster immobilisation of the lower extremities	1	
Recently bedridden for 3 days or more or major surgery within 12 weeks requiring general or regional anaesthesia	1	
Localised tenderness along the distribution of the deep venous system	1	
Calf swelling at least 3 cm larger than normal side	1	
Pitting oedema confined to the affected leg	1	
Collateral superficial veins (non-varicose)	1	
Previously documented DVT	1	
An alternative diagnosis is as likely as DVT	-2	
Clinical probability simplified score		
DVT likely	2 points or more	
DVT unlikely	Less than 2	

- **NOTE: In patients with symptoms involving both lower limbs, the more affected leg should be used.**
- If the score ≥ 2 points = DVT likely: perform compression venous ultrasound; if positive, treat as DVT
 - If compression venous ultrasound is inconclusive, run a D-dimer test; if D-dimer test is positive and compression venous ultrasound is negative, repeat ultrasound in 1 week
 - If both D-dimer and compression venous ultrasound are negative, DVT is excluded
 - If the score < 2 points = DVT unlikely: perform D-dimer test (where available); if D-dimer test is negative, DVT is excluded; if D-dimer test is positive, perform compression venous ultrasound
 - If compression venous ultrasound is negative, DVT is excluded; if positive, treat as DVT

Alternative diagnoses may include superficial thrombophlebitis, post thrombotic syndrome, cellulitis, muscle strain, venous insufficiency, popliteal (Bakers) cyst, haematoma and pseudo-aneurysm.

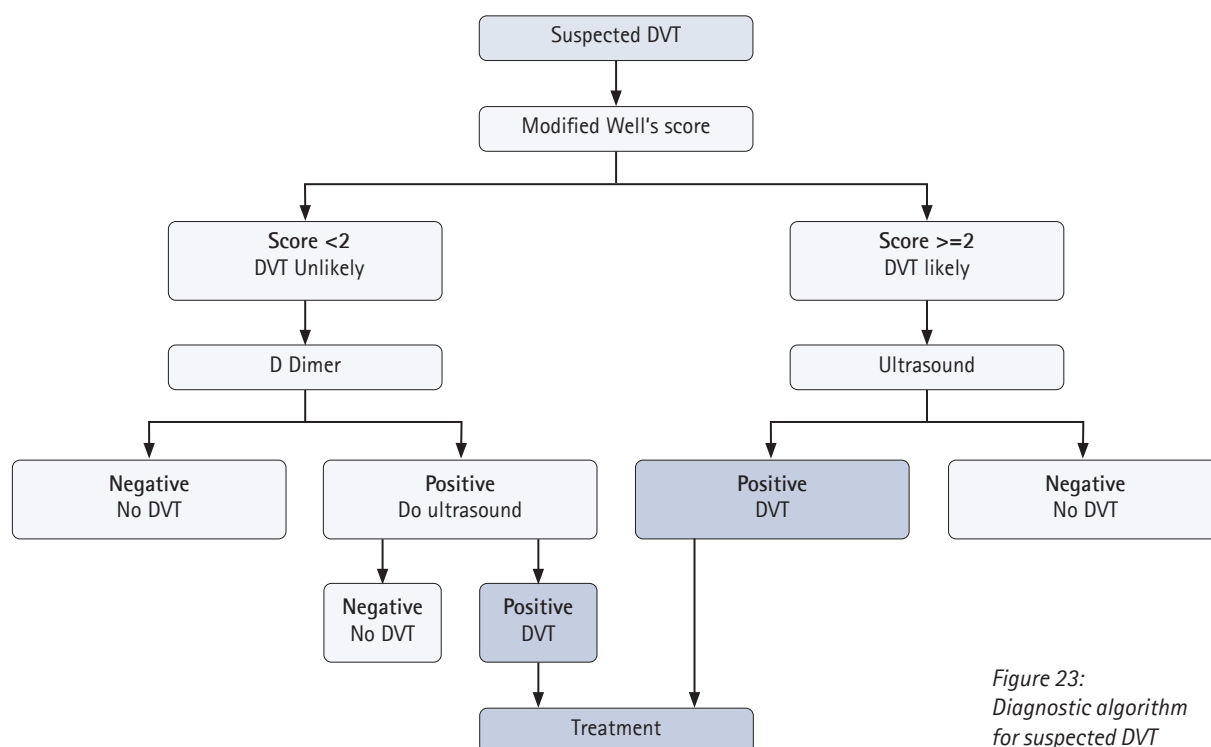


Figure 23:
Diagnostic algorithm
for suspected DVT

MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

- ▶ Score as per algorithm shown in *figure 19*
- ▶ Supportive therapy with analgesic
- ▶ Refer to a health facility with a doctor

SECONDARY HEALTH FACILITY

- ▶ Score as per algorithm shown in *figure 19*

LABORATORY INVESTIGATION

D-DIMER:

D-dimer levels are elevated in plasma in the presence of acute thrombosis because of simultaneous activation of coagulation and fibrinolysis.

The negative predictive value of D-dimer testing is high and a normal D-dimer level renders acute PE or DVT unlikely. On the other hand, the positive predictive value of elevated D-dimer levels is low which implies that a positive D-dimer does not mean absolute diagnosis as could be elevated in other medical conditions such as infections⁷.

NON-LABORATORY INVESTIGATION

IMAGING FOR DVT: COMPRESSION VENOUS ULTRASOUND

Compression venous ultrasonography (CUS) is currently the first-line imaging examination for suspected DVT because of its relative ease of use.

► **Note: Above knee (proximal) DVT have a higher risk of embolisation.**

Abdominal ultrasonography USG and chest X-ray may be considered to establish some of the risk factors for DVT such as abdominal/chest malignancies.

PHARMACOLOGICAL TREATMENT

► If DVT is confirmed, start parenteral therapeutic anticoagulation as follows.

► **Refer to a specialist for continuation of treatment, monitoring of anticoagulation and management of associated complications.**

Table 60: Pharmacological treatment

Medication	Route of administration	Frequency
Enoxaparin	subcutaneous	1.5mg/kg daily (1mg/kg twice daily in obese patient) Caution: if eGFR < 30 ml/min: use an alternative medication
Dalteparin	subcutaneous	100 IU/kg twice daily
Unfractionated heparin	subcutaneous	Bolus of 80 units per kg, then 300 units per kg in divided doses daily
Fondaparinux*	subcutaneous	If body weight <50kg: 5mg daily, 50-100kg: 7.5mg daily, >100kg: 10mg daily

TERTIARY HEALTH FACILITY

► Score as per algorithm in *figure 19*

LABORATORY INVESTIGATION

D-DIMER

In addition, laboratory investigation for possible risk factors for DVT can be considered. These include:

- C-reactive protein (CRP): non-specific, may be elevated in cancers, infections and inflammation
- Antinuclear antibody (ANA)
- Prostate specific antigen (PSA)
- Carcinoembryonic antigen (CEA)
- Anti-phospholipid syndrome
- Antithrombin deficiency
- Protein C deficiency
- Protein S deficiency
- Factor V Leiden
- Prothrombin 20210 mutation
- Homocysteine levels

NON-LABORATORY INVESTIGATION

- **Compression ultrasound**
- **Other imaging**

Advanced imaging studies used in DVT such as CT scan, venography, impedance plethysmography, MRI, and nuclear imaging are either not readily available or reserved for imaging segments that are not easily accessible by compression ultrasound.

PHARMACOLOGICAL TREATMENT

Anticoagulation for inpatients should include **Heparin** or a low-molecular-weight **Heparin (LMWH)**, followed by the initiation of a vitamin K antagonist usually **Warfarin**. Alternately, Direct Oral Anticoagulant (DOAC) may be given as shown in *table 59*.

DOACs are preferred over warfarin for long-term anticoagulation therapy.

Table 61: Pharmacological treatment of venous thromboembolism

Medication	Route of administration	Frequency
Low Molecular Weight Heparin (LMWH): LOE A		
Enoxaparin	subcutaneous	1.5mg/kg daily (1mg/kg twice daily in obese patient)
Dalteparin	subcutaneous	100 IU/kg twice daily
Fondaparinux*	subcutaneous	If body weight <50kg: 5mg daily Body weight 50-100 kg: 7.5mg daily Body weight > 100 kg: 10 mg daily
Tinzaparin*	subcutaneous	175 IU/ kg daily
Direct-acting oral anticoagulants (DOACs): LOE A		
Rivaroxaban*	oral	15mg twice daily for 21 days, then 20mg daily for at least 3 months
Apixaban*	oral	10mg twice daily for 7 days, then 5mg twice daily for at least 3-6 months
Dabigatran*	oral	150mg twice daily for at least 3-6 months (must be preceded by 5-10 days of LMWH)
Edoxaban*	oral	60mg once daily for at least 3-6 months (30 mg once daily if CrCl <30 ml/min); must be preceded by 5-10 days of LMWH therapy
Vitamin K Antagonist (Warfarin)		
<ul style="list-style-type: none"> ▪ Starting dose: 5-10mg daily orally (in healthcare facilities without specialist, and in the elderly patients, the starting dose of Warfarin should not exceed 5mg) ▪ Initiate Warfarin on day 1 of parenteral anticoagulation therapy ▪ Check INR on the 3rd day and adjust dose accordingly ▪ Overlap Warfarin and parenteral anticoagulant until desired INR is maintained for 2 consecutive days, and then discontinue parenteral anticoagulation therapy ▪ Typical maintenance dose: 2 to 10mg orally once a day ▪ Dosage must be individualised according to the patient's INR ▪ Target INR: 2.5 (range: 2 to 3) ▪ Renal dose: no dosage adjustment is necessary for patients with renal failure 		

On discontinuation of anticoagulation, a venous compression ultrasound should be performed to at least establish a baseline comparative exam in case of recurrence.

VENA CAVAL FILTERS

These are indicated in patients who have absolute contraindications to anticoagulation. Other indications are PE despite adequate anticoagulation and preoperatively when manipulation puts DVT at high risk of embolisation.

DURATION OF THERAPY

- For provoked DVTs, where there is a reversible risk factor, consider treatment for 3 months
- For unprovoked DVTs, consider treatment for 6 months; however, if there is recurrence, consider lifelong treatment

SPECIAL POPULATIONS (CONSIDER LIFELONG ANTICOAGULATION)

- Recurrent DVT
- Active malignancy
- Thrombophilia/antiphospholipid syndrome

Table 62: Criteria for DOAC (direct oral anticoagulant) dose adjustment⁵

DOAC	Standard full dose	Criteria for dose reduction	Reduction dose only if criteria met
Apixaban	5 mg twice daily	Two out of three needed for dose reduction: <ul style="list-style-type: none"> ▪ age ≥ 80 years ▪ body weight ≤ 60 kg ▪ serum creatinine ≥ 133 mmol/L. 	2.5 mg twice daily
Dabigatran	150 mg twice daily	Dose reduction recommended if any apply: <ul style="list-style-type: none"> ▪ age ≥ 80 years ▪ receiving concomitant Verapamil Dose reduction considered on an individual basis if any apply: <ul style="list-style-type: none"> ▪ age 75-80 years ▪ moderate renal impairment (creatinine clearance 30-50 mL/min.) ▪ patients with gastritis, oesophagitis, or gastro-oesophageal reflux ▪ others at increased risk of bleeding 	110 mg twice daily
Edoxaban	60 mg once daily	Dose reduction if any apply: <ul style="list-style-type: none"> ▪ moderate or severe renal impairment (creatinine clearance 15-50 mL/min.) ▪ body weight ≤ 60 kg ▪ concomitant use of Ciclosporin, Dronedronone, Erythromycin, or Ketoconazole 	30 mg once daily
Rivaroxban	20 mg once daily	Creatinine clearance 15-49 mL/min.	15 mg once daily

5.5.3 ACUTE PULMONARY EMBOLISM (PE)

CLASSIFICATION OF ACUTE PE

A classification of pulmonary embolism is based on the stage (acute or chronic) and the size or haemodynamic consequences of the emboli (massive or sub-massive).

MASSIVE PE: IT IS CHARACTERISED BY SYSTEMIC ARTERIAL HYPOTENSION DEFINED AS:

- A systolic arterial pressure <90 mmHg sustained for at least 15 minutes or
- A drop in systolic arterial pressure of at least 40 mmHg for at least 15 minutes which is not caused by new onset arrhythmias or
- Shock (manifested by evidence of tissue hypoperfusion and hypoxia, including an altered level of consciousness, oliguria, or cold, clammy extremities)

NON-MASSIVE PE:

It is recommended that in patients with acute PE without hemodynamic instability (massive PE) are further stratified into intermediate- and low-risk categories. In addition to clinical indicators⁴²:

- Patients who show evidence of both RV dysfunction (on echocardiography or CTPA) and elevated cardiac biomarker levels, particularly cardiac troponin are classified into the sub-massive (intermediate) high-risk category.
- In patients in whom the RV appears normal on echocardiography or CTPA, and/or who have normal cardiac biomarker levels, belong to sub-massive (intermediate) low-risk category (Konst).

CLINICAL PRESENTATION

The diagnosis of PE may be easily missed since the clinical signs and symptoms are non-specific and may vary widely. When the clinical presentation raises the suspicion of PE in an individual patient, it should prompt further objective testing.

PE may be completely asymptomatic and be discovered incidentally during diagnostic workup for another disease or at autopsy.

SYMPTOMS

- Dyspnoea (difficulty in breathing)
- Pleuritic chest pain
- Cough
- Haemoptysis
- Sudden collapse/syncope
- Low grade fever
- Decreased level of consciousness

SIGNS

- Tachypnoea (respiratory rate >20/min)
- Accentuated second heart sound
- Tachycardia (heart rate >100/min)
- Fever (temperature >37.5°C)
- Diaphoresis (profuse sweating)
- S3 or S4 gallop
- Clinical symptoms and signs suggesting DVT
- Cardiac murmur
- Cyanosis

Table 63: Assessment of clinical probability in acute PE

Clinical characteristic	Simplified Well's score
Previous pulmonary embolism or deep vein thrombosis	1
Heart rate >100 beats per minute	1
Recent surgery or immobilisation (within the last 30 days)	1
Clinical signs of deep vein thrombosis	1
Alternative diagnosis less likely than pulmonary embolism	1
Haemoptysis	1
Cancer (treated within the last 6 months)	1
Clinical probability score	
PE unlikely	less than 2
PE likely	=2 or more

Use the Well's or Geneva rules to choose tests based on a patient's risk for PE.

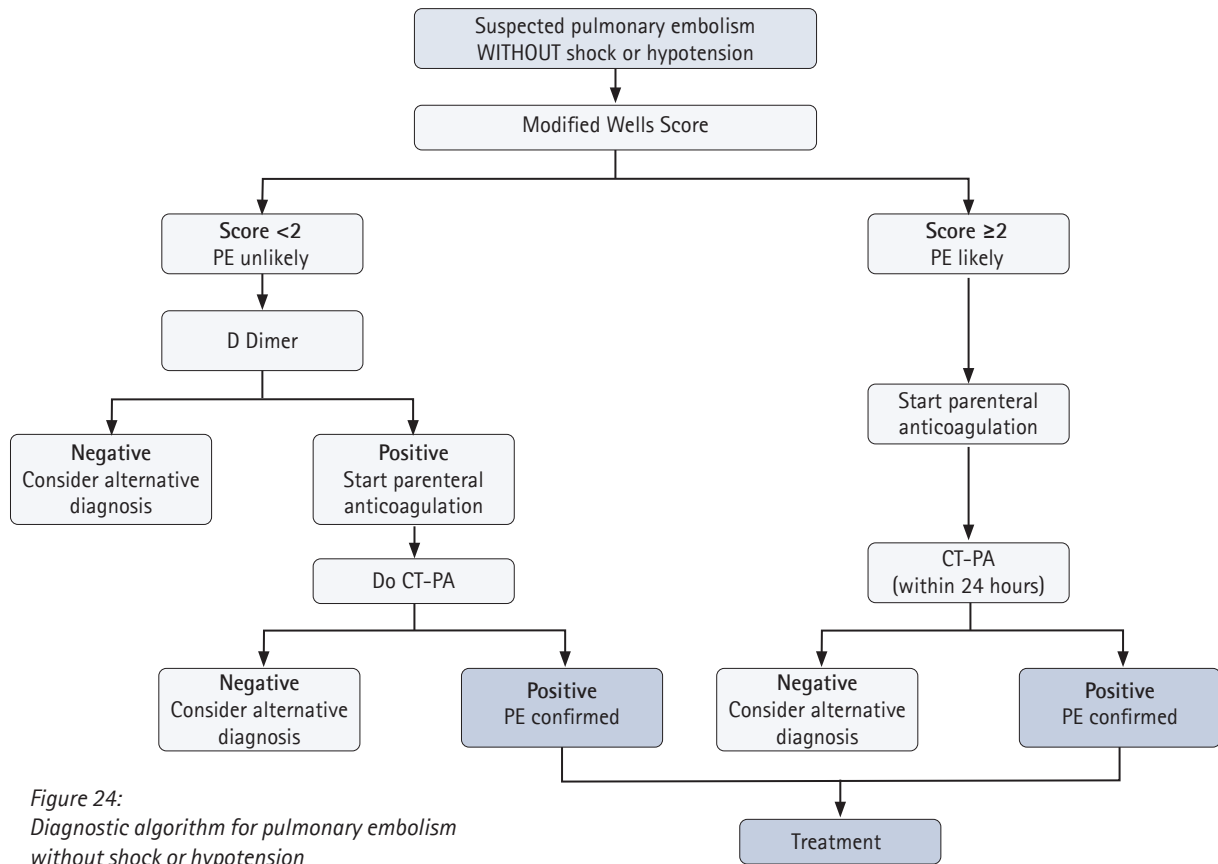


Figure 24: Diagnostic algorithm for pulmonary embolism without shock or hypotension

FOR NON-MASSIVE PE

- ▶ If the score ≥ 2 points = PE likely: Perform CT-PA; if positive, treat as PE; if negative, consider alternative diagnosis
- ▶ If the score < 2 points = PE unlikely: Perform D-dimer test (where available); if D-dimer test is negative, PE is excluded; if D-dimer test is positive, perform CT-PA. If CT-PA is negative, PE excluded; if positive, treat as PE

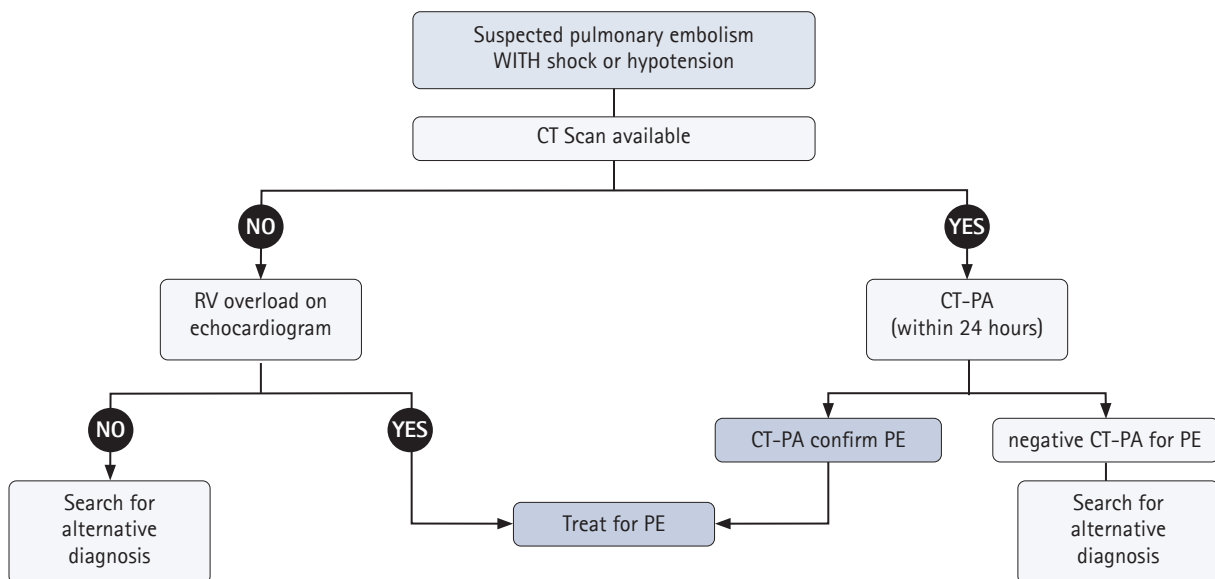


Figure 25: Diagnostic algorithm for pulmonary embolism with shock or hypotension

- ▶ Note: In the absence of immediate CT-PA and/or echocardiogram, administer IV bolus unfractionated heparin 5000–7500 IU in the average adult and refer.

MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

- ▶ Assess with simplified Wells' Score if non-massive PE is suspected (*figure 19*)

If PE is unlikely, consider alternative causes of symptoms

If PE is likely, administer a stat dose of LMWH (*table 59*) and refer to a secondary health facility

- ▶ **Immediate referral to health facility with a doctor.**

While waiting for transport:

- Intranasal oxygen if SpO₂ is less than 92%
- Elevate head of the bed
- Hydration with normal saline

SECONDARY AND TERTIARY HEALTH FACILITY

Assess on Well's score for PE and follow algorithm, *figure 19*

- If score is less than 2 (PE unlikely), request D-dimer test and follow as per algorithm, *figure 20*
- ▶ If score >2 (PE likely), administer stat dose of LMWH and follow algorithm, *figure 20*
- ▶ If score >2 (PE likely) with shock, follow algorithm, *figure 21*
- ▶ **Note: if D-dimer test not available refer to facility with a specialist.**

LABORATORY INVESTIGATION

- Full blood cell count
- White blood cell count may be elevated (risk of confusion with pneumonia-always risk stratify if PE suspected)
- Clotting profile
- Doppler USG of lower limb and pelvis if indicated

NON-LABORATORY INVESTIGATION

Chest X-ray

Chest radiographs may be normal in pulmonary embolism, but where abnormal the findings may be non-specific as follows:

- pleural effusion
- parenchymal opacities
- elevation of a hemidiaphragm

These classic radiographic findings of pulmonary embolism are infrequently observed:

- Hampton's hump: wedge-shaped, pleura-based triangular opacity with an apex pointing toward the hilum.
- Westermark sign: decreased vascularity or focal area of oligemia.

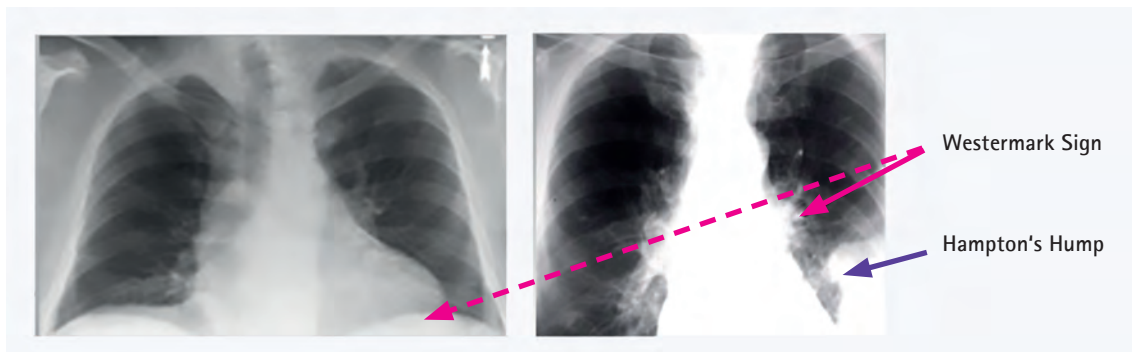


Figure 26: Westermark sign and Hampton's Hump

ELECTROCARDIOGRAM (ECG)

Electrocardiographic abnormalities which may be suggestive of PE include sinus tachycardia (most common finding):

- Atrial fibrillation - usually new onset
- Nonspecific ST-T wave abnormalities
- $S_1 Q_3 T_3$ (classical finding) is nonspecific and insensitive in the absence of clinical suspicion for pulmonary embolism
- Right heart strain findings such as
 - tall, peaked P waves in lead II (P pulmonale);
 - right axis deviation;
- right bundle-branch block (complete or incomplete)

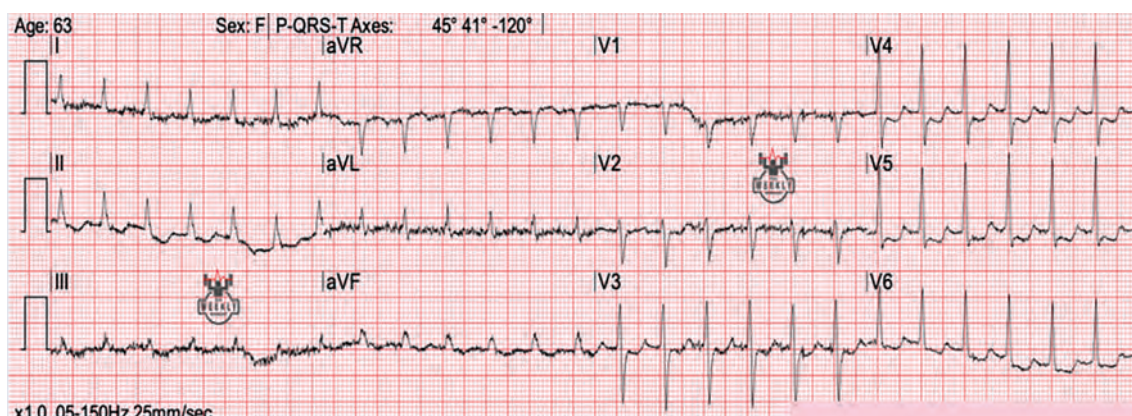


Figure 27: ECG findings in PE

ECHOCARDIOGRAM

- This modality generally has limited accuracy in the diagnosis of PE; it may allow diagnosis of other conditions that may be confused with PE, such as pericardial effusion
- Haemodynamically unstable patients with suspected PE should have urgent echocardiogram; the presence of signs of RV pressure overload and dysfunction should justify immediate reperfusion treatment (e.g. thrombolysis) for PE; in such cases CT angiography should be done when patients are stable

- Echocardiographic examination is not recommended as part of the diagnostic work-up in haemodynamically stable, normotensive patients with suspected PE

CT PULMONARY ANGIOGRAPHY

Computed tomography pulmonary angiography (CTPA) is the earliest imaging modality of choice for stable patients with suspected PE⁷.

PHARMACOLOGICAL TREATMENT

MASSIVE PE

Thrombolysis

- ▶ Systemic thrombolytic therapy is recommended for such patients, in addition to haemodynamic support with IV fluids (normal saline) and inotropic support (if required).

Anticoagulation

Intravenous UFH should be administered to these patients as the preferred mode of initial anticoagulation (refer algorithm). The dosing of UFH is adjusted, based on the activated partial thromboplastin time (APTT).

In patients with contraindications to thrombolysis, and in those in whom thrombolysis has failed to improve the haemodynamic status; percutaneous catheter-directed treatment or surgical embolectomy is recommended when available⁷.

Table 64: Dosage for thrombolysis medication

Disease modifying medication in heart failure and their doses		
Drug	Route of administration	Frequency
Streptokinase*	IV	250,000 IU as a loading dose over 30 minutes, followed by 100,000 U/hour over 12-24 hours
Recombinant tissue plasminogen activator (rt-PA):		
▪ Tenecteplase	IV	30-50mg administered as a single bolus, depending on weight
▪ Alteplase	IV	90mg as a continuous infusion over 2 hours; a 10mg bolus administered first, followed by 80mg administered over 2 hours

- ▶ Note: Heparin infusion must be discontinued during thrombolysis with streptokinase but resume after thrombolysis.

NON-MASSIVE PE

For cases of acute PE without shock or hypotension, treatment is the same as treatment for DVT (refer to section on DVT of this chapter).

Patients with non-massive PE require further risk stratification after the diagnosis of PE has been confirmed. In these patients, risk assessment should begin with a validated clinical score, preferably the Pulmonary Embolism Severity Index (PESI) or simplified PESI (sPESI).

Low-risk patients with sPESI of 0, should be considered for early discharge and outpatient treatment, if this appears feasible based on the patient's anticipated compliance as well as his/her family and social background.

NON-PHARMACOLOGICAL MANAGEMENT

- Educating patients on risk factors of VTE
- Counselling patients on anticoagulation medication adherence; advise patients on drugs that may interfere with anticoagulation
- Carrying anti-coagulation medication card/bracelet

DURATION OF ANTICOAGULATION

- Unprovoked PE should generally be treated with anticoagulation for at least 6 months
A compression ultrasound should be repeated at 3 months before cessation of therapy for all confirmed DVTs and in the case of a PE a CT-PA; where resources are limited an echocardiogram may be performed instead of a CT-PA; treatment may be extended if PE persist
- Anticoagulants are only discontinued when the perceived risk of anticoagulation-related bleeding and the inconvenience of remaining on treatment outweigh the risk of recurrent VTE
- For patients with irreversible risk factors (unprovoked PE), or those presenting with recurrent PE, lifelong anticoagulation therapy should be considered

Table 65: Simplified PESI²

Variable	Score
Age > 80 years	1
History of cancer	1
History of heart failure or lung disease	1
Pulse ≥ 110 bpm	1
Systolic bp < 100	1
Arterial oxygen saturation <90	1
Score summary	0 points - low risk, ≥ 1 points - high risk

5.5.4 MANAGEMENT OF VTE IN SPECIAL POPULATIONS (RELEVANT FOR ALL LEVELS OF CARE)

PREGNANCY AND LACTATION

In pregnancy, establishing a clear guideline for the treatment of VTE is difficult from an evidence-based perspective. LMWH is the anticoagulant of choice, given its relative safety for the foetus⁷.

Warfarin is safe during lactation but not advised in pregnancy. There is not enough evidence to warrant use of DOACs in pregnancy and lactation due to limited evidence.

PATIENTS WITH CANCER

Edoxaban and rivaroxaban should be considered as an alternative to weight-adjusted subcutaneous LMWH in patients without gastrointestinal cancer⁶.

CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION (CTEPH)

Chronic thromboembolic pulmonary hypertension (CTEPH) usually results from obstruction of the pulmonary vascular bed by non-resolving thromboemboli in patients with DVT, acute or recurrent PE. Increased pulmonary vascular resistance subsequently leads to progressive pulmonary hypertension, right atrial dilatation, right ventricular hypertrophy and right ventricular failure. Studies suggest that 1%-3.8% of patients with acute PE may develop CTEPH two years after diagnosis⁷.

First-line imaging for diagnosis of CTEPH is planar ventilation-perfusion (V/Q) lung scan. However, echocardiography, CT pulmonary angiography, right heart catheterisation and pulmonary angiography should be done when available.

Pulmonary endarterectomy (surgical) in addition to secondary prevention with medical therapy as well insertion of vena caval filters are the management of choice. Without surgical treatment, the prognosis of patients with CTEPH is poor.

5.5.5 PREVENTION OF VTEs

The rationale for use of thromboprophylaxis is based on solid principles and scientific evidence. Almost all hospitalised patients have at least one risk factor for VTE, and approximately 40% have three or more risk factors. Without thromboprophylaxis, the incidence of objectively confirmed, hospital-acquired DVT is approximately 10 to 40% among medical or general surgical patients and 40 to 60% following major orthopaedic surgery¹¹.

The mortality, acute and long-term morbidities, and resource utilisation related to unprevented VTE strongly support effective preventive strategies at least for moderate-risk and high-risk patients¹¹.

MECHANICAL THROMBOPROPHYLAXIS FOR ALL LEVELS OF CARE

- Early and frequent ambulation of hospitalised patients
- Specific mechanical methods of thromboprophylaxis include graduated compression stockings (GCS), intermittent pneumatic compression (IPC) devices, and the venous foot pump (VFP)
- The primary advantage of mechanical thromboprophylaxis is its use in patients at high risk of bleeding

PHARMACOLOGICAL THROMBOPROPHYLAXIS SECONDARY AND TERTIARY HEALTH FACILITY

For acutely ill medical patients admitted to hospital with congestive heart failure or severe respiratory disease, or who are confined to bed and have one or more additional risk factors, including active cancer, previous VTE, sepsis, acute neurologic disease, or inflammatory bowel disease, it is recommended that thromboprophylaxis with LMWH, unfractionated Heparin or Fondaparinux[♦] be administered.

Thromboprophylaxis should also be considered in surgical patients with moderate to high risk for VTE and also for those undergoing pelvic and orthopaedic surgeries.

Table 66: Dosage of pharmacologic thromboprophylaxis

Medications	Route of administration	Frequency
Dalteparin	subcutaneous	5,000 IU once daily
Enoxaparin	subcutaneous	40mg once daily
Unfractionated Heparin	subcutaneous	5000 IU twice daily
Fondaparinux [♦]	subcutaneous	2.5mg daily

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NOTES

5 DISEASES

5.6 ACUTE RHEUMATIC FEVER

LIST OF ABBREVIATIONS AND ACRONYMS

ARF	ACUTE RHEUMATIC FEVER	FBC	FULL BLOOD COUNT
BPG	BENZATHINE PENICILLIN G	GAS	GROUP A BETA-HAEMOLYTIC STREPTOCOCCUS
CRP	C-REACTIVE PROTEIN	RHD	RHEUMATIC HEART DISEASE
ECG	ELECTROCARDIOGRAPHY	WBC	WHITE BLOOD CELL
ESR	ERYTHROCYTE SEDIMENTATION RATE		

5.6.1 INTRODUCTION

DEFINITION

Acute rheumatic fever (ARF) is an immune-mediated, non-suppurating complication of an infection of the pharynx (and less commonly the skin) with group A beta-haemolytic streptococcus (GAS)¹. Following a prior infection with group A Beta hemolytic streptococcus. The commonest site of infection is the pharynx, but it may also affect the skin, with a quiescent 2-3 week period after which signs and symptoms of acute rheumatic fever may appear. Typically, the skin, brain, heart and medium to large joints are affected.

EPIDEMIOLOGY

Most cases occur in children between 5 to 15 years of age but may occur at any age. Previous ARF patients are much more likely than most others to develop repeat episodes with majority of mortalities found in developing countries². The incidence and prevalence of ARF is reduced in the developed world after measures to reduce transmission of streptococci and improvement in general hygiene were implemented. Additionally, treatment measures were stringently implemented. However, ARF remains common in many developing countries including Ghana³.

AETIOLOGY

The pathophysiologic mechanisms that lead to acute rheumatic fever (ARF) are not completely known. Streptococcal pharyngeal infection is a prerequisite, and genetic susceptibility may be present. GAS skin infections may play a role in ARF pathogenesis. As a result of molecular mimicry, antibodies directed against GAS antigens cross-react with host antigens⁴. Cellular immunity is also thought to play a role in ARF. About 3–5% of the population may have an inborn susceptibility to ARF, the basis of which is uncertain⁴.

5.6.2 CLINICAL PRESENTATION

The diagnosis of ARF is usually guided by the modified Jones criteria, 2015. Currently, there is no diagnostic laboratory test for ARF, so diagnosis remains a clinical decision.

See *table 67: Modified Jones criteria for the diagnosis of ARF⁵ next page.*

MAJOR MANIFESTATIONS

ARTHRITIS

- Swollen and hot joint with pain on movement
- Asymmetrical and migratory
- Joints may be involved one after the other or several of them involved simultaneously without remitting
- Large joints are usually affected, particularly the ankles and knees
- Extremely painful arthritis

Table 67: Modified Jones criteria for the diagnosis of ARF⁵

Definition		
Definite initial episode of ARF	2 major or 1 major with 2 minor manifestations plus evidence of a preceding GAS infection	
Definite recurrent episode of ARF in a patient with known past ARF or RHD	2 major or 1 major and 1 minor or 3 minor manifestations with evidence of a previous GAS infection	
Probable ARF (first episode or recurrence)	A clinical presentation lacking one major or one minor manifestation, or the unavailability of streptococcal serology results, but with ARF being thought of as the likely diagnosis; in these cases, there is further categorisation according to the level of confidence with which the diagnosis is made: <ul style="list-style-type: none"> ▪ highly suspected ARF ▪ uncertain ARF 	
Manifestations	Moderate/high-risk groups	Low-risk groups (ARF incidence ≤ 2 per 100,000 school-aged children or all-age)
Major manifestations	<ul style="list-style-type: none"> ▪ Carditis (including subclinical evidence of rheumatic valvulitis on echocardiogram) ▪ Polyarthritits or aseptic mono-arthritis or polyarthralgia ▪ Chorea ▪ Erythema marginatum ▪ Subcutaneous nodules 	<ul style="list-style-type: none"> ▪ Carditis (excluding subclinical evidence of rheumatic valvulitis on echocardiogram) ▪ Polyarthritits ▪ Chorea ▪ Erythema marginatum ▪ Subcutaneous nodules
Minor manifestations	<ul style="list-style-type: none"> ▪ Monoarthralgia ▪ Fever ▪ ESR ≥ 30 mm/h ▪ CRP ≥ 30 mg/L ▪ Prolonged P-R interval on ECG 	<ul style="list-style-type: none"> ▪ Fever ▪ Polyarthralgia or aseptic monoarthritis ▪ ESR ≥ 30 mm/h ▪ CRP ≥ 30 mg/L ▪ Prolonged P-R interval on ECG

SYDENHAM'S CHOREA

- Abrupt, uncoordinated movements, especially affecting the hands, feet, tongue and face, which are not present during sleep
- May involve only one side of the body (hemichorea)
- Adolescent females are particularly affected⁶

The presence of chorea may be a predictor of future carditis in a patient managed for ARF⁷.

CARDITIS

- Florid inflammation of the myocardium, endocardium and pericardium with involvement of the endocardium being predominant
- Mainly affecting the mitral and aortic valves
- Incidence of carditis in initial attacks of ARF lies between 30% and 82%⁸
- Carditis may present early on in the disease but usually presents within the first 2–6 weeks, making repeated physical examination during admission critical
- There are four clinical findings of carditis:
 - (a) significant murmur due to valvulitis
 - (b) cardiac enlargement
 - (c) cardiac decompensation
 - (d) pericardial friction rub or effusion⁹

VALVULITIS

- Most commonly affects the mitral valve but may also involve aortic valve leaflets
- Results in regurgitation or stenotic lesions occurring due to extensive scarring. Post-inflammatory fibrotic changes result in valve regurgitation or stenosis
- Mitral regurgitation is an apical blowing, holosystolic murmur which may have an associated mid-diastolic flow murmur (Carey Coomb's murmur)
- In aortic valvulitis, usually seen as aortic regurgitation, an early diastolic murmur is heard at the base of the heart (enhanced by leaning forward and also in expiration)¹⁰
- Valvulitis usually results in volume and pressure overload with ensuing acute heart failure

SUBCUTANEOUS NODULES

- Uncommon (usually below 2% of cases) but very specific for ARF
- The usual size is 0.5–2 cm in diameter and are mobile, painless and nodular crops of up to 12 over the elbows, wrists, knees and ankles
- They appear 1–2 weeks after the onset of the other symptoms and resolve after 1–2 weeks⁵

ERYTHEMA MARGINATUM

- Found in less than 2% of cases in developing countries and also very specific for ARF
- They are dark blanching maculopapular rash which is painless and non-itchy
- Lesions may be recurrent and unresponsive to medication and show up more after taking a bath
- They are found on the trunk and proximal extremities, are not painful or itchy^{5,7}

MINOR MANIFESTATIONS

ARTHRALGIA

- There is no associate swelling or differential warmth

FEVER

- Temperature commonly higher than 38°C
- Mostly associated with other manifestations of ARF
- Usually responds well to salicylates

ELEVATED ACUTE-PHASE REACTANTS

- ARF patients usually have a raised serum C-reactive protein (CRP) level and erythrocyte sedimentation rate (ESR)
- The peripheral white blood cell (WBC) count is $<15 \times 10^9/l$ in 75% of patients, making elevated WBC an insensitive marker of inflammation in ARF
- Most patients have both a serum CRP level of $>30mg/l$ and an ESR of >30 mm/h
- The serum CRP concentration rises more rapidly than the ESR, and also falls more rapidly with resolution of the attack, the ESR may remain elevated for 3–6 months

PROLONGED P-R INTERVAL (PR $>200MS/0.2SECONDS$)/CONDUCTION ABNORMALITIES

- A prolonged P-R interval that resolves over days to weeks may be a useful diagnostic feature especially adjunctive to other clinical features
- Severe first-degree block may lead to a junctional rhythm, second-degree or complete heart block
- Electrocardiography (ECG) should be documented in all cases of possible ARF and if a prolonged P-R interval is detected, the ECG should be repeated after 2 weeks, and again at 2 months to document a normal tracing; the return of the ECG to normal supports the diagnosis of ARF

5.6.3 MANAGEMENT ACCORDING TO LEVEL OF CARE

Confirmation of the diagnosis and timely treatment are key. All patients with suspected ARF (first episode or recurrence) should be hospitalised.

PRIMARY HEALTH FACILITY

LABORATORY INVESTIGATION

- Full blood cell count
- Malaria parasite RDT/Blood film

Diagnosis of ARF at a health facility without a doctor may be difficult.

- ▶ **Patient with persistent fever, joint pains and skin rashes should be referred to a facility with a doctor.**

SECONDARY HEALTH FACILITY

LABORATORY INVESTIGATION

- Full blood cell count
- Blood cultures
- Erythrocyte sedimentation rate (ESR)
- C-reactive protein (CRP)

Throat swab and culture for group A beta-haemolytic streptococcus, if available.

Anti-streptolysin O and anti-DNAse B titres, which may be repeated in 2 weeks if not confirmatory.

PHARMACOLOGICAL TREATMENT

Intramuscular (im) Benzathine Penicillin G (LOE A)

- Adults: 1,200,000 U as a single shot
 - Children less than 20 kg: 600,000 U as a single shot
- or

Oral Penicillin V (LOE A)

- Adults: 500mg twice daily for 10 days
 - Children: 250mg twice daily for 10 days
- ▶ Patients with a known allergy to Penicillin: oral Erythromycin (LOE B)

ARTHRITIS AND FEVER

- **Aspirin** starting at a dose of 50–60mg/kg/day, titrated up to 80–100mg/kg/day (4–8 g/day in adults) and administered in divided doses; the dose may be increased to 125mg/kg/day at which time signs of toxicity must be looked for (LOE A)
- **Naproxen**, (10–20mg/kg/day) or **Ibuprofen** are suitable alternatives given twice-daily¹⁵ (LOE B)
- If the diagnosis is uncertain, **Paracetamol** or **Codeine** may be administered for pain relief (LOE C)

- ▶ Note: If clinical signs do not resolve within 3 days of start of medications, look for an alternative diagnosis.
- ▶ Anti-inflammatory medication may be given for 1–2 weeks; however, it may be continued for as long as 6 weeks depending on how drastically the clinical symptoms and inflammatory markers improve.

CARDITIS/HEART FAILURE

- Bed rest with mobilisation
- Gradual ambulation, especially in patients with heart failure
- ▶ Refer patient to a health facility with a physician specialist, when there is severe carditis with persistent heart failure, or poor resolution of symptoms despite optimal treatment.

TERTIARY HEALTH FACILITY

LABORATORY INVESTIGATION

- Full blood cell count (FBC)
- Blood cultures
- Erythrocyte sedimentation rate (ESR)
- C-reactive protein (CRP)
- Throat swab (before giving antibiotics): culture for GAS
- Antistreptococcal serology: Anti Streptolysin O titre and anti-DNase B titres which may be repeated in two weeks if the result is not confirmatory

NON-LABORATORY INVESTIGATION

- Electrocardiogram
- Chest X-ray
- Echocardiogram (consider repeating after 1 month, if negative)

PHARMACOLOGICAL TREATMENT

Intramuscular (im) Benzathine Penicillin G (Level of evidence A)

- Adults: 1,200,000 U as a single shot
 - Children less than 20 kg: 600,000 U as a single shot
- or

Oral Penicillin V (LOE A)

- Adults: 500mg twice daily for 10 days
- Children: 250mg twice daily for 10 days

- ▶ Patients with a known allergy to Penicillin: oral Erythromycin (LOE B)

ARTHRITIS AND FEVER

- Aspirin starting at a dose of 50–60mg/kg/day, titrated up to 80–100mg/kg/day (4–8g/day in adults) and administered in divided doses; the dose may be increased to 125 mg/kg/day at which time signs of toxicity must be looked for (LOE A)
 - Naproxen (10–20mg/kg/day) or Ibuprofen suitable alternatives given twice-daily¹⁵ (LOE B)
 - If the diagnosis is uncertain, Paracetamol or Codeine for pain relief (LOE C)
- ▶ Note: If clinical signs do not resolve within 3 days of start of medications, look for an alternative diagnosis
- ▶ Anti-inflammatory medication may be given for 1–2 weeks however may be continued for as long as 6 weeks depending on how drastically the clinical symptoms and inflammatory markers improve

CARDITIS/HEART FAILURE

- ▶ Refer to *chapter 5.4* on heart failure.

5.6.4 SECONDARY PREVENTION (APPLIES FOR HEALTH FACILITIES WITH A DOCTOR AND A PHYSICIAN SPECIALIST)

This is the continual use of antibiotics in patients with a history of rheumatic fever, or rheumatic heart disease. By this treatment, infection with GAS and the subsequent development of recurrent attacks of rheumatic fever is curtailed¹⁷. This is an effective ARF prevention strategy¹⁸.

INTRAMUSCULAR (I.M) BENZATHINE PENICILLIN G (BPG) (LOE A)

- Adults: 900mg (1,200,000 U) as a single shot monthly
 - Children less than 30 kg: 450mg (600,000 U) as a single shot monthly
- ▶ The rates of allergic and anaphylactic reactions to monthly BPG are 3.2% and 0.2%, respectively, and fatalities are rare¹⁸.
- ▶ Before the start of Penicillin treatment, allergies to these medicines must be assessed (allergy history) in patients and erythromycin used instead in cases of penicillin allergy¹⁸.

IN PREGNANCY

Erythromycin considered to be safe in patients with known allergies to Penicillin¹⁸.

DURATION OF SECONDARY PREVENTION

The appropriate duration of secondary prevention is determined by factors such as age, risk factors in the environment, the most recent episode of ARF among others.

Table 68: Prophylaxis for acute rheumatic fever

Category	Definition of category	Duration
All persons with ARF or Rheumatic Heart Disease (RHD)		Minimum 10 years after most recent episode of ARF or until age 21 years (whichever is longer)
Status after initial period elapsed:		
No RHD	No pathological mitral or aortic regurgitation, but may have minor morphological changes to mitral or aortic valves on echocardiography	Discontinue at that time
Mild RHD	Mild mitral or aortic regurgitation clinically and on echocardiography, with no clinical evidence of heart failure, and no evidence of cardiac chamber enlargement on echocardiography	Discontinue at that time
Moderate RHD	<ul style="list-style-type: none"> ▪ Any valve lesion of moderate severity clinically (e.g. mild-moderate cardiomegaly and/or mild-moderate heart failure) or on echocardiography ▪ Mild mitral regurgitation, together with mild aortic regurgitation clinically or on echocardiography ▪ Mild or moderate mitral or aortic stenosis ▪ Any pulmonary or tricuspid valve lesion coexisting with a left-sided valve lesion 	Continue until 35 years of age
Severe RHD	<ul style="list-style-type: none"> ▪ Any severe valve lesion clinically (e.g. moderate to severe cardiomegaly or heart failure) or on echocardiography ▪ Any impending or previous cardiac valve surgery for RHD 	Continue until age 40 years or longer

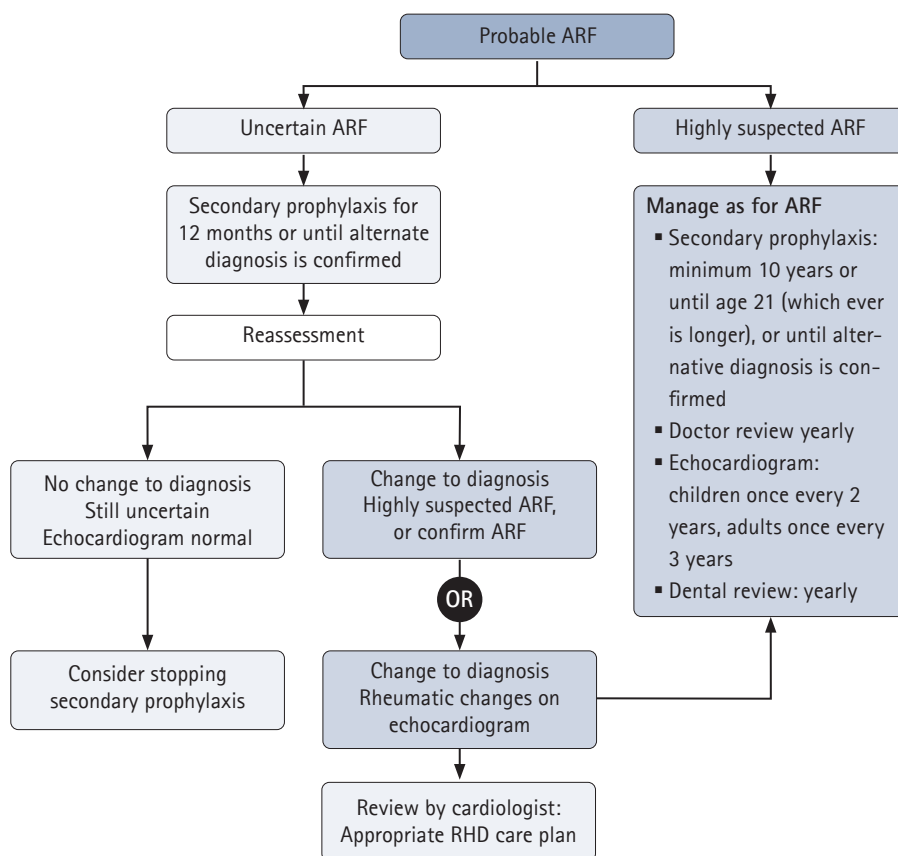


Figure 28: Algorithm for diagnosis and management of ARF (Adapted from the 2012 Australian Guidelines for Diagnosis and Management of ARF)

RISK FACTORS FOR ARF

- A preceding throat, or skin infection with group A B hemolytic streptococcus.
- Environmental factors such as overcrowding in households and large social contacts, the sharing of personal items such as tooth brushes, exposure to tobacco smoke and damp and cold temperatures within residences.
- Nutritional factors include poor oral hygiene and general poor health status and the presence of chronic medical conditions and poor nutritional status/ malnutrition.
- Social determinants of health including poor economic status and low incomes with subsequent poor living conditions and malnutrition.
- Healthcare factors, largely fuelled by lack of education on the risk factors for this condition.
- Individual risk factors may include genetic predisposition as it is highly concordant among monozygotic twins compared to dizygotic twins. Additionally factors such as low birth weight/ preterm delivery, and the concept of auto immunity all contribute to make a person more at risk of developing ARF than other people.

PREVENTION OF ARF

- Primordial prevention: these include regular bathing and twice daily brushing of teeth, regular washing of bedding, reduction of dust and moisture in living environments, control/prevention of insect bites, and improving nutrition and the preparation and storage of food hygienically.
- Primary prevention includes the proper diagnosis and treatment of skin or throat infections with group A B hemolytic streptococcus.
- Secondary prophylaxis in patients who have developed ARF and is aimed at preventing recurrent episodes of ARF and reduce the likelihood of RHD occurrence.

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NOTES

5 DISEASES

5.7 RHEUMATIC HEART DISEASE

LIST OF ABBREVIATIONS AND ACRONYMS

RF	RHEUMATIC FEVER	LFT	LIVER FUNCTIONTEST
GAS	GROUP A STREPTOCOCCUS	ECG	ELECTROCARDIOGRAM
CRP	C-REACTIVE PROTEIN	JVP	JUGULAR VENOUS PULSATION/ PRESSURE
ESR	ERYTHROCYTE SEDIMENTATION RATE	S1, S2,	FIRST, SECOND, THIRD
FBC	FULL BLOOD COUNT	S3, S4	AND FOURTH HEART SOUNDS
MR	MITRAL REGURGITATION	A1, A2	FIRST AND SECOND HEART SOUNDS AT THE AORTIC AREA
MS	MITRAL STENOSIS	P2	SECOND HEART SOUND AT THE PULMONARY AREA
RHD	RHEUMATIC HEART DISEASE		
BUE	BLOOD, UREA, AND ELECTROLYTES		
ASO	ANTI-STREPTOLYSIN O		
CXR	CHEST X-RAY		

5.7.1 INTRODUCTION

DEFINITION

The long-term damage to cardiac valves caused by acute rheumatic fever, which can result from a single severe episode or from multiple recurrent episodes of the illness is known as rheumatic heart disease (RHD). It is a known cause of cardiac associated morbidity and mortality in resource poor settings¹. It is the most serious consequence of acute rheumatic fever with rheumatic carditis. Patients may sometimes present with the complications of RHD, which include heart failure, endocarditis, atrial fibrillation and embolic stroke¹.

EPIDEMIOLOGY

RHD remains the leading cause of acquired heart disease among the young worldwide. The exact mortality rate due to RHD is underestimated in Africa. A large multinational African study demonstrated that RHD is the most frequent cause of heart failure among children and young adults, and importantly that the 180-day mortality rate is as high as 17.8%². Admittedly, the prevalence of RHD in LMICs, such as Ghana, as a cause of frequent heart failure hospitalisations falls far below that for hypertension and coronary artery disease related aetiologies.³ Recent data also suggests possible genetic predisposition to RHD among black Africans⁴.

RISK FACTORS FOR RHD:

- Age: RHD starts in children but its prevalence peaks in adulthood between 25 years to 45 years
- Sex: RHD occurs more commonly in females, relative risk of 1.6 to 2 compared with males
- Environmental factors e.g. household overcrowding
- Rural residence²
- Poverty
- Reduced access to medical care

CLASSIFICATION

- Mitral regurgitation
- Mitral stenosis
- Aortic regurgitation
- Aortic stenosis
- Pulmonic valve involvement
- Tricuspid valve involvement

5.7.2 AETIOLOGY

RHD is a late complication of ARF

- ▶ Refer to chapter on ARF.

The valves most affected by rheumatic fever, in descending order, are the mitral, aortic, tricuspid, and pulmonary valves. In most cases, the mitral valve is involved with one or more of the other 3. In acute disease, small thrombi form along the lines of valve closure. In chronic disease, there is thickening and fibrosis of the valve resulting in stenosis and regurgitation².

5.7.3 SYMPTOMS AND SIGNS

MITRAL REGURGITATION (MR)

- Mitral regurgitation, as an isolated lesion or in combination with other valvar defects, is probably the most common valvular dysfunction resulting from the acute rheumatic process; in developing countries, severe forms have necessitated early surgical intervention in young patients³
- Unlike mitral stenosis, when there is a variable latent period between the establishment of the valvular lesion and the acute episode, mitral regurgitation on the other hand is frequently present from the onset of the active process³
- Initial regurgitation has been noted to disappear over periods ranging from 2 months to 9 years, while new lesions such as mitral stenosis, or stenosis combined with regurgitation, appeared over a period of up to 12 years³
- Patients with mitral regurgitation are far more likely to have suffered a more severe acute episode than those with mitral stenosis

SYMPTOMS

The severity, and to a lesser extent the chronicity, of the regurgitant valve are the main factors in determining the symptoms.

- Patients with mild lesions - completely asymptomatic
- Patients with moderate mitral regurgitation - symptoms may be relatively unimpressive
- Patients with severe valvular incompetence - effort dyspnoea, easy fatigability, poor weight gain, palpitations on effort, paroxysmal nocturnal dyspnoea, and finally congestive heart failure (CHF)³

SIGNS

Radial pulse may be normal but increased with low volume in severe regurgitation

- Blood pressure - normal with a slightly widened pulse pressure, giving a brisk pulse
 - Jugular venous pressure - normal when there is no CHF, elevated in CHF
 - Apical impulse - usually normal in those with mild lesions, with no major precordial pulsations
 - In significant mitral regurgitation, there is a hyperdynamic forcible left ventricular heaving apex which may be palpable, displaced downwards and laterally
 - The first heart sound is normal in intensity or somewhat soft; the second heart sound is usually normal; in severe lesions markedly split because of the shortening of left ventricular systole³
 - The presence of a loud third heart sound excludes the coexistence of significant mitral stenosis
- **The most important clinical feature is the characteristic apical pan-systolic murmur**
- It is heard best at the apex, radiates to the left axilla and left sternal edge and has a blowing quality with no accentuation in mid- or late systole

- Occasionally, especially in the presence of acute valvulitis, the murmur may be short
- A low-pitched third heart sound, which is often palpable and is caused by the considerable early diastolic filling of the ventricle, is heard in those with significant mitral regurgitation and left ventricular failure⁴
- Associated pulmonary hypertension:
 - right ventricular parasternal lift/heave
 - a loud palpable pulmonary sound
 - murmurs of pulmonary and/or tricuspid incompetence

The clinical signs of mitral regurgitation are much less clear-cut than those of mitral stenosis¹ as a secondary cause of pulmonary hypertension.

MITRAL STENOSIS

SYMPTOMS

Those with mild stenosis may be completely asymptomatic⁵. Exercise intolerance and atrial fibrillation are among the precipitating causes of the initial presentation of symptoms.

Critical or significant mitral stenosis is present when the area of the valvular orifice is reduced to about one-quarter of the expected normal for age.

- The common symptoms in critical stenosis are cough with frothy or blood-stained sputum, effort dyspnoea, orthopnoea, paroxysmal nocturnal dyspnoea and episodes of pulmonary oedema
- These symptoms may be aggravated by recurrence of carditis, intercurrent infections, and uncontrolled tachycardia or atrial fibrillation
- Congestive cardiac failure usually occurs with severe stenosis and moderate-severe pulmonary hypertension⁵

SIGNS

With chronic mitral stenosis, reduced cardiac output and vasoconstriction can result in mitral facies (violaceous papules on the cheeks). Other signs include:

- Jugular venous distension
- Right ventricular heave in the left parasternal region in the patient with superimposed pulmonary hypertension; a loud P2 might be heard in the left 2nd intercostal space
- Apex beat is usually not displaced unless there is associated mitral regurgitation
- Apical beat may be tapping in nature
- On apical auscultation, there is an opening snap, loud first heart sound, and a low-pitched mid-diastolic rumble murmur
- A high-pitched decrescendo diastolic murmur secondary to pulmonary regurgitation (Graham-Steel's murmur) may be audible at the upper sternal border⁶

AORTIC REGURGITATION (AR)

SYMPTOMS

Patients with chronic AR are often asymptomatic for several years. When symptoms develop, cardiac function deteriorates quickly, and mortality rate might exceed 10% a year. **Symptoms include:**

- Palpitations
- Shortness of breath
- Chest pain
- Orthopnoea

SIGNS

Most of the physical signs of AR are a result of the widened pulse pressures that are characteristic of this condition:

- Visible systolic pulsations of retinal arterioles (fundoscopy)
- Water-hammer pulse
- Bobbing motion of head with each heartbeat
- Systolic murmur over the femoral artery with proximal compression of the artery, and diastolic murmur over the femoral artery with distal compression of the artery
- On palpation, the point of maximal impulse (apex beat) may be diffuse or hyperdynamic but is often displaced inferiorly and laterally, peripheral pulses are prominent or bounding
- Auscultation may reveal an S3 gallop, if left ventricular dysfunction is present⁷
- Early diastolic murmur at right parasternal area which radiates to the apex
- For severe AR, ejection systolic murmur could be heard over the aortic area due to large stroke volume

AORTIC STENOSIS

SYMPTOMS

Usually asymptomatic for up to 20 years. However, the following might be elicited as left ventricular outflow obstruction and myocardial pressure load worsen:

- Exertional dyspnoea (most common initial complaint)
- Paroxysmal nocturnal dyspnoea
- Orthopnoea
- Exertional chest pain⁸
- Syncope

SIGNS

- Soft S1 and diminished/absent A2
- Paradoxical splitting of S2
- Prominent S4
- Systolic crescendo-decrescendo murmur at the second intercostal space at the right upper sternal border which radiate to the carotid arteries⁸

TRICUSPID REGURGITATION (TR)

SYMPTOMS

The general presentation is that of right-sided heart failure.

- Exertional dyspnoea
- Abdominal swelling
- Bodily swelling⁹

SIGNS

- S3 gallop
- Jugular venous distension
- Right ventricular heave
- Ascites
- Peripheral oedema
- Pulsatile hepatomegaly⁹

PULMONARY VALVE

SYMPTOMS AND SIGNS

- Pulmonic regurgitation is rarely noticed by the patient; however, right ventricular enlargement and/or pulmonary hypertension can ensue and result in heart failure, leading to dyspnoea on exertion (most common), easy fatigability, light-headedness, peripheral oedema, chest pain, palpitations, and frank syncope; the JVP will likely be increased¹⁰
- Clinical features of pulmonic stenosis include dyspnoea, cyanosis, fatigue, dizziness and syncope, and chest pain¹¹

5.7.4 MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

Clinical suspicion or diagnosed based on symptoms and signs.

Place the patient in the cardiac position and perform the following basic labs when available:

- Full blood cell count
- Erythrocyte sedimentation rate

Administer supplemental oxygen if oxygen saturation falls below 92% on room air!

- ▶ Refer to a health facility with a doctor or physician specialist.

SECONDARY HEALTH FACILITY

LABORATORY INVESTIGATION

Perform the following:

- Full blood cell count
- Erythrocyte sedimentation rate
- C-reactive protein
- Blood urea electrolytes and creatinine
- Liver function test

PHARMACOLOGICAL TREATMENT

Provide symptomatic relief with medical treatment when patient has symptoms and signs of heart failure.

- **Furosemide:**
 - **Adults:**
 - 20-80mg orally once daily; may be increased by 20-40mg 6-8 hourly; not to exceed 600mg/day
 - Alternative: 20-40mg IV/IM once; may be increased by 20mg 2 hourly; individual dose not to exceed 200mg/dose¹²
 - **Infants and children:**
 - 1-2mg/kg IV/IM/orally once initially; increased by 1-2mg/kg q6-8hrs (orally) or 1mg/kg q2hrs (IV/IM); individual dose not to exceed 6mg/kg¹²
- ▶ Refractory chronic heart failure may necessitate larger doses
- ▶ Additional medication can be discussed with specialist before initiation (please note precautions)
- ▶ **Refer to health facility with a physician specialist.**

HEALTH FACILITY WITH A PHYSICIAN SPECIALIST

LABORATORY INVESTIGATION

Perform the following:

- Full blood cell count
- Erythrocyte sedimentation rate
- C-reactive protein
- Blood urea electrolytes and creatinine
- Liver function tests
- Throat swab
- Anti-streptolysin O titres

NON-LABORATORY INVESTIGATION

- CXR
- ECG
- Echocardiography

PHARMACOLOGICAL TREATMENT

MANAGEMENT OF HEART FAILURE

Treat based on New York Heart Association staging of heart failure for classes III-IV:

A. OXYGEN BY NASAL PRONGS OR FACE MASK IF HYPOXAEMIA IS PRESENT (SPO₂ <90%)

B. CARDIAC POSITION

C. DIURETICS

- Furosemide
 - Adults: 20-80mg orally once daily; may be increased by 20-40mg 6-8 hourly; not to exceed 600mg/day
Alternative: 20-40mg IV/IM once; may be increased by 20mg 2 hourly; individual dose not to exceed 200mg/dose¹⁵
 - Infants and children: 1-2mg/kg IV/IM/orally once initially; increased by 1-2mg/kg 6-8 hourly (orally) or 1mg/kg 2 hours (IV/IM). Individual dose not to exceed 6mg/kg¹⁵

▶ Maintenance after stabilization¹⁴:

- Furosemide IV
 - Adults: 40-80mg 12 hourly
 - Children: 12-18 years: 20-40mg 8 hourly as required
1 month - 12 years: 0.5-1mg/kg 8 hourly (max. 4mg/kg/dose)

▶ Patient not improving after initial treatment:

- Furosemide IV
 - Adults: 40-80mg 12 hourly
 - Children: 12-18years: 20-40mg repeated 8 hourly as necessary
1 month - 12 years: 0.5-1mg/kg 8 hourly (max. 4mg/kg/dose)

and

- Morphine IV for patients with acute left ventricular failure
 - Adults: 2.5-10mg (for the elderly 2.5-5mg slowly)
 - Children: not recommended

and

- Metoclopramide IV
 - Adults: 10mg to prevent vomiting
 - Children: not required

D. ANGIOTENSIN CONVERTING ENZYME/RECEPTOR BLOCKER THERAPY

- Lisinopril
 - Adults: Initial: 2.5mg orally once daily and titrate upwards
- ▶ Avoid in unstable heart failure or patients which hypotension¹⁶
or
- Losartan
 - Adults: 25mg orally daily initially; may increase to 100mg¹⁷

ANTICOAGULATION

- ▶ Anticoagulation, if there is a history of thromboembolism and/or atrial fibrillation.
- ▶ Anticoagulation: maintain INR of 2-3.
 - Adults: Warfarin
 - Initial dose: 2-5mg orally day × 2 days, or 10mg orally × 2 days in healthy individuals¹³
 - It is important to bridge the initiation of Warfarin with unfractionated or low molecular weight heparin; check INR after 2 days and adjust dose according to results
 - Typical maintenance dose ranges between 2-10mg/day¹³

RATE CONTROL IN PATIENTS WITH ATRIAL FIBRILLATION

For patients with atrial fibrillation, control of ventricular response could be achieved with the following:

- Adults:
 - Atenolol orally 25-100mg daily
or
 - Bisoprolol orally 2.5-10mg daily
or
 - Metoprolol tartrate orally 50-100mg twice or three times daily (max. 300mg daily)¹⁴

If Beta-blockers are not tolerated, it is recommended to initiate therapy with:

- Digoxin 125-250mcg once daily, or
- Amiodarone, commencing with 200mg three times a day for the first week, and titrating down to 200mg daily

SECONDARY PROPHYLAXIS AGAINST RECURRENT ARF AND CARDITIS

- Intramuscular (im) Benzathine Penicillin G (BPG)
 - Adults: 900mg (1,200,000 U) as a single shot monthly
 - Children less than 30 kg: 450mg (600,000 U) as a shot monthly
- or
- Penicillin V
 - Adults: 250mg orally twice daily²

DURATION OF PROPHYLAXIS:

- RF with carditis and residual heart disease (persistent valvular disease):
10 years or until age 40 years (whichever is longer)
- RF with carditis but no residual heart disease (no valvular disease):
10 years or until age 21 years (whichever is longer)
- RF without carditis:
5 years or until age 21 years (whichever is longer)²

INFECTIVE ENDOCARDITIS PROPHYLAXIS IN PATIENTS WITH RHD

- Antibiotic prophylaxis before major dental, oral, respiratory tract, or oesophageal procedures is targeted towards *S viridans*

- Standard general prophylaxis is a single dose Amoxicillin 2g orally 30-60 minutes before the procedure.
- If unable to take oral medication, consider a single dose of Ampicillin, 2g IV/IM 30-60 minutes before the procedure¹⁹
- Activity restrictions based on severity of valvular disease

► Refer to a facility with a cardiologist/cardiothoracic surgeon for definite treatment of the RHD.

HEALTH FACILITY WITH A CARDIOLOGIST OR CARDIOTHORACIC SURGEON

PERCUTANEOUS BALLOON VALVULOPLASTY

Valvuloplasty might become necessary for symptom relief, especially with rheumatic mitral stenosis. American Heart Association (AHA)/American College of Cardiology (ACC) guideline recommendations are as follows²⁰:

- Perform percutaneous mitral balloon valvuloplasty (PMBV) for patients with severe mitral stenosis Mitral valve area (MVA) $<1.5 \text{ cm}^2$, favourable valve morphology and absence of contraindications such as left atrial thrombus or significant mitral regurgitation (class I)
- Asymptomatic patients with MVA $<1.5 \text{ cm}^2$, pulmonary hypertension (systolic pulmonary pressure $>50 \text{ mmHg}$ at rest or $>60 \text{ mmHg}$ with exercise), and favourable valve morphology should also be considered for PMBV (class I)
- Patients with calcific mitral stenosis who are at high risk for surgical commissurotomy should be considered for PMBV when advanced heart failure (NYHA class III-IV) and severe mitral stenosis (MVA $<1.5 \text{ cm}^2$) are present (class IIa)
- Similar patients who are at lower risk for surgical commissurotomy may also be considered for PMBV (class IIb)
- Symptomatic patients (NYHA class II-IV) with milder stenosis (MVA $>1.5 \text{ cm}^2$) and pulmonary hypertension may be considered for PMBV (class IIb)
- Asymptomatic patients with MVA less than 1.5 cm^2 with new atrial fibrillation may also be considered for PMBV (class IIb)

Similar recommendations have been made by the European Society of Cardiology. Palliative treatment may be considered in patients who are not suitable candidates for surgery even when valve morphology is not ideal.

SURGICAL VALVE REPAIR/REPLACEMENT²¹

Current guidelines limit mitral valve replacement to irreparable valve pathology that will result in poor durability outcomes, especially in patients unlikely to tolerate future reinterventions.

Valve replacement for mitral stenosis (MS) may be considered in patients who are candidates for surgical therapy when the valve is not suitable for valvotomy (either surgical or percutaneous). The recommendations for surgery in patients with mitral stenosis, according to the current ACC/AHA guidelines, are described below:

- Mitral valve surgery (repair if possible) is indicated in patients with symptomatic (New York Heart Association [NYHA] functional class III-IV) moderate or severe MS under any of the following circumstances:
 - Percutaneous mitral balloon valvotomy is unavailable

- Percutaneous mitral balloon valvotomy is contraindicated because of left atrial thrombus despite anticoagulation or because concomitant moderate to severe mitral regurgitation (MR) is present
- The valve morphology is not favourable for percutaneous mitral balloon valvotomy in a patient with acceptable operative risk (class I)
- Symptomatic patients with moderate to severe MS who also have moderate to severe MR should receive mitral valve replacement (MVR) unless valve repair is possible at the time of surgery (class I)
- Mitral valve replacement is reasonable in patients with severe MS and severe pulmonary hypertension (pulmonary artery systolic pressure >60 mmHg) who have NYHA functional class I-II symptoms and who are not considered candidates for percutaneous mitral balloon valvotomy or surgical mitral valve repair (class IIa)

5.7.5 PATIENT INFORMATION

- Counselling: patients should be counselled at diagnosis and prior to discharge on disease condition
- Within 4 weeks of discharge, patient should be reviewed or reassessed
- Patient management should be individualised in relation to comorbidities and disease severity
- Counsel on diuretics, febrile illness and diarrhoeal illness, salt and fluid restriction
- Infective endocarditis prophylaxis be considered and individualised in patients undergoing dental procedures
- Report to the cardiologist once pregnancy occurs; planned pregnancy is preferred with prior cardiologist consult

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5 DISEASES

5.8 INFECTIVE ENDOCARDITIS

LIST OF ABBREVIATIONS AND ACRONYMS

ARF	ACUTE RHEUMATIC FEVER	HF	HEART FAILURE
ASO	ANTISTREPTOLYSIN O	IE	INFECTIVE ENDOCARDITIS
BUE	BLOOD UREA ELECTROLYTES	MI	MYOCARDIAL INFARCTION
CHD	CONGENITAL HEART DISEASE	NVE	NATIVE VALVE ENDOCARDITIS
CRP	C-REACTIVE PROTEIN	PVE	PROSTHETIC VALVE ENDOCARDITIS
ECG	ELECTROCARDIOGRAM	TOE	TRANSOESOPHAGEAL ECHOCARDIOGRAM
ESR	ERYTHROCYTE SEDIMENTATION RATE	WBC	WHITE BLOOD CELL COUNT
GAS	GROUP A STREPTOCOCCUS		
FBC	FULL BLOOD CELL COUNT		

5.8.1 INTRODUCTION

DEFINITION

Infective endocarditis (IE) is an infection involving the endocardial surface (inner lining) of the heart which may include heart valves and congenital defects. Infections are mainly bacterial and fungal in origin. The process of endocarditis involves infection, inflammation and immune response to the bacteria or fungi. The process of endocarditis leads to the formation of vegetation on the valve or endocardium, which is made up of bacteria/fungi, clots and inflammatory substances. The vegetation can dislodge (embolize) to distant organs like the brain¹.

CLASSIFICATION

IE IS CLASSIFIED INTO FIVE MAIN TYPES:

- Native (natural) valve (NVE)
- Prosthetic (artificial) valve endocarditis (PVE)
- Intravenous drug abuse (IVDA) endocarditis
- Fungal endocarditis
- Nosocomial/hospital acquired

RISK FACTORS

- Congenital heart defects
- Rheumatic valvular disease
- Degenerative heart disease including calcific aortic stenosis due to either a bicuspid valve, Marfan's syndrome or syphilitic disease
- Mitral valve prolapse
- Prosthetic (artificial) valve

Rarely do we have endocarditis involving normal valves.

5.8.2 AETIOLOGY

See *table 67*: Aetiology of infective endocarditis based on classification on next page.

Table 69: Aetiology of infective endocarditis based on classification

Classification	Characteristics	Causative organism
Native (natural) valve endocarditis (NVE)	Complications arise due to slowly progressive valvular destruction, embolic or immunologic phenomena	<ul style="list-style-type: none"> ▪ Streptococcus spp ▪ S. viridans ▪ S. bovis ▪ Enterococci ▪ Staphylococcus spp
Prosthetic (artificial) valve endocarditis (PVE)	<p>A complication of surgery (early or late):</p> <ul style="list-style-type: none"> ▪ Early complication of the surgery (less than a year) runs an aggressive acute course with local abscess, valve dehiscence, and fistula formation resulting in shock, heart failure, emboli and pericardial tamponade ▪ Late complication of surgery (>1 year) runs a sub-acute course 	<ul style="list-style-type: none"> ▪ Staphylococcus aureus ▪ Corynebacterium, ▪ Fungi (candida spp, aspergillus spp) ▪ Legionella ▪ Haemophilus spp ▪ Actinobacillus spp ▪ Cardiobacterium hominis ▪ Eikenella corrodens ▪ Kingella kingae
Intravenous drug abuse (IVDA) endocarditis	Right-sided endocarditis is the most common presentation, which involves the tricuspid valve, and a murmur is not always present	<ul style="list-style-type: none"> ▪ Staph. aureus ▪ Group A strep ▪ Enterococci
Fungal endocarditis	Commonly found in intravenous drug users and intensive care unit patients who receive broad-spectrum antibiotics	<ul style="list-style-type: none"> ▪ Candida spp ▪ Aspergillus spp <p>blood cultures are usually negative</p>
Nosocomial (hospital-acquired) endocarditis	A rare complication of nosocomial sepsis usually from intravascular devices e.g. central lines/ catheters, peripheral intravenous catheters and intracardiac devices such as pacemakers	<ul style="list-style-type: none"> ▪ Staph. aureus ▪ Enterococci

5.8.3 CLINICAL PRESENTATION

A high index of suspicion (alertness) is required in the diagnosis of infective endocarditis. The clinical presentation (signs and symptoms) of infective endocarditis is highly variable. Presentation depends on the causative organism, the presence or absence of pre-existing cardiac disease, and the presence or absence of prosthetic valves or cardiac devices. Symptoms are therefore commonly non-specific constitutional symptoms (fever, weight loss, joint pains, etc.), symptoms associated with primary cardiac defects, or secondary embolic phenomena.

COMMON SYMPTOMS

- Fever
- Chills
- Anorexia
- Malaise
- Myalgia
- Headache
- Weight loss
- Night sweats
- Dyspnoea
- Chest pain
- Cough
- Joint pains

SYMPTOMS ASSOCIATED WITH SECONDARY EMBOLIC PHENOMENA

- Symptoms of acute meningitis (fever, severe headache, seizures, photophobia, confusion)
- Focal neurologic complaints (e.g. hemiplegia) due to embolic stroke (infarct or haemorrhage)
- Angina/myocardial infarction
- Back pain associated with vertebral osteomyelitis
- Unilateral blindness
- Painless haematuria

Dyspnoea, cough, and chest pain are common complaints of intravenous drug users. This is due to the predominance of tricuspid valve endocarditis in this group and secondary emboli to the pulmonary vasculature.

SIGNS

- Fever
- Heart murmurs
- Change in a pre-existing murmur
- Petechiae
- Splinter haemorrhages: dark red linear lesions in the nailbeds
- Janeway lesions: non-tender maculae on palms and soles
- Osler nodes: tender subcutaneous nodules usually found on the distal pads of the digits
- Roth spots: retinal haemorrhages with small, clear centre rare)
- Splenomegaly

OTHER SIGNS INCLUDE THE FOLLOWING:

- Stiff neck
- Paralysis, hemiparesis, aphasia
- Delirium
- Pallor
- Conjunctival haemorrhage
- Crackles
- Pleural friction rub
- Cardiac arrhythmia
- Gallops
- Pericardial rub

Table 70: Major and minor criteria for the diagnosis of infective endocarditis³

Major and minor criteria for the diagnosis of infective endocarditis			
Major criteria	<ul style="list-style-type: none"> ▪ All of 3 or a majority of 4 or more positive blood cultures (with at least 1 h between first and last culture) for organisms consistent with endocarditis ▪ Serologic evidence of <i>Coxiella burnetii</i> (IgG titre > 1:800) or one positive blood culture for <i>Coxiella burnetii</i> ▪ Echocardiographic evidence of endocardial involvement: ▪ Oscillating intracardiac mass (vegetation) on a heart valve, on supporting structures, in the path of regurgitant jets, or on implanted material without another anatomic explanation ▪ Cardiac abscess ▪ New dehiscence of prosthetic valve ▪ New valvular regurgitation 		
Minor criteria	<table border="0"> <tr> <td> <ul style="list-style-type: none"> ▪ Predisposing heart disorder ▪ IV drug abuse ▪ Fever $\geq 38.0^{\circ}\text{C}$ <p>Immunologic phenomena:</p> <ul style="list-style-type: none"> ▪ Glomerulonephritis ▪ Osler nodes ▪ Roth spots ▪ Rheumatoid factor </td> <td> <p>Vascular phenomena:</p> <ul style="list-style-type: none"> ▪ Arterial embolism ▪ Septic pulmonary embolism ▪ Mycotic aneurysm ▪ Intracranial haemorrhage ▪ Conjunctival petechiae ▪ Janeway lesions </td> </tr> </table>	<ul style="list-style-type: none"> ▪ Predisposing heart disorder ▪ IV drug abuse ▪ Fever $\geq 38.0^{\circ}\text{C}$ <p>Immunologic phenomena:</p> <ul style="list-style-type: none"> ▪ Glomerulonephritis ▪ Osler nodes ▪ Roth spots ▪ Rheumatoid factor 	<p>Vascular phenomena:</p> <ul style="list-style-type: none"> ▪ Arterial embolism ▪ Septic pulmonary embolism ▪ Mycotic aneurysm ▪ Intracranial haemorrhage ▪ Conjunctival petechiae ▪ Janeway lesions
<ul style="list-style-type: none"> ▪ Predisposing heart disorder ▪ IV drug abuse ▪ Fever $\geq 38.0^{\circ}\text{C}$ <p>Immunologic phenomena:</p> <ul style="list-style-type: none"> ▪ Glomerulonephritis ▪ Osler nodes ▪ Roth spots ▪ Rheumatoid factor 	<p>Vascular phenomena:</p> <ul style="list-style-type: none"> ▪ Arterial embolism ▪ Septic pulmonary embolism ▪ Mycotic aneurysm ▪ Intracranial haemorrhage ▪ Conjunctival petechiae ▪ Janeway lesions 		
Microbiologic evidence of infection consistent with but not meeting major criteria			
Serologic evidence of infection with organisms consistent with endocarditis			

DIAGNOSTIC CRITERIA

Diagnosis of infective endocarditis is based on the modified Duke's criteria which differentiates diagnoses into definite, possible or rejected infective endocarditis.

Table 71: Modified Duke's criteria for infective endocarditis³

Modified Duke's criteria for infective endocarditis	
Clinical diagnostic status	Criteria
Definite endocarditis	One of the following: <ul style="list-style-type: none"> ▪ 2 major criteria ▪ 1 major and 3 minor ▪ 5 minor
Possible endocarditis	One of the following: <ul style="list-style-type: none"> ▪ 1 major and 1 minor ▪ 3 minor
Endocarditis rejected (excluded)	One of the following: <ul style="list-style-type: none"> ▪ Firm alternative diagnosis explaining the findings of infective endocarditis ▪ Resolution of symptoms and signs after ≤ 4 d of antimicrobial therapy ▪ No pathologic evidence of infective endocarditis found during surgery or autopsy ▪ Failure to meet the clinical criteria for possible endocarditis

5.8.4 MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

The diagnosis of Infective endocarditis in a facility without a doctor may be very difficult. IE should be suspected in a patient with a known heart condition presenting with fever, weight loss and worsening heart failure or any patient who presents with fever, weight loss and no response to antimalarial and antibiotic therapy for >4 days.

LABORATORY INVESTIGATION

- Full blood cell count
- Urine dipstick

PHARMACOLOGICAL TREATMENT

Oral analgesics/antipyretic in case of fever 1g Paracetamol t.d.s (oral)

- ▶ **Refer to a health facility with a doctor.**

SECONDARY HEALTH FACILITY

IE should be suspected in a patient with a known heart condition presenting with fever, weight loss and worsening heart failure or any patient who presents with fever, weight loss and no response to antimalarial and antibiotic therapy for >4 days and a high ESR/CRP.

LABORATORY INVESTIGATION

- Full blood cell count
- Blood cultures: at least three samples containing 10ml of blood each, taken at 30 minutes intervals from a peripheral vein
- Erythrocyte sedimentation rate (ESR)
- Urinalysis: proteinuria, microscopic haematuria

PHARMACOLOGICAL TREATMENT¹

The successful treatment of IE relies a lot on effective antimicrobial therapy². The biofilm structure of the vegetation, protects the microorganisms within this vegetation and prevents effective eradication. The effectiveness of therapy is therefore enhanced with prolonged antibiotic treatment and early surgical intervention when there is an indication to treat. Due to the varied aetiologies of IE, broad-spectrum antibiotic cover is usually a good initial step but must be quickly replaced with culture-specific antibiotic therapies.

PATIENTS WITH NON-COMPLICATED NATIVE VALVE ENDOCARDITIS (NVE) WITH NORMAL RENAL FUNCTION:

- Penicillin G, IV (Evidence rating B)
 - Adults: 12-18 million U/day in 4-6 daily doses (or continuous infusion) for 2 weeks
 - Children: 200,000 U/kg/day in 4-6 doses for 2 weeks
 or
- Ceftriaxone, IV or IM (Evidence rating B)
 - Adults: 2g/day in 1 dose for 2 weeks
 - Children: 100mg/kg/day in 1 dose for 2 weeks
 with
- Gentamycin, IV or IM (Evidence rating B)
 - Adults: 3mg/kg/day in 1 dose for 2 weeks
 - Children: 3mg/kg/day in 1 dose or 3 equally divided doses for 2 weeks
- ▶ Patients ≥65 years or with impaired renal or VIII (Vestibulocochlear) cranial nerve dysfunction: avoid Gentamycin

- Penicillin G, IV (Evidence rating B)
 - Adults: 12-18 million U/day in 4-6 daily doses (or continuous infusion) for 4 weeks
 - Children: 200,000 U/kg/day in 4-6 daily doses for 4 weeks
 or
- Ceftriaxone, IV or IM (Evidence rating B)
 - Adults: 2g/day in 1 dose for 4 weeks
 - Children: 100mg/kg/day in 1 dose for 4 weeks
- ▶ NB: A 6-week therapy is recommended for patients with prosthetic valve endocarditis (PVE)

Beta-lactam (Penicillin) allergic patients:

- Vancomycin, IV (Evidence rating C)
 - Adults: 30mg/kg/day in 2 doses for 4 weeks
 - Children: 40mg/kg/day in 2 or 3 equally divided doses for 4 weeks
- ▶ NB: A 6-week therapy is recommended for patients with PVE

PATIENTS WITH STRAINS RELATIVELY RESISTANT TO PENICILLIN (MIC 0.250–2MG/L):

- Penicillin G, IV (Evidence rating B)
Adults: 24 million U/day in 4-6 daily doses (or continuous infusion) for 4 weeks
or
- Ceftriaxone, IV or IM (Evidence rating B)
Adults: 2g/day in 1 dose for 4 weeks
with
- Gentamycin, IV or IM (Evidence rating B)
Adults: 3mg/kg/day in 1 dose for 2 weeks

FOR STRAINS RELATIVELY RESISTANT TO PENICILLIN (MIC 0.250–2MG/L) IN BETA-LACTAM ALLERGIC PATIENTS:

- Vancomycin, IV (Evidence rating C)
Adults: 30mg/kg/day in 2 doses for 4 weeks
Children: 40mg/kg/day in 2 or 3 equally divided doses for 4 weeks
with
- Gentamycin, IV or IM (Evidence rating C)
Adults: 3mg/kg/day in 1 dose for 2 weeks
Children: 3mg/kg/day in 1 dose or 3 equally divided doses for 2 weeks

- ▶ Refer all cases of infective endocarditis to physician specialist.
- ▶ Refer all cases of complicated infective endocarditis to cardiologist/cardiothoracic surgeon.

TERTIARY HEALTH FACILITY**LABORATORY INVESTIGATION**

- Full blood cell count
- Blood cultures: at least three samples containing 10ml of blood each, taken at 30 minutes intervals from a peripheral vein
- Erythrocyte sedimentation rate (ESR)
- Urinalysis- proteinuria, microscopic haematuria

NON-LABORATORY INVESTIGATION

- Echocardiography
- Chest X-ray

PHARMACOLOGICAL TREATMENT**PATIENTS WITH NON-COMPLICATED NATIVE VALVE ENDOCARDITIS (NVE) WITH NORMAL RENAL FUNCTION:**

- Penicillin G, IV (Evidence rating B)
Adults: 12-18 million U/day in 4-6 daily doses (or continuous infusion) for 2 weeks
Children: 200,000 U/kg/day in 4-6 doses for 2 weeks
or

- Ceftriaxone, IV or IM (Evidence rating B)
 - Adults: 2g/day in 1 dose for 2 weeks
 - Children: 100mg/kg/day in 1 dose for 2 weeks
 with
 - Gentamycin, IV or IM (Evidence rating B)
 - Adults: 3mg/kg/day in 1 dose for 2 weeks
 - Children: 3mg/kg/day in 1 dose or 3 equally divided doses for 2 weeks
- ▶ Patients ≥65 years or with impaired renal or VIII (vestibulocochlear) cranial nerve dysfunction: avoid Gentamycin

- Penicillin G, IV (Evidence rating B)
 - Adults: 12-18 million U/day in 4-6 doses (or continuous infusion) for 4 weeks
 - Children: 200,000 U/kg/day in 4-6 doses for 4 weeks
 or
- Ceftriaxone, IV or IM (Evidence rating B)
 - Adults: 2g/day in 1 dose for 4 weeks
 - Children: 100 mg/kg/day in 1 dose for 4 weeks

- ▶ NB: A 6-week therapy is recommended for patients with prosthetic valve endocarditis (PVE).

BETA-LACTAM (PENICILLIN) ALLERGIC PATIENTS:

- Vancomycin, IV (Evidence rating C)
 - Adults: 30mg/kg/day in 2 doses for 4 weeks
 - Children: 40mg/kg/day in 2 or 3 equally divided doses for 4 weeks

- ▶ NB: A 6-week therapy is recommended for patients with PVE.

PATIENTS WITH STRAINS RELATIVELY RESISTANT TO PENICILLIN (MIC 0.250–2MG/L):

- Penicillin G, IV (Evidence rating B)
 - Adults: 24 million U/day in 4-6 doses (or continuous infusion) for 4 weeks
 or
- Ceftriaxone, IV or IM (Evidence rating B)
 - Adults: 2g/day in 1 dose for 4 week
 with
- Gentamycin, IV or IM (Evidence rating B)
 - Adults: 3mg/kg/day in 1 dose for 2 weeks

FOR STRAINS RESISTANT TO PENICILLIN (MIC 0.250–2MG/L) IN BETA-LACTAM ALLERGIC PATIENTS:

- Vancomycin, IV (Evidence rating C)
 - Adults: 30mg/kg/day in 2 doses for 4 weeks
 - Children: 40mg/kg/day in 2 or 3 equally divided doses for 4 weeks
 with
- Gentamycin, IV or IM (Evidence rating C)
 - Adults: 3mg/kg/day in 1 dose for 2 weeks
 - Children: 3mg/kg/day in 1 dose or 3 equally divided doses for 2 weeks

- ▶ Refer all cases of complicated infective endocarditis to a centre with cardiothoracic surgical facilities.

Table 72: Indications for surgery⁴

Indications for surgery	
Heart failure	<ul style="list-style-type: none"> ▪ Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock ▪ Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance
Uncontrolled infection	<ul style="list-style-type: none"> ▪ Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation) ▪ Infection caused by fungi or multi-resistant organisms ▪ Persistent positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci ▪ PVE caused by staphylococci or non-HACEK gram-negative bacteria
Prevention of embolism	<ul style="list-style-type: none"> ▪ Aortic or mitral NVE or PVE with persistent moderate size vegetation (10mm) after one or more embolic episode despite appropriate antibiotic therapy ▪ Aortic or mitral NVE with moderate size vegetation (10mm) associated with severe valve stenosis or regurgitation, and low operative risk ▪ Aortic or mitral NVE or PVE with isolated very large vegetations (30mm) ▪ Aortic or mitral NVE or PVE with isolated large vegetations (15mm) and no other indication for surgery ▪ HACEK = Haemophilus spp, Actinobacillus spp, Cardiobacterium spp., Eikenella spp., Kingella spp.

Table 73: Proposed antibiotic regimens for initial empirical treatment of infective endocarditis in acute severely ill patients (before pathogen identification)⁴

Antibiotic	Dosage and route	Class ^b	Level ^c	Comments
Community-acquired native valves or late prosthetic valves (≥ 12 month post surgery) endocarditis				
Ampicillin with (Flu)cloxacillin or oxacillin with Gentamicin ^d	12 g/day iv in 4-6 doses 12 g/day iv in 4-6 doses 3 mg/kg/day iv or im in 1 dose	IIa	C	Patients with BCNIE should be treated in consultation with an ID specialist
Vancomycin ^d with Gentamicin ^d	30-60 mg/kg/day iv or im in 2-3 doses 3 mg/kg/day iv or im in 1 dose	IIb	C	
Early PVE (< 12 month post surgery) or nosocomial and non-nosocomial healthcare associated endocarditis				
Vancomycin ^d with Gentamicin ^d with Rifampin	30 mg/kg/day iv in 2 doses 3 mg/kg/day iv or im in 1 dose 900-1200 mg iv or orally in 2 or 3 divided doses	IIb	C	Rifamin is only recommended for PVE and it should be started 3-5 days later than Vancomycin and Gentamicin had been suggested by some experts. In healthcare associated native valve endocarditis, some experts recommend in settings with a prevalence of MRSA infections >5% the combination of Cloxacillin plus Vancomycin until they have the final <i>S. aureus</i> identification

BCNIE = blood culture-negative infective endocarditis ID = infectious disease im = intramuscular iv = intravenous
PVE = prosthetic valve endocarditis

^a If initial blood cultures are negative and there is no clinical response, consider BCNIE aetiology and maybe surgery for molecular diagnosis and treatment, and extension for the antibiotic spectrum to blood culture-negative pathogens (Doxycycline, Quinolones) must be considered.

^b Class of recommendation

^c Level of Evidence

^d Monitoring of Gentamicin or Vancomycin dosages is as described in table 73

5.8.5 COMPLICATIONS

CARDIAC

- Myocardial infarction
- Pericarditis
- Cardiac arrhythmia
- Cardiac valvular insufficiency
- Congestive heart failure
- Sinus of Valsalva aneurysm
- Aortic root or myocardial abscesses
- Arterial emboli, infarcts, mycotic aneurysms

EXTRA-CARDIAC

- Arthritis, myositis
- Glomerulonephritis
- Acute renal failure
- Stroke syndromes
- Mesenteric or splenic abscess or infarct

5.8.6 PREVENTION

Antibiotic prophylaxis should not routinely be prescribed for:

- Patients undergoing dental procedures.
- Patients undergoing non-dental procedures at the following sites:
 - Gastrointestinal tract
 - Genitourinary tract (including urological, gynaecological and obstetric procedures, and child-birth)
 - Respiratory tract (including ear, nose and throat procedures and bronchoscopy)⁵

- ▶ Antibiotic prophylaxis is recommended only for the highest risk patients during certain high risk procedures⁵.

Cardiac conditions at highest risk of infective endocarditis for which preventive treatment should be considered when a high-risk procedure is performed are:

- Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac repair
- Patients with previous episode of IE
- Patients with congenital heart disease (CHD)
- Any type of CHD repaired with a prosthetic material, whether placed surgically or by percutaneous techniques, up to 6 months after the procedure or lifelong if residual shunt or valvular regurgitation remains⁵

Table 74: Recommendations for prophylaxis of infective endocarditis in the highest-risk patients according to the type of at-risk procedure (Adapted from the 2015 ESC Guidelines for the management of infective endocarditis⁶)

Risk Score	Recommendations	Level of evidence
Dental Procedures	Antibiotic prophylaxis should only be considered for dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa	C
	Antibiotic prophylaxis is NOT recommended for local anaesthetic injections in non-infected tissues, treatment of superficial caries, removal of sutures, dental X-rays, placement or adjustment of removable prosthodontic or orthodontic appliances or braces or following the shedding of deciduous teeth or trauma to the lips and oral mucosa	C
Respiratory tract procedures	Antibiotic prophylaxis is NOT recommended for respiratory tract procedures, including bronchoscopy or laryngoscopy, or transnasal or endotracheal intubation	C
	Patients who undergo an invasive respiratory tract procedure to treat an established infection (i.e. drainage of an abscess) should receive an antibiotic regimen that contains an anti-staphylococcal drug	
Gastrointestinal or urogenital procedures or TOE	Antibiotic prophylaxis is NOT recommended for gastroscopy, colonoscopy, cystoscopy, vaginal or caesarean delivery or TOE	C
	In the case of an established infection or if antibiotic therapy is indicated to prevent wound infection or sepsis associated with a gastrointestinal or genitourinary tract procedure in patients, it is recommended that the antibiotic regimen includes an agent active against enterococci	B
Skin and soft tissue procedures	Antibiotic prophylaxis is not recommended for any procedure	C
	For patients undergoing surgical procedures involving infected skin (including oral abscesses), skin structure or musculoskeletal tissue, it is advised that the therapeutic regimen contains an agent active against staphylococci and beta-haemolytic streptococci	C
Cardiac and vascular procedures	Perioperative prophylaxis is recommended before placement of a pacemaker or implantable cardioverter defibrillator	C
	Perioperative antibiotic prophylaxis should be considered in patients undergoing surgical or transcatheter implantation of a prosthetic valve, intravascular prosthetic or other foreign material	B

Table 75: Recommended prophylaxis regimen for high-risk dental procedures in high risk patients

Clinical situation	Antibiotic	Single-dose 30–60 minutes before procedure	
		Adults	Children
No allergy to Penicillin	Amoxicillin	2g orally or iv	50mg/kg orally or iv
	or Ceftriaxone	1g iv	50mg/kg iv
Allergy to Penicillin	Clindamycin	600mg orally or iv	20mg/kg orally or iv

OTHER PREVENTIVE MEASURES

Although antibiotic prophylaxis is not recommended for patients at intermediate risk of IE, i.e. any other form of native valve disease (including the most commonly identified conditions such as bicuspid aortic valve, mitral valve prolapse and calcific aortic stenosis), both intermediate- and high-risk patients should be advised on the importance of dental and skin hygiene. These measures of general hygiene apply to patients and healthcare workers and should ideally be applied to the general population, as IE can occur without known cardiac disease⁶.

RECOMMENDED GENERAL HYGIENE MEASURES INCLUDE

- Strict dental and skin hygiene; dental follow-up should be performed twice a year in high-risk patients and yearly in the others
- Disinfection of wounds
- Curative antibiotics for any focus of bacterial infection
- No self-medication with antibiotics
- Strict infection control measures for any at-risk procedure
- Discourage piercing and tattooing
- Limit the use of infusion catheters and invasive procedure when possible. Favour peripheral over central catheters, and systematic replacement of the peripheral catheter every 3-4 days; strict adherence to care bundles for central and peripheral cannulae should be performed

5.8.7 PATIENT INFORMATION/EDUCATION

- Patients should be educated about the symptoms and signs of IE after discharge
- Patients should be informed that IE could recur and that new onset of fever, chills or other signs of infection mandate immediate evaluation, including procurement of blood cultures before empirical use of antibiotics
- Patients should be advised to attend regular clinical and echocardiographic follow-up during the first year following completion of treatment
- Patients should also be educated on good oral health maintenance, preventive dentistry and advised about skin hygiene, including tattoos and skin piercing⁶

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- 2 Imazio M. The 2023 new European guidelines on infective endocarditis: main novelties and implications for clinical practice. *J Cardiovasc Med (Hagerstown)*. 2024 Oct 1;25(10):718–726.
- 3 The 2023 Duke–International Society for Cardiovascular Infectious Diseases Criteria for Infective Endocarditis: Updating the Modified Duke Criteria. *Clin Infect Dis*. 2023 Aug 22;77(4):518–526.
- 4 Miao H, Zhang Y, Zhang Y, Zhang J. Update on the epidemiology, diagnosis, and management of infective endocarditis: A review. *Trends Cardiovasc Med*. 2024 Nov;34(8):499–506
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5 DISEASES

5.9 CARDIAC ARRHYTHMIAS AND CONDUCTION ABNORMALITIES

LIST OF ABBREVIATIONS AND ACRONYMS

AF	ATRIAL FIBRILLATION	HR	HEART RATE
BP	BLOOD PRESSURE	INR	INTERNATIONAL NORMALISED RATIO
BPM	BEATS PER MINUTE	LOE	LEVEL OF EVIDENCE
CPR	CARDIOPULMONARY RESUSCITATION	SVT	SUPRAVENTRICULAR TACHYCARDIA
CT	COMPUTED TOMOGRAPHY	VF	VENTRICULAR FIBRILLATION
ECG	ELECTROCARDIOGRAPHY	VT	VENTRICULAR TACHYCARDIA

5.9.1 INTRODUCTION

DEFINITION

Arrhythmias are abnormal heart rate or rhythm. This definition includes an increase in the rate of occurrence of impulses (tachyarrhythmias), a decrease in the rate of occurrence of electrical impulses (bradyarrhythmias) or a change in the normal rhythm of impulses. The commonest form of arrhythmia worldwide is atrial fibrillation¹.

EPIDEMIOLOGY

Atrial fibrillation, the commonest and most persistent form of cardiac arrhythmia was shown to affect 33.5 million people worldwide (20.9 million males and 12.6 million females) in the year 2010¹. Ventricular arrhythmias include a spectrum that ranges from premature ventricular complex (PVC) to ventricular fibrillation (VF). Incidence and prevalence of ventricular arrhythmias has been shown to increase with age and in the presence of structural heart disease².

CLASSIFICATION OF ARRHYTHMIAS

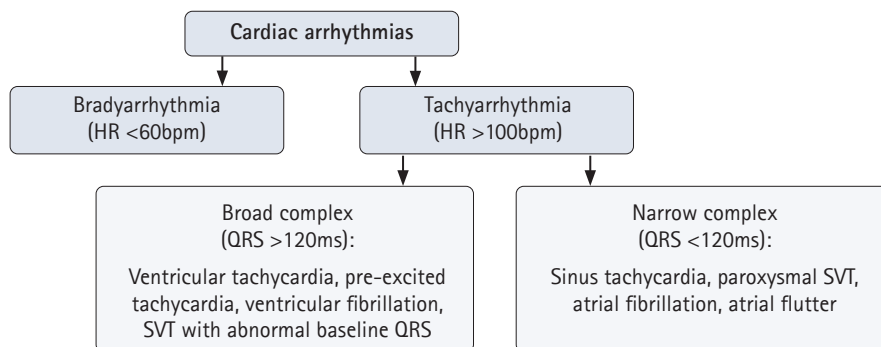


Figure 29:
Classification of
cardiac arrhythmias

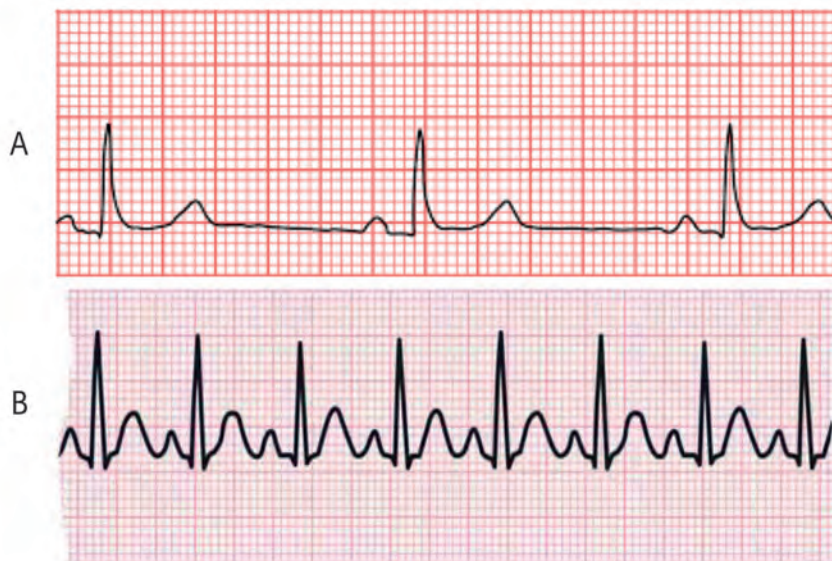


Figure 30: ECG tracing of bradycardia (A) and tachycardia (B)

5.9.2 AETIOLOGY

Arrhythmias could arise from both cardiac and non-cardiac causes. These include:

Table 76: Causes of arrhythmias

Cardiac causes	Non-cardiac causes
Myocardial infarction	Hypertension
Rheumatic heart disease and other valvular heart diseases	Thyroid dysfunction (hypo- and hyperthyroidism)
Ischaemic heart disease	Alcoholism
Cardiomyopathies	Smoking
Post-cardiac surgery	Drugs (beta 2 agonists, L- Dopa, Digoxin, Doxorubicin)
Pericardial disease	Electrolyte imbalance
Myocarditis	Metabolic imbalance (hypoxia, hypercapnia, acidosis)
Infiltrative heart diseases	Pulmonary embolism
Channelopathies (e.g. Brugada syndrome and Long-QT Syndrome)	Pneumonia
Physiologic causes:	Sleep, exercise, anaemia, fever, changes in autonomic tone

- ▶ **Note:** Sinus arrhythmias are due to fluctuations of autonomic tone during respiration, resulting in phasic changes of the sinus discharge rate (acceleration and deceleration). This variation is normal, particularly in children and young adults and typically results in predictable irregularities of the pulse. Hence non-pathological or of no clinical relevance.

5.9.3 CLINICAL PRESENTATION

Patients may have arrhythmias without symptoms. relevant symptoms usually occur as a result of haemodynamic compromise/instability.

SYMPTOMS AND SIGNS

Table 77: Symptoms and signs of cardiac arrhythmias

Symptoms	Signs
Palpitations	Pulse rate abnormalities (tachycardia or bradycardia)
Dizziness	Rhythm irregularities e.g. atrial fibrillation
Shortness of breath	Diaphoresis
Chest pain	Hypotension (low blood pressure)
Light-headedness/feeling faint	Signs of heart failure
Loss of consciousness	Signs of structural heart disease: heaves, thrills, murmurs
Seizures	Altered mental state (restlessness, agitation, confusion, unresponsiveness)
Fatigue	Absent central or peripheral pulse

5.9.4 BASIC INVESTIGATION ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

Health facility without a doctor usually do not have ECG machine or the interpretation of ECG is difficult. Hence, any patient suspected of symptomatic arrhythmia (tachycardia or bradycardia) from clinical examination should be referred as soon as possible.

▶ **Refer if diagnosis of arrhythmia is suspected; do not delay referral if ECG is not readily available.**

SECONDARY HEALTH FACILITY

- 12-lead ECG (LOE A)
- Serum electrolytes, calcium, magnesium assay (LOE C)
- Chest Xray
- Full blood count

TERTIARY HEALTH FACILITY

- ECG
- Full blood count
- ESR/CRP
- Serum electrolytes, calcium, magnesium assay (LOE C)
- Chest X-ray
- Echocardiogram (can go to another facility to have this since it not be possible to refer to cardiologist)
- Thyroid function test, particularly, thyroxin stimulating hormone (TSH) (LOE C)
- Serum cardiac enzyme levels particularly hs-troponins/ CK-MB during acute episodes
- Arterial blood gases (ABG) if available

HEALTH FACILITY WITH A CARDIOLOGIST

- Echocardiography to detect valvular and other structural abnormalities (LOE B)
- Holter monitoring (ambulatory ECG) (LOE B)
- Exercise stress test
- Coronary angiogram

5.9.5 TACHYARRHYTHMIAS: GENERAL OVERVIEW

Life-threatening tachyarrhythmia may present at any facility. The most important aspect of care is to determine whether this patient is in danger. Diagnosis and management of life-threatening arrhythmias depend on the level of care (availability of diagnostic tools, drugs and expertise of attending clinician). *Figure 31* shows the algorithm for the management of patient with significant tachyarrhythmia.

MANAGEMENT ACCORDING TO LEVEL OF CARE

PRIMARY HEALTH FACILITY

- ▶ Refer if diagnosis of **SYMPTOMATIC** arrhythmia is suspected.
- ▶ Identify and treat reversible causes of arrhythmia while awaiting referral (see *table 78*)

Table 78: Management of reversible causes of arrhythmia in health facility without a doctor

Reversible Cause	Management
Hypoxia	<ul style="list-style-type: none"> ▪ Check + maintain airway (prop up in bed/perform jaw thrust + chin lift/oropharyngeal airway, if available, etc.) ▪ Check oxygenation and ventilation ▪ Administer oxygen
Hypovolaemia	Replace blood or fluid loss with: Crystalloid (e.g. normal saline, Ringer's lactate)
Hypo-/ Hyperthermia	Hypothermia: <ul style="list-style-type: none"> ▪ Warmed intravenous fluids ▪ Warm blankets Hyperthermia: <ul style="list-style-type: none"> ▪ Cooling blankets ▪ Tepid sponging
Toxins/ Medications	<ul style="list-style-type: none"> ▪ Activated charcoal (within 1 hour of ingestion) ▪ Supportive measures ABCDE

SECONDARY HEALTH FACILITY

LABORATORY INVESTIGATION

- 12-lead electrocardiography (LOE A)
- Serum electrolytes, calcium, magnesium assay (LOE C)
- Full blood count

OTHER INVESTIGATION

- Chest X-ray

Table 79: Management of reversible causes of cardiac arrhythmias in health facility with a doctor (Adapted from Liverpool Hospital ICU Guideline on Management of Arrhythmias)

Reversible Cause	Management
Acidosis (Respiratory/ metabolic/renal)	<ul style="list-style-type: none"> ▪ Adequate hydration ▪ Treat the underlying cause: <ul style="list-style-type: none"> Metabolic: e.g. diabetic ketoacidosis: give insulin, hydrate Renal: e.g. acute kidney injury: hydrate, dialysis Respiratory: e.g. severe asthma/COPD or pneumonia: ventilation with a self-inflating mask, non-invasive ventilation, mechanical ventilation ▪ Administer sodium bicarbonate (50-100ml of 8.4% NaHCO₃ intermittently) Consider if acidosis persists despite the treatment outlined above
Hypokalaemia or hyperkalaemia	<ul style="list-style-type: none"> ▪ Hypokalaemia (from diuretics, GIT loss): hydrate, administer iv potassium chloride (KCL) 40-120mmol slowly over 24 hours; ideally using a perfuser ▪ Hyperkalaemia: <ul style="list-style-type: none"> ▪ Give 10mls of 10% Ca gluconate ▪ iv 10 IU soluble Insulin in 50ml of 50% glucose (or in 250ml of 10% glucose) ▪ Nebulized Salbutamol 10mg

Other reversible causes include pulmonary embolism, myocardial infarction, cardiac tamponade

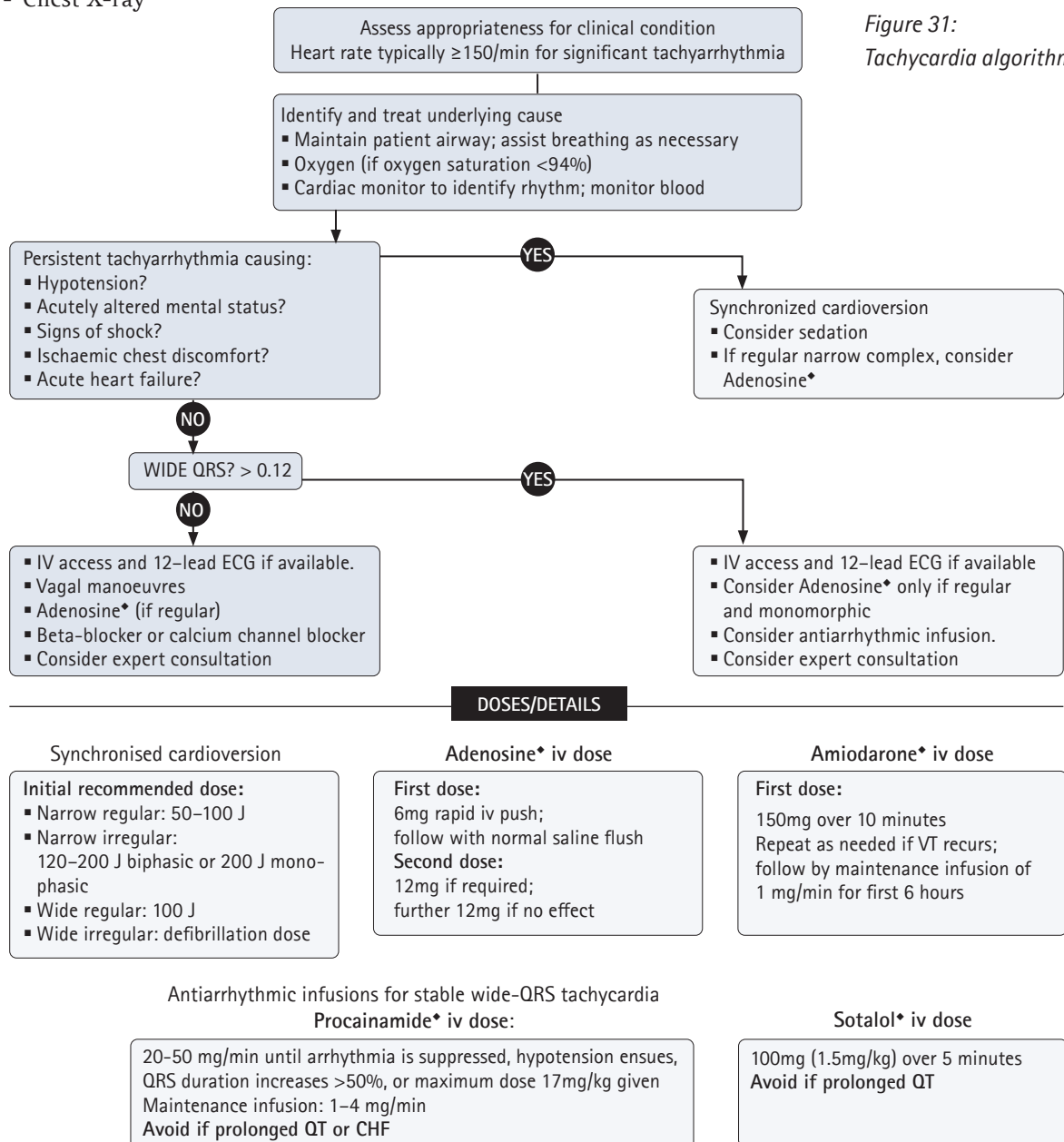
TERTIARY HEALTH FACILITY SPECIALIST

LABORATORY INVESTIGATION

- Serum electrolytes, calcium, magnesium assay (LOE C)
- Full blood cell count
- TSH
- Troponins, especially CK-MB
- ABG (if available)
- Further investigation to be requested by cardiologist

OTHER INVESTIGATION

- 12-lead ECG (LOE A)
- Chest X-ray



ATRIAL FIBRILLATION

CLINICAL PRESENTATION

- Palpation of the pulse as a basic screening tool may help detect AF³
- The pulse is characteristically described as being “irregularly irregular” (in both volume and rhythm)
- A definitive diagnosis of AF requires rhythm documentation using an ECG showing a typical pattern of no discernible, distinct P waves and irregular RR interval (*figure 27*)

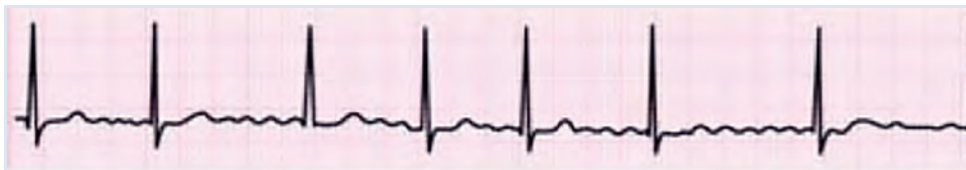


Figure 32: Atrial fibrillation

CLASSIFICATION (ALL LEVELS)

Atrial fibrillation can be classified into five groups based on the pattern (*table 80*)

Table 80: Classification of atrial fibrillation (Adapted from The ESC Guideline on Atrial Fibrillation, 2016)

AF pattern	Definition
First diagnosed	Prior diagnosis of AF has not been made, irrespective of duration of symptoms
Paroxysmal	Typically, self-limiting- resolves within 48 hours or may persist up to 7 days (Includes atrial fibrillation cardioverted within one week of onset)
Persistent	Episode lasts longer than 7 days. Includes episodes terminated by cardioversion after ≥ 7 days
Longstanding persistent	Continuous AF lasting for ≥ 1 year when a decision is made to adopt a rhythm control strategy
Permanent	AF accepted by both patient and physician hence rhythm control not pursued. A decision to adopt a rhythm control strategy converts it to a "Longstanding persistent AF"

MANAGEMENT OF STABLE ATRIAL FIBRILLATION

PRIMARY HEALTH FACILITY

- ▶ **Refer if diagnosis is suspected.**
- ▶ Do ECG where available
- ▶ Identify and treat reversible causes (refer to *table 78*)

NON-PHARMACOLOGICAL THERAPY

Lifestyle modifications should be instituted. These include

- Smoking cessation
- Avoidance of alcohol
- Increased physical activity
- Weight reduction
- Blood pressure control

SECONDARY AND TERTIARY HEALTH FACILITIES

THIS INVOLVES:

- A. Identification and treatment of precipitating factors (e.g. thyrotoxicosis, sepsis, or postoperative AF) and underlying cardiovascular conditions
- B. Anticoagulation
- C. Rate control
- D. Rhythm control

IDENTIFICATION OF PRECIPITATING FACTORS

- ▶ Refer to *table 78*.

ANTICOAGULATION (STROKE PREVENTION THERAPY, LEVEL OF EVIDENCE A)

- Anticoagulation is mandatory in valvular AF (i.e. AF with moderate-severe mitral stenosis and in those who had mitral valve repair or mechanical or bioprosthetic heart valve)
Patients with heart failure, hypertrophic cardiomyopathy or cardiac amyloidosis and atrial fibrillation should be anticoagulated, without the need for CHA₂DS₂VASc assessment
- The need for anticoagulation in patients with non-valvular AF should be determined using the CHA₂DS₂VASc score (*table 81*)
- ▶ Give anticoagulant if CHA₂DS₂VASc score is ≥ 2

Table 81: The CHA₂DS₂VASc score for stroke risk prediction⁴ of anticoagulant therapy (LEVEL A)

CHA ₂ DS ₂ VASc Risk factor	Points
Congestive heart failure (signs and symptoms or evidence of reduced LVEF)	+1
Hypertension	+1
Age >75 years	+2
Diabetes mellitus	+1
Previous stroke, TIA	+2
Vascular disease (peripheral artery disease, previous MI, aortic plaque)	+1
Age 65-74 years	+1
Sex category (female)	+1
Maximum score	9 points

After the need for anticoagulation is determined, it is important to assess bleeding risk using the HAS-BLED score (*table 82*) prior to commencement of anticoagulant therapy (LEVEL A).

Table 82: The HAS-BLED bleeding risk score⁵

Letter	Clinical characteristic	Points awarded
H	Hypertension	1
A	Abnormal renal and liver function (1 point each)	1 or 2
S	Stroke	1
B	Bleeding tendency or predisposition	1
L	Labile INRs (if taking vitamin K antagonists)	1
E	Elderly (e.g. age >65, frail condition)	1
D	Drugs (concomitant Aspirin, NSAID) or alcohol	1 or 2
Maximum		9 points

NOTE:

- ▶ A high HAS-BLED score (≥ 3) is not an indication for withholding anticoagulant therapy in patients in whom it is indicated ($\text{CHA}_2\text{DS}_2\text{VA} \geq 2$ or in patients with mitral stenosis)
- ▶ Rather, such high-risk patients require regular review and cautious anticoagulation
- ▶ Manipulation of modifiable risk factors for bleeding such as hypertension, drugs and alcohol intake may reduce bleeding risk in such patients and hence enable anticoagulant therapy commencement

PHARMACOLOGICAL TREATMENT

Table 83: Oral anticoagulant therapy

Drug Group	Drug	Dosage (oral)
Vitamin K antagonists	Warfarin	Starting dose: 10mg for first two days, 5mg for third day, after which INR is checked and dose adjusted to achieve therapeutic INR
Factor X antagonists	Rivaroxaban*	20mg daily as maintenance dose
	Apixaban*	5mg twice daily as maintenance dose
Direct thrombin inhibitors	Dabigatran*	150mg twice daily as maintenance dose

CONSIDERATIONS FOR ANTICOAGULANT THERAPY

- ON Direct oral anticoagulants (DOACs) are recommended in preference to VKAs in patients who meet the eligibility criteria for anticoagulation. Warfarin use requires monitoring of INR. Target INR is between 2-3 and during initiation of therapy, INR should be determined on the third day after initiation of the Warfarin, with dose modification until target is reached, after which INR monitoring can be done every two months. The ideal time in therapeutic range (TTR ie time the INR remain in ideal range) is $>70\%$
- The Direct Oral Anticoagulants (DOACs) have a less risk of bleeding and do not require INR monitoring.⁶ Apixaban has the lowest risk of bleeding⁷⁻⁹
- Renal function should be evaluated before commencement of NOAC therapy

RATE CONTROL

ACUTE RATE CONTROL

This can be achieved in atrial fibrillation with very fast ventricular response using one of the the following medication in *table 84*. Calcium channel blockers in tables 80 and 81 below may be used ONLY in patients with ejection fraction greater than 40%.

Table 84: Acute rate control in atrial fibrillation

Drug Group	Drug (route)	Dosage
Beta-blockers	Metoprolol (IV)	5mg over 1-2 minutes every 5 minutes (total maximum: 15mg)
	Esmolol* (IV)	500mcg/kg over 1 minute, then 50mcg/kg/min, increasing every 4 minutes (maximum dose 200mcg)
Calcium channel blockers	Verapamil (IV)	5-10mg (0.075– 0.15mg/kg) over 2 minutes; repeat as needed
	Diltiazem* (IV)	20mg (0.35mg/kg) bolus over 2 minutes; repeat if response is poor
Cardiac glycosides	Digoxin (IV)	0.5mg IV loading, then 0.25mg 6 hourly twice, followed by once daily

LONG-TERM RATE CONTROL

For long term rate control of AF, the following medication could be used (*table 85*) to achieve a target HR of <110bpm.

Table 85: Long-term rate control (Adapted from The ESC Guideline on Atrial Fibrillation, 2016)

Drug Group	Drug	Dosage	Level of evidence
Beta-blockers	Bisoprolol	1.25 - 20mg daily	B
	Metoprolol	25-200mg daily (oral)	
	Carvedilol	3.125-50mg twice daily	
	Nebivolol*	2.5-10mg daily	
	Atenolol	25-100mg daily (oral)	
Calcium channel blockers	Verapamil	40-120mg 6-8 hourly (oral)(max 480mg)	
	Diltiazem*	60mg tds or 120-360mg daily as modified release (max 360mg)	
Cardiac glycosides	Digoxin	0.0625-0.25mg (oral)	

RHYTHM CONTROL

- ▶ Refer patient to cardiologist for further management.

ATRIAL FLUTTER

Atrial flutter is a cardiac arrhythmia characterized by atrial rate of 240-400bpm and some degree of atrio-ventricular node conduction block. Causes include Structural heart diseases especially post-surgery, hypertensive heart disease and ischaemic heart disease.

PRIMARY HEALTH FACILITY WITHOUT A DOCTOR

Diagnosis of Atrial flutter may be difficult in a facility without a doctor because ECG may not be available and interpretation of ECG may be difficult.

- ▶ A patient suspected of having arrhythmia or atrial flutter should be referred to a facility with a doctor.

PHARMACOLOGICAL TREATMENT

- ▶ Refer if diagnosis is suspected.
- ▶ Identify and treat reversible causes (refer to *table 79*)

SECONDARY AND TERTIARY HEALTH FACILITIES

INVESTIGATION

- Pulse is usually regular and rapid on palpation
- ECG: shows “saw-toothed” flutter (p) waves especially in the inferior leads (II, III, aVf) with RR intervals which are usually regular (*figure 28*)

- ▶ May come with 2:1, 3:1, 4:1 or variable block.
- ▶ May be confused with atrial fibrillation and is often initiated by a brief episode of atrial tachycardia or by AF.



Figure 33: Atrial flutter on an ECG showing regular RR intervals and saw-toothed P waves

PHARMACOLOGICAL TREATMENT

- ▶ Refer to *treatment of AF*.

MANAGEMENT OF PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA

A narrow complex tachycardia that arises from the atria or AV node with an abrupt onset or termination.

CLINICAL PRESENTATION

- Regular HR approximately 140–280 bpm
- Usually narrow QRS complex <120 ms
- P waves may be absent or if visible may be inverted or buried in the QRS complex or come after the QRS complex (*figure 29*)



Figure 34: ECG showing supraventricular tachycardia

NON-PHARMACOLOGICAL TREATMENT

If haemodynamically stable for all levels:

- ▶ Vagal manoeuvres such as carotid sinus massage, valsalva manoeuvre may help abort the arrhythmia (LOE B).
- ▶ **Patients should be referred to the cardiologist for assessment and long-term management (LOE C).**

STEPS FOR THE PERFORMANCE OF THE MODIFIED VASALVA MANEUVER⁷

- Explain procedure to patient
- With patient approval, place patient in a semi-recumbent position
- Ask patient to blow into a 10ml syringe hard enough to shift plunger for 15 seconds while in semi-recumbent position
- Patient is made to lie supine or head end of bed is flattened immediately after the strain while passively elevating both lower limbs at the same time
- Patient should maintain this position for 15 seconds

PRIMARY HEALTH FACILITY

PHARMACOLOGICAL TREATMENT

- ▶ None recommended, refer to health facility with a doctor.

SECONDARY AND TERTIARY HEALTH FACILITY

- ▶ Treat reversible causes refer to *table 75*
- ▶ Vagal manoeuvre as above

PHARMACOLOGICAL TREATMENT

Options available include:

- IV Adenosine* or
- IV Verapamil or
- IV Diltiazem* or
- IV Beta-blocker
- ▶ Refer to cardiologist for further assessment and management.

MANAGEMENT OF VENTRICULAR TACHYARRHYTHMIA IN STABLE PATIENTS

Ventricular tachycardia (VT) is a broad complex tachycardia arising from either the right or left ventricle. It is said to be slow VT when the rate is <150 bpm and fast when >180 bpm. However, the haemodynamic compromise is the best determinant of how severe the VT is but not the heart rate. *Figure 30* shows an ECG with VT. It is the most common form of broad complex tachycardia with increased risk of morbidity and mortality⁸.

INVESTIGATION

- ECG
- A diagnosis of VT is supported by the presence of:
 - AV dissociation
 - QRS complex >0.14s
 - Monophasic R wave in lead aVR
 - Absence of an RS complex in all precordial leads
 - RS interval >100 ms in at least 1 precordial lead

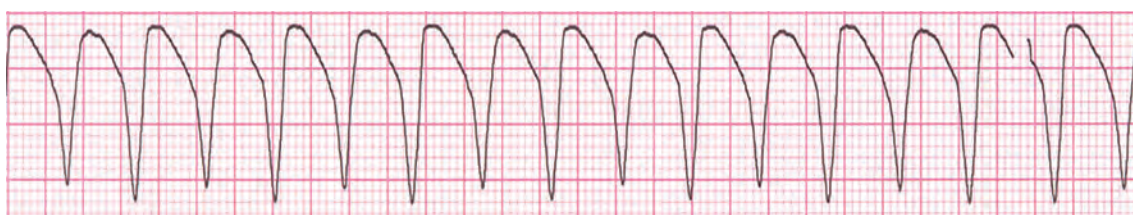


Figure 35: ECG of ventricular tachycardia

Table 86: Useful medications in acute management of VT and their indications

Agent	Indication(s) for use
Beta-blocker: <ul style="list-style-type: none"> ▪ Metoprolol ▪ Esmolol* ▪ Carvedilol 	Heart failure with reduced left ventricular ejection fraction; (reduces risk of sudden cardiac death) Polymorphic VT due to myocardial ischaemia Recent MI with VT
Procainamide* Sotalol*	Stable patients with monomorphic VT and normal LV function; (NB: Procainamide* may further prolong QT interval and lead to torsades de pointes)
Lidocaine	Polymorphic VT with: <ul style="list-style-type: none"> ▪ QT prolongation ▪ Ongoing MI ▪ Cardiac arrest unresponsive to defibrillation and may increase overall mortality; harmful if given as prophylaxis for VT in acute MI
Amiodarone*	Haemodynamically unstable VT persisting after maximal energy shock; in combination with Beta-blocker for VT with left ventricular dysfunction
Magnesium sulphate	Polymorphic VT with QT prolongation, torsades de pointes

PRIMARY HEALTH FACILITY

► Refer to health facility with a doctor/physician specialist.

SECONDARY AND TERTIARY HEALTH FACILITIES

PHARMACOLOGICAL TREATMENT

Useful medications in management of VT are summarised in the table 86. Figure 36 shows the algorithm for the management of ventricular tachycardia.

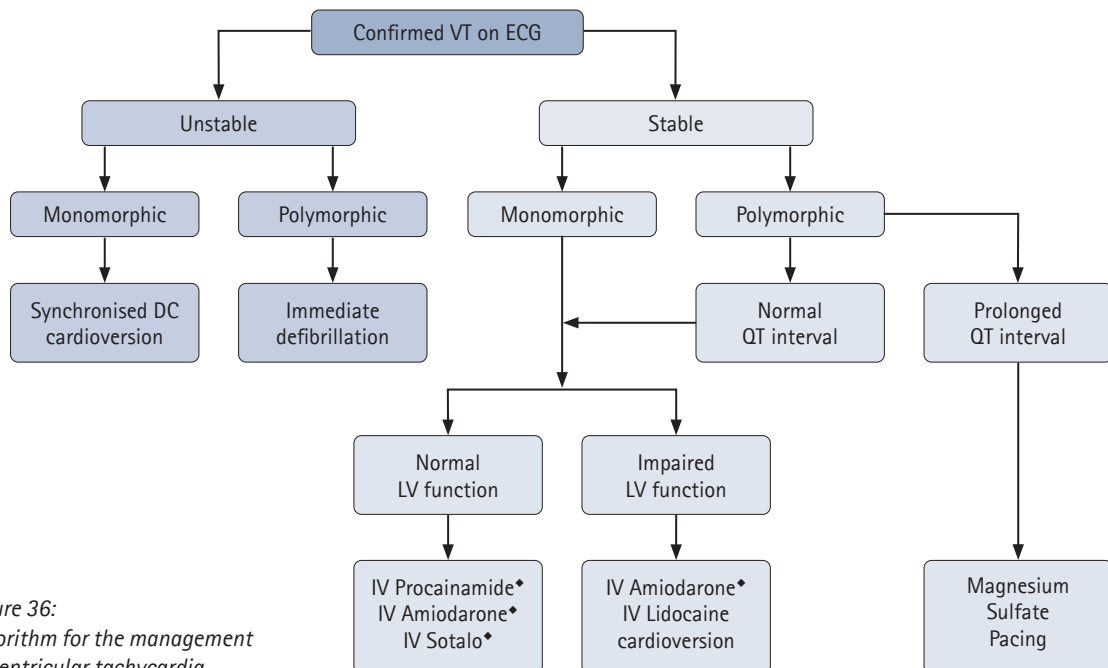


Figure 36:
Algorithm for the management
of ventricular tachycardia

- ▶ For VT that does not terminate with cardioversion or antiarrhythmic medication, catheter ablation is recommended, hence, immediate referral to a cardiologist.
- ▶ CPR according to the Advanced Cardiac Life Support (ACLS) protocol should be administered in patients who develop cardiac arrest.
- ▶ Refer patient to cardiologist for post-stabilisation management.

MANAGEMENT OF VENTRICULAR FIBRILLATION

SECONDARY AND TERTIARY HEALTH FACILITIES

- ▶ Ventricular fibrillation is a rapid, grossly irregular ventricular activity with marked variability in electrocardiographic waveform (AHA 2017). Ventricular rate is usually >300 bpm. The disorganised excitation and irregular ventricular contractions result in heart failure and rapidly progress to cardiac arrest and ultimately death⁹.

NON-LABORATORY INVESTIGATION

- ▶ ECG (*figure 37*)



Figure 37: ECG ventricular fibrillation

FINDINGS ON A 12-LEAD ECG SUGGESTIVE OF VENTRICULAR FIBRILLATION INCLUDE:

- Irregular waves which are coarse initially but flatten out as the arrhythmia progresses and heart failure worsens
- Shapeless rapid oscillations

TREATMENT

- ▶ Begin CPR immediately.
- ▶ Refer to *figure 8 on page 57*: Advance Cardiac Life Support (ACLS) Algorithm.

5.9.6 BRADYARRHYTHMIAS

A. SINUS BRADYCARDIA

General description:

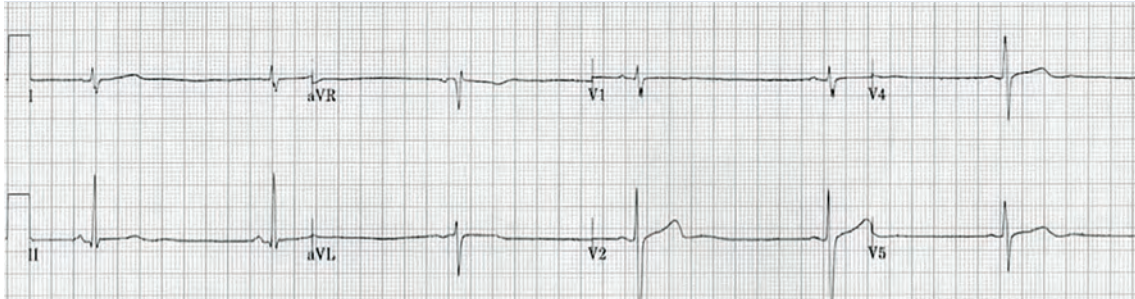


Figure 38: ECG showing sinus bradycardia

- ▶ This may be due to sinus node dysfunction or external influences (such as Beta-blockers, hypothyroidism) on a relatively normal sinus node.

AETIOLOGY

EXTRINSIC:

hypothermia, hypothyroidism, cholestatic jaundice and raised intracranial pressure, drugs (Beta-blockers, digitalis and other anti-arrhythmic drugs) and neurally mediated causes (carotid sinus syndrome, vasovagal syndrome etc.)

INTRINSIC:

Acute ischaemia and infarction of the sinus node, fibrosis of the atrium and sinus node (sick sinus syndrome)

B. ATRIOVENTRICULAR BLOCK

FIRST DEGREE:

- ▶ This is seen as prolonged PR interval (>0.20 s or 5 small boxes) on ECG (figure 39)

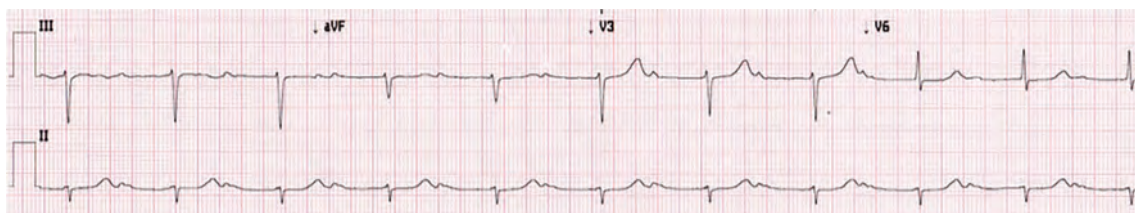


Figure 39: ECG showing prolonged PR interval in first degree heart block

SECOND DEGREE:

- ▶ This occurs when some atrial impulses fail to reach the ventricles (figure 40, next page)

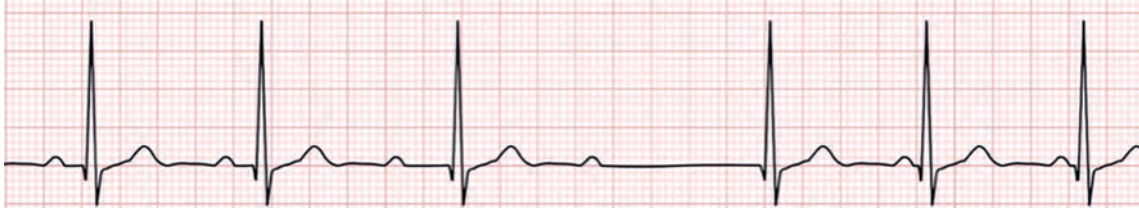


Figure 40: ECG showing second degree heart block

THIRD DEGREE:

- ▶ Complete dissociation between P wave and QRS complex, also known as complete heart block (figure 41)

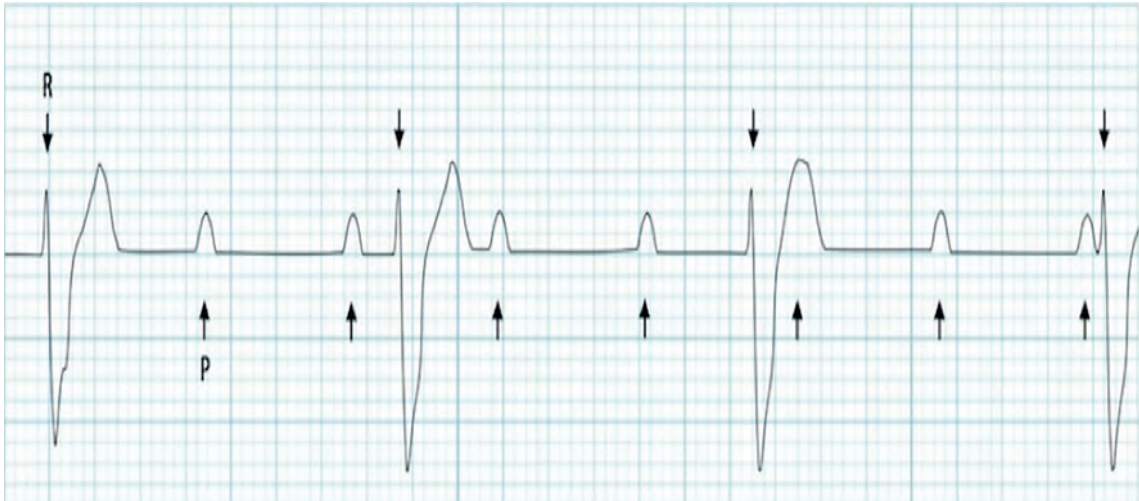


Figure 41: ECG of complete heart block showing complete dissociation between P waves and QRS complexes

DIAGNOSIS

- ▶ A history of symptoms as mentioned above with pulse rate <60 bpm on examination.
- ▶ A detailed physical examination should be carried out to detect signs of possible underlying disease.

TREATMENT IN GENERAL

Treatment objectives include restoration of sinus rhythm where possible, and prevention of complications. Treatment is indicated if patient is haemodynamically unstable with symptoms and signs of inadequate perfusion (hypotension, altered mental status, signs of shock, ongoing ischaemic chest pain) and evidence of acute pulmonary oedema.

PRIMARY HEALTH FACILITY

NON-PHARMACOLOGICAL TREATMENT

- Nurse propped up (bed at 30° to the horizontal)
- Give oxygen if hypoxic or cyanotic
- Provide warmth
- Initiate CPR if haemodynamically unstable
- ▶ **Prompt referral.**

SECONDARY AND TERTIARY HEALTH FACILITY

- Nurse propped up (bed at 30° to the horizontal)
- Give oxygen if hypoxic or cyanotic
- Provide warmth
- Initiate CPR if haemodynamically unstable
- Investigate and treat underlying cause
- Administer atropine cautiously (500mcg up to 3mg) IV
- ▶ **Refer to cardiologist for investigation and management.**
 - To assess the cause of the sinus bradycardia with both invasive and/or non-invasive diagnostics
 - Give more advanced therapeutics in the event when the sinus bradycardia is persistent or recurrent
 - Treat reversible causes (see *table 78* on page 194)
- ▶ **Refer to cardiologist for pacemaker implantation (either temporary or permanent depending on patient's history and clinical examination findings).**

ATRIOVENTRICULAR BLOCKS IN GENERAL

FIRST DEGREE:

- ▶ No pharmacologic treatment indicated in stable patients; patient requires follow up with ECG monitoring

SECOND AND THIRD DEGREE:

- ▶ Pacemakers are beneficial hence patient requires referral to cardiologist

REFERRAL

- ▶ Cardiologist referral required in:
 - Symptomatic patients with pulse rate less than 50 bpm
 - Patients with underlying structural heart disease
- ▶ Specialist referral based on underlying condition:
 - i.e. neurologist referral in patients with raised intracranial pressure, Endocrinologist referral in patients with hypothyroidism

C. SICK SINUS SYNDROME (SINUS NODE DYSFUNCTION)

It is caused by fibrosis of the sinus node, which is usually idiopathic and associated with old age^{10, 11}.

DIAGNOSIS

Made by correlating symptoms of end-organ hypoperfusion with occurrence of bradycardia, with or without tachycardia in the presence of ECG abnormalities.

ECG abnormalities in sinus node dysfunction include periods of:

- Sinus bradycardia
- Sinus pauses
- Sinus arrest
- 3rd degree SA nodal exit block
- Supraventricular tachycardia (as part of tachy-brady syndrome)

Presence of ECG findings in the absence of symptoms may be explained by physiologic and pathologic processes such as increased vagal tone during sleep or obstructive sleep apnoea.

Other helpful investigations for health facility with a physician specialist include:

- Serum electrolyte assay (LOE B)
- Holter monitoring

HEALTH FACILITIES AT ALL LEVELS OF CARE

Figure 38 shows the algorithm for the management of sinus nodal dysfunction.

ACUTE NON-PHARMACOLOGICAL TREATMENT

Rapid assessment of ABCs

- ▶ Identification and elimination of reversible causes such as medications in symptomatic patients (LOE C)

CARDIOLOGIST REFERRAL FOR:

- ▶ Transvenous temporary or permanent pacemaker in haemodynamically unstable patients who are refractory to medical therapy; this will take care of bradyarrhythmic phase of the disease (LOE C)
- ▶ NOTE: Atropine should not be used to treat sinus bradycardia in patients who have undergone cardiac transplant (LOE C)¹²

HEALTH FACILITY WITH A PHYSICIAN SPECIALIST

PHARMACOLOGICAL TREATMENT

- IV Atropine 4microg/kg every 2-4 hours (for the bradyarrhythmias)
and/or:
- IV Isoproterenol• 0.05- 0.5mcg/kg/min (for the bradyarrhythmias)

In patients with coexisting (paroxysmal) tachyarrhythmias, these should be given after pacemaker has been implanted for the bradycardia episodes:

- Beta-blockers
- Antiarrhythmic medication

HEALTH FACILITY WITH A CARDIOLOGIST

LONG-TERM NON-PHARMACOLOGICAL MANAGEMENT

Permanent dual-chamber pacemakers (LOE B):

Pacemaker therapy is the only effective and definitive therapy for patients with chronic symptomatic sinus node dysfunction. The therapy has not been shown to increase survival in patients. It however relieves symptoms and improves quality of life.

Table 87: Indications for permanent cardiac pacing in sinus node dysfunction (LOE C)
(Adapted from The 2018 Bradycardia Clinical Practice Guidelines¹³)

Indications for permanent cardiac pacing in sinus node dysfunction	
Compelling indications	Relative indications
Documented symptomatic bradycardia with frequent sinus pause that is symptomatic	Significant symptoms of bradycardia and documented heart rate less than 40 beats per minute without documentation of bradycardia in the presence of symptoms
Symptomatic sinus bradycardia caused by medication required for medical condition (essential drug therapy)	Syncope of unexplained origin with dysfunction of sinoatrial node discovered or provoked in electrophysiologic studies
Symptomatic chronotropic incompetence	Minimally symptomatic patients with chronic heart rate less than 40 beats per minute while awake

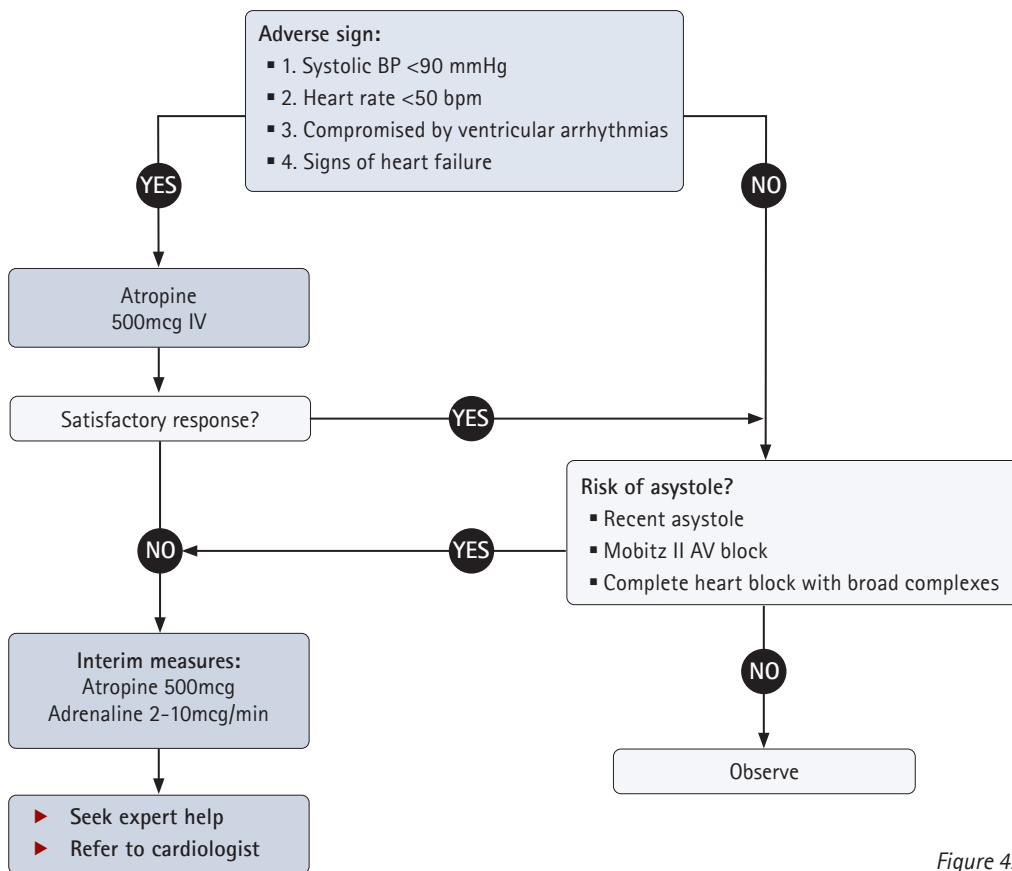


Figure 42:
Bradycardia algorithm (Adapted from Liverpool ICU guidelines)

5.9.7 PREVENTION

Multiple clinical risk factors have been associated with the development of arrhythmias. Thus it may be possible to prevent some arrhythmias by risk factor modification.

PREVENTION INCLUDES:

- Lifestyle modification (refer to *chapter 2* of these guidelines on risk factors and *chapter 5.1* on hypertension)
- Target control of predisposing and precipitating factors, such as thyrotoxicosis, rheumatic heart diseases and hypertension

5.9.8 PATIENT INFORMATION/EDUCATION

- Patients should be taught to recognise symptoms of arrhythmia and danger signs
- Avoid precipitants such as binge drinking, excessive caffeine intake etc
- Patients on anticoagulants should be told about possible interactions with other medications and diets and when to report
- Patient's family should be counselled about condition and how to offer support, both life-saving (e.g. CPR) and emotional support
- Asymptomatic family members may require screening in arrhythmias with genetic linkage (LOE C)

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ANNEX 1

GHS REFERRAL FORM

2013Z 0000175

DATE

DAY.....	MONTH.....	YEAR.....
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REFERRING HEALTH FACULTY INFORMATION

NAME OF REFERRING CLINICS / HOSPITAL
ADDRESS OF REFERRING CLINIC (INCLUDE TELEPHONE NO)

PATIENT/CLIENT INFORMATION

SURNAME			OTHER NAMES		
SEX <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	DATE OF BIRTH DAY/MONTH/YEAR	AGE	INSURANCE STATUS	INSURANCE (IF INSURANCE STATE IDM) UN INSURED	
ADDRESS OF CONTACT PERSON / RELATIVE (INCLUDE TEL NO)					

REFERRAL DETAILS SURNAME

CLINIC / HOSPITAL REFERRED TO							
DIAGNOSIS							
PRESENTING COMPLAINT(S)							
EXAMINATION FINDINGS			HEIGHT	WEIGHT	TEMPERATURE	BP	PULSE
EXAMINATION FINDINGS							
RESULTS OF ANY INVESTIGATIONS CARRIED OUT							
TREATMENTS GIVEN							
COMMENTS							

REFERRING OFFICER

NAME OF OFFICER REFERRING SIGNATURE		POSITION OF OFFICER REFERRING
RECEIVING CLINICIAN		
NAME OF OFFICER REFERRING SIGNATURE		POSITION OF OFFICER RECEIVING
COMMENTS (PLEASE WRITE SUMMARY OF FINAL DIAGNOSIS AND TREATMENT GIVEN)		
		DATE

ANNEX 2

GHANA HEALTH SERVICE REFERRAL FEEDBACK FORM

PATIENT REG NO.....

SERIAL NO

DAY	MONTH	YEAR
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Kindly fill this form in duplicate and return to the facility which referred this client
HEALTH FACILITY INFORMATION

NAME % ADDRESS OF HEALTH FACILITY PROVIDING FEEDBACK
NAME % ADDRESS OF HEALTH FACILITY TO WHICH FEEDBACK IS BEING SENT
NAME AND POSITION OF CLINICAL WHO RECEIVED CLIENT

PATIENT / CLIENT INFORMATION

SURNAME		OTHER NAME							
SEX MALE <input type="checkbox"/> FEMALE <input type="checkbox"/>		DATE OF BIRTH <table border="1"> <tr> <td>DAY</td> <td>MONTH</td> <td>YEAR</td> </tr> </table>		DAY	MONTH	YEAR			
DAY	MONTH	YEAR							
AGE		INSURANCE STATUS UNSURE <input type="checkbox"/> INSURES <input type="checkbox"/> ID NO							
NAME AND ADDRESS OF CONTACT PERSONAL RELATIVE									
TELEPHONE NO OF CONTACT PERSON									
DATE OF REFERRAL <table border="1"> <tr> <td>DAY</td> <td>MONTH</td> <td>YEAR</td> </tr> </table>		DAY	MONTH	YEAR	DATE OF ARRIVAL AT REFERRAL FACILITY <table border="1"> <tr> <td>DAY</td> <td>MONTH</td> <td>YEAR</td> </tr> </table>		DAY	MONTH	YEAR
DAY	MONTH	YEAR							
DAY	MONTH	YEAR							
DIAGNOSIS ON REFERRAL									

FINAL DIAGNOSIS	
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MEDICAL MANAGEMENT TREATMENT GIVEN (PLEASE WRITE HOW PATIENT WAS MANAGED)	
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OUTCOME (PLEASE TICK)	DISCHARGED <input type="checkbox"/>	DAY	MONTH	YEAR
	DIED <input type="checkbox"/>	DAY	MONTH	YEAR

IF CLIENT IS BEING REFERRED BACK TO ANOTHER FACILITY ON DISCHARGED PLEASE PROVIDE ADVANCE FOR FURTHER MANAGEMENT AND ANY OTHER RECOMMENDATION USE EXTRA L SHEET IF NEED BE

NEXT REVIEW DATE (WHERE APPLICABLE)	
NAME OF OFFICER PROVIDING FEEDBACK	
POSITION	
SIGNATURE	DATE
CONTACT (S) OF OFFICER PROVIDING FEEDBACK	

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