

Cardiovascular

Therapeutic Guidelines

3rd edition

**Prepared for the Ministry of Health and Medical Services, Government of Fiji
by the Cardiovascular Guidelines Committee
with assistance from the Fiji Health Sector Support Program**

Version 1.1, April 2015



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While every effort has been made to ensure that the information contained in these guidelines is correct and in accordance with current evidence-based clinical practice, the dynamic nature of medicine requires that users exercise independent professional judgement in all cases when using these guidelines.

The authors also acknowledge that this document has been produced with the financial assistance of The Fiji Health Sector Support Program (FHSSP) and Australian Aid. The views expressed herein are those of the Fiji National Medicines and Therapeutic Committee and can therefore in no way be taken to reflect the official opinion of FHSSP and Australian Aid.

Version: 1.1

Edition: April 2015



Australian Government
Department of Foreign Affairs and Trade

The Fiji Health Sector Support Program (FHSSP) is an Australian Government initiative, providing support to the Fiji Ministry of Health and Medical Services to deliver essential health services to the people of Fiji. The FHSSP supports activities that contribute to improving health outcomes in maternal and child health, strengthening diabetes and hypertension prevention and management, and revitalising primary health care and targeted health systems strengthening. FHSSP is implemented by Abt JTA on behalf of the Australian Government.

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Foreword

The first edition of the Cardiovascular Drug Guidelines was published in 1999, and the second edition was revised by the subcommittee of the National Medicines and Therapeutic Committee and published in 2006. The Fiji Ministry of Health and Medical Services, led by the Medical Clinical Services Network, have revised the second edition of the Cardiovascular Drug Guidelines to produce this third edition.



This new third edition, renamed as the Cardiovascular Therapeutic Guidelines, provides the reader with a holistic approach to the management of cardiovascular diseases. Not only does the Guideline incorporate pharmacological therapies, as per previous editions, but this new edition also includes non-pharmacological aspects of treatment of cardiovascular diseases to provide the reader with comprehensive treatment options for their patients.

Some of the new features of this revised edition include:

- Cardiovascular risk assessment using the World Health Organization (WHO) risk assessment chart and adapting the WHO PEN (Package of Essential Non-communicable Disease Interventions for Primary Health Care) protocols.
- Behavioural risk factor modification by addressing: smoking, nutrition, alcohol, physical activity, and stress (SNAPS) to reduce the risk of CVD.
- Section on acute rheumatic fever and rheumatic heart disease.
- ECG images of tachyarrhythmias and bradyarrhythmias for easy reference and recognition.
- Management of deep venous thrombosis (DVT), arterial and venous thromboembolism, and anticoagulation.
- Perioperative and periprocedural management of patients with CVD in non-cardiac surgery.
- Advice on when to refer the patient to the next level of health care.

The medications stated in this Guideline are mostly those that are available on the Fiji Essential Medicines List (EML); however, there are some medications that are not on the EML and these are clearly stated. All recommended therapies are either evidence-based or universally-accepted standards.

The content of this Cardiovascular Guideline is mainly intended for adult patients. The committee has tried its best to be inclusive of all groups of patients, but this is not practically possible. There are limited sections that apply to special groups of patients, such as pregnant women and children. For further details and specific treatments regarding these special groups of patients, the committee strongly advises that the reader consults the concerned specialties involved at the Divisional Hospital.

It is hoped that this Guideline will be a reference for all healthcare workers, both in the public and private sector, to care for people suffering from cardiovascular diseases. The Cardiovascular Guidelines Committee welcomes any comments and suggestions, which will help in the improvement of the development of future standard treatment guidelines. Please forward your feedback to <shrish.acharya@health.gov.fj>.

I hereby acknowledge the support of Australian Aid through the Fiji Health Sector Support Program for the production of these guidelines.



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Acknowledgements

The first edition of the Cardiovascular Guidelines was published in 1999. The Guideline was drafted by Professor Anthony Smith of Newcastle, Australia, during a month-long consultancy generously funded by the World Health Organization and using a template prepared by the Victorian Medical Postgraduate Foundation Inc. Their permission to use the template without levy of any fee is acknowledged.

The second edition of the Cardiovascular Guidelines was published in 2006 and reprinted in 2009. The Guideline was prepared by the subcommittee of the National Medicines and Therapeutics Committee.

This, the third edition of the Cardiovascular Therapeutic Guidelines, was based on the Australian Cardiovascular Therapeutic Guidelines, Version 6, 2012. The Cardiovascular Clinical Services Network (CSN) gratefully acknowledges the permission to use the Guidelines from Dr Sue Phillips, Chief Executive Officer of Therapeutic Guidelines Limited, without levy of any fee, and expresses appreciation to Professor Robert Moulds, Chairman of the Cardiovascular Expert Group and Medical Advisor for the Therapeutic Guidelines Limited, for the first draft of this edition. The Cardiovascular Guidelines Committee updated this edition of the Cardiovascular Therapeutic Guidelines and acknowledges contributions and comments from:

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Secretariat support was provided by FHSSP.

Abbreviations

ACEI	Angiotensin converting enzyme inhibitors
ACS	Acute coronary syndrome
ALT	Alanine aminotransferase
AMI	Acute myocardial infarction
ANC	Antenatal care
ANW	Antenatal ward
APTT	Activated partial thromboplastin time
ARB	Angiotensin II receptor blockers
ARF	Acute rheumatic fever
ASO	Antistreptolysin-O test
AV	Atrioventricular
BD	Twice daily
BMI	Body mass index
BP	Blood pressure
CABG	Coronary artery bypass grafting
CBG	Capillary blood glucose
CCU	Coronary care unit
CIED	Cardiac implanted electronic devices
CK	Creatinine kinase
CKD	Chronic kidney disease
CPAP	Continuous positive airway pressure
CPG	Clinical Practice Guideline
CR	Cardiac rehabilitation
CRP	C-reactive protein
CSN	Clinical Services Network
CTPA	CT pulmonary angiography
CV	Cardiovascular
CVD	Cardiovascular disease
CWMH	Colonial War Memorial Hospital

DC	Direct current
DES	Drug-eluting stent
DVT	Deep vein thrombosis
ECG	Electrocardiogram
ECT	Electroconvulsive therapy
EML	Essential Medicines List
ESR	Erythrocyte sedimentation rate
FFP	Fresh frozen plasma
eGFR	Estimated glomerular filtration rate
GAS	Group A streptococcal
GFR	Glomerular filtration rate
GIT	Gastrointestinal
HDL	High-density lipoprotein
HF	Heart failure
HF-LVSD	Heart failure with left ventricular systolic dysfunction
HFPEF	Heart failure with preserved left ventricular ejection fraction
HIT	Heparin-induced thrombocytopenia
ICD	Implantable cardioverter defibrillators
ICU	Intensive care unit
IM	Intramuscular
IMI	Intramuscular injection
INR	International normalised ratio
ISH	International Society for Hypertension
IU	International unit
IV	Intravenous
JVP	Jugular venous pressure
LDL	Low-density lipoprotein
LMWH	Low molecular weight heparins
MDG	Millennium Development Goal
METS	Metabolic equivalent
MI	Myocardial infarction

MoHMS	Ministry of Health and Medical Services (formerly Ministry of Health [MoH])
NSAID	Nonsteroidal anti-inflammatory drugs
NSTEACS	Non-ST elevation acute coronary syndrome
NSTEMI	Non-ST elevation myocardial infarction
PAD	Peripheral arterial disease
PCI	Percutaneous coronary intervention
PE	Pulmonary embolism
PIH	Pregnancy-induced hypertension
PSVT	Paroxysmal supraventricular tachycardia
PVC	Premature ventricular complex
qid	Four times a day
RCRI	Revised Cardiac Risk Index
RHD	Rheumatic heart disease
RYGB	Roux-en-Y gastric bypass
SC	Subcutaneous
SLE	Systemic lupus erythematosus
SNAPS	Smoking, nutrition, alcohol, physical activity, and stress
SSRI	Selective serotonin reuptake inhibitor
TC	Total cholesterol
tds	Three times daily
TG	Triglyceride
tPA	Tissue plasminogen activator
UFH	Unfractionated heparin
ULN	Upper limit of normal
VHD	Valvular heart disease
VT	Ventricular tachycardia
VTE	Venous thromboembolism
WHO	World Health Organization
WPR	Western Pacific Region [World Health Organization]

1. Cardiovascular risk assessment

Cardiovascular disease (CVD) includes coronary heart disease, stroke, and other vascular disease, such as peripheral arterial disease. CVD is the leading cause of death and ill health in the world. Most patients who develop CVD have one or more identifiable risk factors, such as smoking, hypertension, or hyperlipidaemia. If these risk factors are recognised early and appropriately managed, fewer patients will develop both initial and recurrent CV events. To aid in the recognition of individuals at risk of CVD and to guide appropriate management, absolute CVD risk assessment tools have been developed.

Absolute CVD risk is defined as the probability (expressed as a percentage) of a person having a cardiovascular event within a specified period of time (usually 5 or 10 years). Assessment of absolute CVD risk for an individual takes into account the interaction of all of their risk factors. This is superior to using a single risk factor (e.g. elevated BP) for clinical decision-making, as it more accurately predicts who will have a subsequent adverse CV event, such as a heart attack or stroke. For example, a 60-year-old smoker with an elevated BP of 160/100 mm Hg has a significantly greater risk of having a CV event in the next 10 years than a 35-year-old non-smoker with the same degree of BP elevation. By accurately predicting the likelihood of an individual patient developing a CV event, absolute CVD risk assessments guide the clinician as to how vigorously CV risk factors should be treated. While all patients with CV risk factors may gain some benefit from treatment, those patients with higher absolute CV risk generally benefit more from vigorous intervention, including early commencement of drug therapy.

1.1 Patients with established cardiovascular disease

Patients with established cardiovascular disease (e.g. previous myocardial infarction, stroke, peripheral vascular disease) do **not** require absolute CV risk assessment. They are already known to be at high risk of further cardiovascular events, and all of their risk factors should be managed vigorously (see Table 1 — Intervention according to CV risk assessment in Section 1.5).

1.2 Patients without established cardiovascular disease

Some individuals have very high levels of individual cardiac risk factors or other medical conditions, which place them at high risk of CVD. They also do **not** require formal risk stratification, but should be treated automatically as high risk (i.e. 10-year risk $\geq 30\%$). This includes patients with:

- Diabetes and age >60 years
- Diabetes with microalbuminuria or overt nephropathy
- Moderate or severe chronic kidney disease (persistent proteinuria or estimated glomerular filtration rate [eGFR] <45 mL/min)
- Serum total cholesterol >7.5 mmol/L
- Persistent systolic BP ≥ 180 mm Hg or diastolic BP ≥ 110 mm Hg.¹

An absolute CVD risk assessment should be performed at least every 2 years on ALL adults aged 30 years or older who are not already known to have established CVD or one of the high risk conditions listed above.

A cardiovascular risk assessment is calculated using the WHO cardiovascular risk assessment chart for the Western Pacific Region, sub-region B (see Charts 1a and 1b following), according to whether cholesterol can or cannot be measured. This risk calculator categorises a person's risk of having a CV event over the next 10 years. Treatment recommendations are then based on the level of risk calculated.

1.3 WHO cardiovascular risk assessment

Chart 1a for Western Pacific Region: Sub-region B where total cholesterol CAN be measured²

WHO/ISH risk prediction chart for WPR B. 10-year risk of fatal or non-fatal cardiovascular event by gender, systolic blood pressure, total blood cholesterol, smoking status and presence or absence of diabetes mellitus.

Risk Level ■ <10% ■ 10% to <20% ■ 20% to <30% ■ 30% to <40% ■ ≥40%

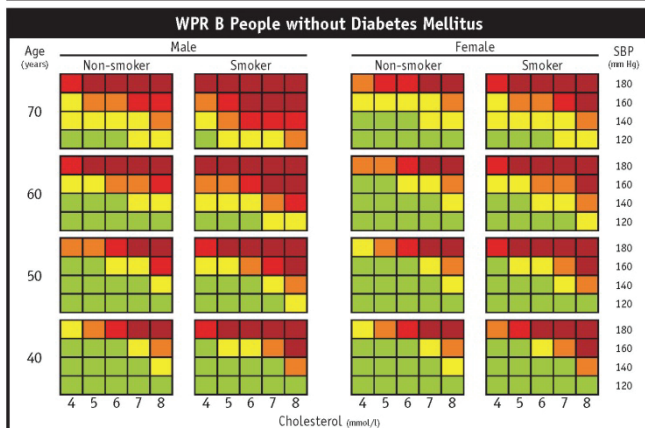
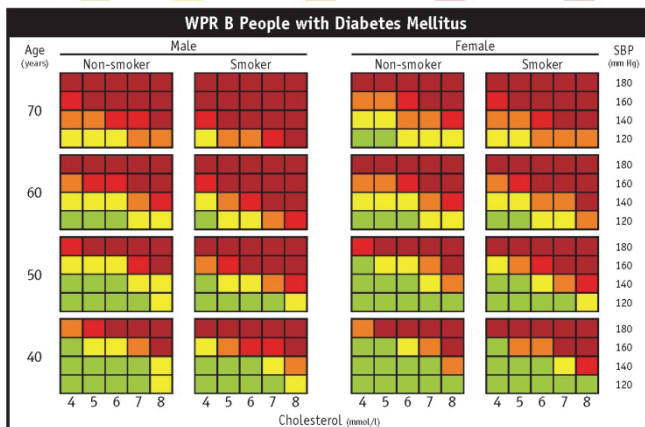
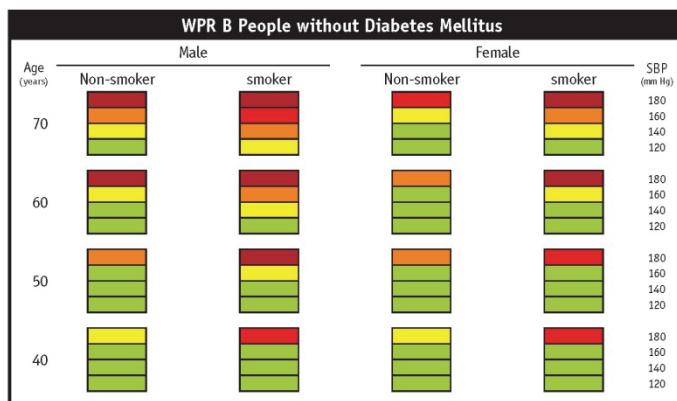
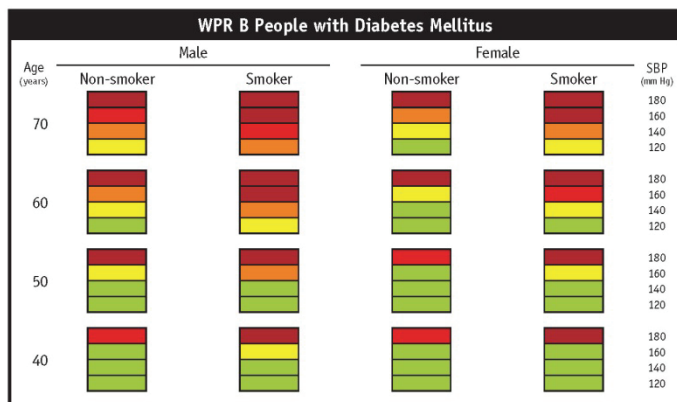


Chart 1b for Western Pacific Region: Sub-region B where total cholesterol CANNOT be measured³

WHO/ISH risk prediction chart for WPR B. 10-year risk of a fatal or non-fatal cardiovascular event by gender, age, systolic blood pressure, smoking status and presence or absence of diabetes mellitus.

Risk Level ■ <10% ■ 10% to <20% ■ 20% to <30% ■ 30% to <40% ■ ≥40%





Use the WHO CV risk assessment chart to estimate the 10-year cardiovascular risk as follows:

- Step 1:** Select the appropriate chart depending on the presence or absence of diabetes.
- Step 2:** Select male or female tables.
- Step 3:** Select smoker or non-smoker boxes (all current smokers and those who quit smoking less than 1 year before the assessment should be considered smokers).
- Step 4:** Select age group box (e.g. if age is 40–49 years, select 40 years; if 50–59 years, select 50 years).
For individuals less than 40 years of age, an age of 40 years should be selected.
For individuals more than 80 years of age, use of the risk assessment chart is not recommended.
- Step 5:** Within this box find the nearest cell where the patient's systolic blood pressure and (if applicable) total blood cholesterol level intersect — rounded up or down to the nearest level (see below for important practice points).
The colour of the final cell determines the 10-year cardiovascular risk.⁴

1.4 Important practice points

Please note that CVD risk may be higher than indicated by the chart in patients with other CV risk factors, such as:

- Strong family history of early CVD in a first degree relative (male <55 years, female <65 years)
- Obesity
- Already on anti-hypertensive and/or lipid-lowering therapy
- Sedentary lifestyle.⁵

If a patient has been diagnosed with diabetes for more than a year and it has been poorly controlled (e.g. CBG frequently >10), increase the risk assessment by one colour.



1.5 Intervention according to cardiovascular risk assessment

Table 1 — Intervention according to CV risk assessment⁶

All patients with a new diagnosis of established CV disease or with a risk assessment of $\geq 40\%$ should be discussed with a specialist.

Cardiovascular risk	Lifestyle	Drug therapy	Treatment goals	Follow-up
Patient has known vascular disease — e.g. previous AMI, angina, or previous stroke	<p>Intensive lifestyle advice on:</p> <ul style="list-style-type: none"> a cardio-protective dietary pattern physical activity weight control smoking cessation. <p>Lifestyle advice should be given simultaneously with drug treatment.</p>	<p>Aspirin, a beta blocker, statin, and an ACE-inhibitor (after MI).</p> <p>Aspirin, statin, and a new or increased dose of a blood pressure lowering agent (after stroke).</p> <p>Treat diabetes energetically if present.</p>	<p>Efforts should be made to reach optimal risk factor levels (refer to Annex A).</p>	<p>Full clinical assessment at least annually — more frequent if symptomatic.</p> <p>Risk factor monitoring every 3 months when stable.</p>
10-year CVD risk calculated $\geq 30\%$	<p>Intensive lifestyle advice on:</p> <ul style="list-style-type: none"> a cardio-protective dietary pattern physical activity weight control smoking cessation. <p>Lifestyle advice should be given simultaneously with drug treatment.</p>	<p>Drug treatment of all modifiable risk factors:</p> <ul style="list-style-type: none"> blood pressure lowering lipid modification glycaemic control. <p>Aspirin where no contraindications.*</p>	<p>Risk factors reduced to a level that will lower 10-year cardiovascular risk to less than 20% (by recalculating risk).</p>	<p>Cardiovascular risk assessment annually.</p> <p>Risk factor monitoring every 3 months when stable.</p>

10-year CVD risk calculated 20% to less than 30%	<p>Intensive lifestyle advice on:</p> <ul style="list-style-type: none"> • a cardio-protective dietary pattern • physical activity • weight control • smoking cessation. <p>This lifestyle advice should be given by the primary health care team for 3 months prior to initiating drug treatment.</p>	<p>Drug therapy only indicated for people with individual high risk factor levels unresponsive to non-pharmacological measures.</p> <p>Consider aspirin therapy.*</p>	<p>Risk factors reduced to a level that will lower 10-year cardiovascular risk to less than 20% (by recalculating risk).</p>	<p>Cardiovascular risk assessment annually.</p> <p>Risk factor monitoring every 3–6 months, depending on severity.</p>
10-year CVD risk calculated 10% to less than 20%	<p>Intensive lifestyle advice on:</p> <ul style="list-style-type: none"> • a cardio-protective dietary pattern • physical activity • weight control • smoking cessation. <p>This lifestyle advice should be given by the primary health care team.</p>	<p>Non-pharmacological approach to treating abnormal risk factors</p> <p>No aspirin.*</p>	<p>Lifestyle advice aimed at reducing cardiovascular risk.</p>	<p>Cardiovascular risk assessment annually.</p> <p>Risk factor monitoring every 6–12 months.</p>
10-year CVD risk calculated less than 10%	<p>General lifestyle advice on:</p> <ul style="list-style-type: none"> • a cardio-protective dietary pattern • physical activity • weight control 	<p>Non-pharmacological approach to treating abnormal risk factors</p> <p>No aspirin.*</p>	<p>Lifestyle advice aimed at reducing cardiovascular risk.</p>	<p>Cardiovascular risk assessment in 2 years.</p>

	<ul style="list-style-type: none"> • smoking cessation. <p>This lifestyle advice should be given by the primary health care team.</p>			
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*The evidence regarding the use of aspirin as primary prophylaxis for cardiovascular disease (i.e. in patients with CV risk factors but no established CV disease) is less robust than that for secondary prophylaxis, where its benefit is strongly proven. When primary prophylaxis is being considered, an individual risk:benefit assessment should be made on a case-by-case basis, balancing the likelihood of preventing a CV event against the risk of bleeding complications (predominantly gastrointestinal and intra-cerebral haemorrhage).

Aspirin should be used as primary prophylaxis in individuals with a high 10-year CV risk ($\geq 30\%$) and should be considered in individuals with a moderate 10-year CV risk ($20\text{--}<30\%$), where the risk of bleeding complications is not significantly increased (e.g. active peptic ulcer disease, uncontrolled severe hypertension). Recommendations will continue to evolve as ongoing trials are completed.

People at **high absolute CVD risk** (calculated as $\geq 30\%$ over 10 years) should be given early drug therapy for all of their risk factors. Because their absolute risk of having a CV event is highest, they are most likely to derive benefit from treatment, and the benefit of therapy will almost certainly outweigh any harm (e.g. adverse effects, costs). If one risk factor is particularly elevated, it will usually respond better to therapy and can therefore have the greatest impact on reducing absolute CVD risk. It is important to explain to patients that therapy aims to reduce their overall CVD risk, so they will benefit from combined BP-lowering and lipid-modifying therapy, even if the individual levels of these risk factors are not markedly elevated.

For people at **moderate absolute CVD risk** ($20\text{--}<30\%$ over 10 years), drug therapy is indicated after a period of behavioural risk factor modification (at most 3 months) if individual risk factors remain persistently elevated. The absolute benefits of drug therapy are not as great in this group, and may be outweighed by the potential harms. The likely benefits and harms should be discussed with the patient before offering therapy. Even a small reduction in absolute risk may be seen as worthwhile by some patients. If the patient chooses to start drug therapy, monitor for adverse effects and other harms, and reconsider continuing therapy if these become problematic. If the patient prefers not to start drug therapy, reassess absolute CVD risk every 3 to 6 months.

For people at **low absolute CVD risk** (<20% over 10 years), drug therapy is not routinely recommended. However, certain people with elevated individual risk factors may choose to start drug therapy after discussion and consideration of the small absolute benefits and of the risks of therapy. Give advice on behavioural risk factor modification and reassess absolute CVD risk every 2 years.

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¹ Sourced and adapted from: National Vascular Disease Prevention Alliance. (2012). *Absolute cardiovascular disease management: Quick reference guide for health professionals* (p.2). Author.

² World Health Organization & International Society of Hypertension. (c2012). *World Health organization/International Society of Hypertension (WHO/ISH) risk prediction charts: For 14 WHO epidemiological sub-regions (charts in colour)* (p.38). Retrieved 2 March 2015, from <<http://www.ncbi.nlm.nih.gov/books/NBK148602/>>.

³ Ibid., p.40.

⁴ Sourced and adapted from: Ibid, p.5.



⁵ Ibid, p.6.

⁶ Sourced and adapted from: National Heart Foundation of New Zealand, Stroke Foundation of New Zealand, New Zealand Ministry of Health, & New Zealand Guidelines Group. (2003). *The assessment and management of cardiovascular risk: Evidence-based best practice guideline* (p.24). Retrieved 31 March 2015, from <<http://www.health.govt.nz/publication/assessment-and-management-cardiovascular-risk>>; Therapeutic Guidelines Limited. (2015). *eTG complete* [online resource]. Melbourne: Author; World Health Organization. (2007). *Prevention of cardiovascular disease: Western Pacific Region pocket guideline for assessment and management of cardiovascular risk*. Geneva: Author.



2. Behavioural risk factor modification

Healthy habits should be strongly recommended to everyone; however, benefit is greatest in those at increased risk of CVD. Behavioural modifications that reduce the risk of CVD include:

- avoiding tobacco smoking
- eating a balanced diet that is low in saturated fat, salt, and refined carbohydrates (sugar)
- minimising the consumption of alcohol
- undertaking regular physical activity
- maintaining appropriate body weight.

Behavioural risk factor modification is beneficial in primary and secondary prevention of CVD.

2.1 Smoking

Smoking cessation should be given priority in risk factor reduction. Second-hand smoke exposure should also be avoided. All patients should be asked about their tobacco use, and where relevant given counselling and advice about quitting (see Box 1).

Box 1 — Important advice to people wanting to quit smoking⁷

- Tell your family, friends and co-workers that you are quitting.
- Ask friends who smoke not to smoke around you or offer you a cigarette.
- Avoid alcohol and grog which can lead to smoking.
- Follow the 4 D's:
 - Delay
 - Deep breathing
 - Drink water
 - Do something else.

Weight gain following smoking cessation is a common concern for smokers and may lead to a reluctance to quit or relapse after successful cessation. However,

smokers should be reassured that the increase in weight is usually minimal (average 5-year weight gain less than 3 kg) and the significant benefits of smoking cessation should be emphasised.

For patients where counselling alone is ineffective, pharmaceutical options to assist in smoking cessation include nicotine replacement therapy, amfebutamone (bupropion), and nortriptyline.

See the Fiji Ministry of Health (MoH) *Minimal Clinical Intervention for Tobacco Cessation* guideline for further information on smoking cessation strategies.

2.2 Nutrition

Appropriate diet exerts a protective effect beyond the associated improvement in major identified risk factors. Eating habits need to be maintained long-term and are best implemented under the guidance of a dietician, who can provide an individualised eating plan.

Practical dietary guidelines

Patients should:

- Consume a variety of vegetables, fruit, wholegrain breads and cereals, and legumes. Five mixed servings of fruits and vegetables are advisable each day. One serve is represented by the amount that can fit on the palm of the hand.
- Replace foods with a high content of saturated or trans fats (e.g. animal fats, butter) with unsaturated fats (e.g. olive oil, canola oil, soya bean oil, avocados, and nuts). Use all fats minimally. Replace full-fat dairy foods with low-fat dairy products, and choose lean meat and poultry.
- Eat 2–3 serves of oily fish each week (e.g. mackerel or tuna).
- Eat a low or no added salt diet, particularly patients with high blood pressure or heart failure. Do not add salt to cooking or meals. Use natural herbs to enhance the flavour of meals, such as ginger, garlic, lemon juice, coriander, and curry leaves. Avoid processed foods, which often contain high levels of salt (choose low-salt options).
- Minimise energy-dense low-nutrient foods and drinks (e.g. alcohol, food high in sugar or fat), as these provide a large number of kilojoules in a small volume and are easy to overeat.
- For further information, refer to ‘Energy intake’ in Section 4.2 of this guideline, as well as *Food and Health Guidelines for Fiji, 2013*.

2.3 Alcohol consumption

Alcohol consumption is not recommended for cardiovascular protection, because any cardiovascular benefits are outweighed by the health risks associated with alcohol misuse. Therefore, patients should not be encouraged to increase their alcohol consumption, and those who do not drink should not be encouraged to commence. Alcohol consumption should be kept within a safe level (see Box 2), and patients should be advised to avoid binge drinking.

Box 2 — Maximal levels of safe alcohol intake⁸

- Men 1–2 standard drinks per day with at least 2 alcohol-free days each week.
- Women 1 standard drink per day with at least 2 alcohol-free days each week.

One standard drink contains 10 grams of alcohol. Examples of standard drinks are:

- 285 millilitres (mL) full-strength beer
- 375 mL light beer (average can)
- 100 mL wine (small glass)
- 30 mL spirit (bar measure).

2.4 Physical activity

Regular physical activity should be strongly encouraged. It has benefits in both the prevention and management of CVD, with significant mortality benefit. It has a beneficial effect on cardiovascular risk factors, such as type 2 diabetes, bodyweight, blood pressure, lipid profile, depression, and anxiety.

Briffa et al.⁹ state:

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure significantly beyond resting level, particularly involving continuous actions of large muscles. Exercise is defined as the systematic execution of physical activity for a specific purpose...

The [Australian] Heart Foundation's Expert Working Group recommends people with established clinically stable CVD should aim, over time, to achieve 30 minutes or more of moderate intensity physical activity (such as purposeful walking) on most, if not all, days of the week. Moderate intensity is associated with a moderate, noticeable increase in the depth and rate of

breathing while still allowing comfortable talking and is relative for a given person [see Box 3].

Box 3 — Levels of intensity of physical activity¹⁰

Low intensity physical activity elicits a slight increase in breathing rate and is relative for a given person (e.g. strolling on level firm ground, tidying the house, and social lawn bowls).

Moderate intensity physical activity elicits a moderate, noticeable increase in depth and rate of breathing, while still allowing comfortable talking, and is relative for a given person (e.g. brisk walking on level firm ground, water aerobics, cycling for pleasure, and cleaning the house).

2.5 Stress

People under emotional stress tend to neglect looking after themselves.¹¹ They might forget to take their medications or fail to monitor their food choices or intake. Some people cope with stress by drinking alcohol or decreasing their physical activity. Lifestyle strategies to minimise stress should be encouraged (see Box 4).

Box 4 — Patients suffering from stress¹²

Patients suffering from stress should be counselled to:

- Handle stress more positively.
- Replace bad or negative thoughts with good or positive ones.
- Control the body's reaction to stress through:
 - Relaxation techniques like breathing exercises, meditation, yoga
 - Exercising or dancing
 - Listening to calming music.
- Talk to someone and share worries. It helps to see things in a different light. They may not be really as bad as we think.
- Start a hobby, learn new things!
- Practise the 12 S's [refer to the Fiji Association of Mental Health's 12 S's in Annex B].

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¹⁰ Ibid., p.72.

¹¹ Government of Fiji Ministry of Health. op cit.

¹² Ibid., p.7.

3. Type 2 diabetes mellitus and CVD risk

Diabetes is associated with a marked increase in the risk of cardiovascular disease. This increased risk is due to the presence of other CVD risk factors, such as elevated blood pressure (BP) and dyslipidaemia, and the consequences of hyperglycaemia.

It is of great importance to assess and manage all CVD risk factors in patients with diabetes. While glycaemic control is important, patients should also be strongly advised to cease smoking, achieve ideal weight, exercise regularly, control BP, and treat dyslipidaemia where present.

3.1 Glycaemic control

HbA1c targets need to be individualised based on patient-specific factors. These include patient age, the type and duration of diabetes, antidiabetic drugs used, presence of CVD, multiple cardiac risk factors or other comorbidities, and the risk of hypoglycaemia. Aiming for a lower HbA1c often increases the risk of hypoglycaemia and can lead to worsened outcomes in some patient groups.

- For most patients, a HbA1C target of $\leq 7\%$ is appropriate.
- In older patients, or those with advanced micro or macrovascular complications or extensive comorbidities, a HbA1C target of 7.5% is generally more appropriate.
- In younger patients with type 1 diabetes, or more recent onset type 2 diabetes, with minimal comorbidities, more stringent control (HbA1c target $\leq 6.5\%$) may be reasonable.

References

- American Diabetes Association. (2014). Standards of medical care in diabetes — 2014. *Diabetes Care*, 37(Suppl 1), S14–S80.
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4. Overweight and obesity

Overweight and obesity are common worldwide and present both a public health problem and a problem for individuals. They are associated with many conditions, including type 2 diabetes, hypertension, and dyslipidaemia (major risk factors for cardiovascular disease). Even modest weight loss (5–10% of initial body weight) is beneficial and reduces cardiovascular risk. Methods for weight loss include:

- behaviourally-based treatments
- energy-restricted eating plans
- drug therapy
- bariatric surgery.

4.1 Assessment of overweight and obesity

When assessing overweight and obesity, a person's adiposity is more important than their total body weight. A central (abdominal) pattern of fat distribution is the critical issue when considering cardiometabolic risk. Fat on the thighs and buttocks (common among overweight premenopausal women) does not confer increased cardiometabolic risk.

Waist circumference

Waist circumference is a good indicator of total body fat and a useful predictor of central adiposity and cardiometabolic risk. The waist circumference cut-offs that indicate increased cardiometabolic risks (see Table 2 following) are based on studies undertaken mainly in people of European origin. They may overestimate risk in Pacific Islanders and underestimate risk for Asian people.

Waist circumference is measured midway between the lower rib margin and the top of the iliac crest using a stretch-resistant tape. The patient should be standing with arms relaxed and by their side. Stand behind the patient and take the measurement at the end of a normal exhalation.

Table 2 — Waist circumference at which cardiometabolic risk increases* ¹³

	Increased risk	Substantially increased risk
Men	94 cm†	102 cm
Women	80 cm	88 cm

* These figures are for a population of European origin. Higher cut-off values may be considered in Pacific Islanders. † 90 cm for men of South Asian, Chinese or Japanese origin.

Body mass index

Body mass index (BMI) is a measure of general adiposity. Obesity is classified according to BMI (see Table 3 below). As BMI increases, so does the risk of comorbidities.

BMI needs to be interpreted with caution in groups where muscle and fat mass varies significantly. These groups include highly muscular people (e.g. body builders or those doing a lot of aerobic exercise such as running or cycling), older people (where sarcopenia is common and height may be difficult to determine accurately, and loss of muscle leads to a higher proportion of body fat), and some ethnicities (see Table 3 below).

Table 3 — Body mass index classification¹⁴

Classification of weight: BMI = weight (kg)/height (m) ²		
Classification	Body mass index (kg/m ²)*	Risk of obesity-related comorbidities
Underweight	Less than 18.5	Low (but the risk of other clinical problems is increased)
Healthy	18.5 to 24.9	Average
Overweight	25 to 29.9	Increased
Obese:	30 or more	Greatly increased, particularly in association with central fat deposition
• Class I	30 to 34.9	High
• Class II	35 to 39.9	Very high
• Class III	40 or more	Extremely high

* These figures have been determined from population studies. They are based on mortality data for Caucasians and may not be appropriate for other population groups. Lower BMI cut-offs may be considered in Asian populations, including South Asian, Chinese and Japanese people (who may have a higher proportion of body fat). Higher BMI cut-offs may be considered in Pacific Islanders (who generally have a higher proportion of lean body mass).

4.2 Management of overweight and obesity

Management strategies for overweight and obese people need to be long-term to be effective. While many people can achieve weight loss in the short-term, few maintain this loss over a prolonged period. A plan to review the effectiveness of treatment can help to maintain motivation. Long-term weight maintenance requires ongoing follow-up. Treatment must be flexible and tailored to the individual.

Setting goals for weight management

Achievable goals should be set for weight loss — a common and important goal is maintenance of a loss of 5–10% of initial body weight. Other goals may be a smaller waist circumference, control of diabetes or dyslipidaemia, lower blood pressure, better mobility, or control of obstructive sleep apnoea. Reduction in medications and improved quality of life are further benefits from weight loss.

When goals are achieved they should be recorded and the person should be given positive feedback. New goals (e.g. weight maintenance) should then be negotiated.

A realistic rate of weight loss is 1–2 kg per month. It is also important to acknowledge that plateauing is to be expected and should not be regarded as failure of a program.

Improved eating habits are important, even if weight loss is very slow. A reduction of 5–10 kg that is maintained (even if the person remains in the obese or overweight category) has health benefits, particularly a reduction in the risk of type 2 diabetes.

Energy intake

General principles

Severe energy-restricted diets are not good advice for people seeking long-term weight loss, as they may not be nutritionally adequate, and there is a high risk of weight gain after the initial period of loss.

Irrespective of the type of eating plan recommended, weight loss can only be achieved if energy balance is shifted. This requires reduced energy intake via changes in eating patterns, and increased energy expenditure through reducing sedentary behaviour (e.g. 'screen time') and increasing physical activity (e.g. walking).

A useful strategy to reduce energy intake is to minimise the intake of high-energy beverages. Energy consumed as liquid has much less effect on satiety than the same amount of energy consumed as food. High-energy beverages include soft drinks, flavoured mineral waters, cordials, fruit juice (including 100% juice, with or without added sugar), fruit juice drinks, sports and energy drinks, tea or coffee with sugar added, and alcoholic beverages. Alcohol consumption (even without mixers, and including low-carbohydrate products) increases energy intake substantially, and patterns of excessive consumption should be modified. While milk provides important nutrients, the intake of full-fat and flavoured milk as a beverage should be minimised.

In general, people should be encouraged to eat a wide range of vegetables and salad items every day, moderate amounts of breads and cereals (preferably wholegrain), low-fat dairy products, lean cuts of meat and fish prepared using low-fat cooking methods, and very small amounts of foods high in fat and sugar. Highly processed foods should be avoided as they are often energy dense and high in salt.

Added sugar (including honey) should be limited whenever possible. Added fat (e.g. oil, butter, margarine, and cream) in cooking, as a spread, or as an 'extra' (e.g. cream with fruit, butter in mashed potato) should be reduced.

Like milk, cheese provides important nutrients, but most cheeses are very high in fat and energy, and should be eaten in small amounts. Generally, full-fat dairy products should be replaced with moderate-sized serves of low-fat dairy products.

Nuts are very energy dense and should be limited to no more than one handful per day. Muesli bars and 'health' bars are often considered healthy, but they are energy dense and should be avoided.

Understanding food labelling can help patients make better choices. Practical advice for interpreting food labels includes:

- Compare products using the per 100 g or 100 mL column, as serve sizes vary.
- Look for products that have less than 10 g of sugar per 100 g and the lowest saturated fat content.
- Products labelled 'low fat' have 3 g or less of total fat per 100 g (1.5 g or less per 100 mL for liquids) and are usually a good choice. However, not all products labelled 'low fat' or 'reduced fat' are low in energy, as they may contain a lot of sugar or other carbohydrates.

- Products labelled '95% fat free' still have 5 g of fat per 100 g and do not meet the definition of low fat, but are a better option than higher fat content products.
- Products labelled 'reduced' or 'lite' have less than 25% of the fat or energy of the reference product, but may still be very high in fat (e.g. 'lite' cream typically has around 20 g of fat per 100 g).

Other strategies to reduce energy intake include reducing portion size, using small serving plates, and learning to eat slowly. Overweight people frequently skip daytime meals and then overeat in the evening. They should be encouraged to establish regular eating patterns. The key challenge is to establish new eating patterns that can be maintained over the long-term.

Physical activity

Any increase in physical activity is beneficial to overall health and reduces the risk of cardiovascular events, even if there is minimal or no weight loss. However, to achieve and maintain weight loss, a substantial level of activity is required. Most overweight or obese people need to combine physical activity with energy restriction to lose weight.

Physical activity is beneficial even if there is minimal or no weight loss.

In seeking to increase energy expenditure, the initial goal is to reduce sedentary activities (e.g. 'screen time') and build more movement and activity into daily routines (incidental activity). For many people this means walking more as part of their everyday life. In the absence of dietary change, a modest weight loss can be achieved with 150 to 250 minutes per week of moderate-intensity exercise (e.g. brisk walking, light gardening) or lesser amounts of vigorous activity (e.g. jogging, swimming). For people with osteoarthritis, water-based activities (e.g. swimming and cycling) are practical ways to commence an activity program.

Refer also to Section 2.4 Physical activity.

Supporting behavioural modification

Strategies to support behavioural modification can help to produce weight loss and are important in weight maintenance. These may include psychological strategies, such as goal setting, stimulus control, cognitive behavioural therapy, stress management, or other specific counselling. Before they will commit to a behavioural modification program, people who are resistant or unmotivated may

need to participate in health education programs and focused discussions about habits, barriers, and the need for change.

Drug therapy

It is not clear whether weight loss using drug therapy results in the same health gains that could be obtained from an improved diet and increased physical activity. The potential harms and benefits should be considered carefully before prescribing or recommending drug therapy, and the weight loss needs to be supported by behavioural modification approaches.

Complementary and alternative medicines

Reviews of complementary and alternative medicines for weight loss have found little convincing evidence to support their use.

Bariatric surgery

Surgery is the most effective current therapy for the maintenance of a large weight loss (approximately 25 kg). Procedures include adjustable gastric banding, Roux-en-Y gastric bypass (RYGB), and sleeve gastrectomy.

Patient selection for bariatric surgery must be rigorous. Most authorities recommend surgery only when the patient has a BMI greater than 40 kg/m², or a BMI greater than 35 kg/m² if there are comorbidities such as diabetes or obstructive sleep apnoea.

Assessment and continuing follow-up with a multidisciplinary team that has expertise in treating such patients is essential. This should include psychological review, as binge eating disorder is common in obese people and may complicate the outcome if not treated. At present, these procedures are not being performed in Fiji.

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5. Hypertension

Hypertension is the single biggest risk factor for stroke and is an important risk factor for coronary heart disease, peripheral vascular disease, heart failure, chronic renal failure, and retinopathy. See Table 4 for classifications of blood pressure. The importance of hypertension is increased in the presence of other cardiovascular risk factors, such as smoking, diabetes mellitus, hyperlipidaemia, or a family history of premature cardiovascular disease. Therefore, as discussed in Section 1.5 on absolute risk assessment, treatment should be more vigorous in the presence of multiple risk factors.

Table 4 — Classification of blood pressure values¹⁵

Blood pressure	Systolic (mm Hg)	Diastolic (mm Hg)
Normal	<120	<80
High normal	120–139	80–89
Hypertension — Stage 1	140–159	90–99
Hypertension — Stage 2	160–179	100–109
Severe hypertension	≥180	≥110

Causes of hypertension

Primary hypertension

More than 90–95% of patients with hypertension are of the primary or essential type, often with a positive family history. Usually, these patients do not need comprehensive investigations but, whenever possible, urinalysis, blood urea, electrolytes, and creatinine are desirable.

Secondary hypertension

For **secondary** hypertension, careful history and examination will provide clues to underlying causes that are worth investigating further. Secondary hypertension should be suspected in patients:

- less than 40 years old with significantly elevated BP and no family history of hypertension
- with very high BP (systolic BP ≥180 mm Hg and/or diastolic BP ≥110 mm Hg)
- whose BP is difficult to control despite good drug compliance

- with signs and symptoms suggestive of secondary cause
- with accelerated hypertension (with retinal changes with or without papilloedema).

Chronic renal disease is the most common underlying cause for secondary hypertension. Other causes include: renal artery stenosis, pheochromocytoma, Cushing's disease, primary aldosteronism (Conn's syndrome), coarctation of the aorta, and pregnancy-induced hypertension. Occasionally, BP elevation is caused by medications, such as corticosteroids, nonsteroidal anti-inflammatory drugs (NSAIDs), oral contraceptives, or decongestants.

If a secondary cause is suspected, the patient should be referred to a specialist for further investigation.

5.1 Lowering blood pressure

Non-pharmacological measures

Non-pharmacological intervention is recommended for all patients with elevated BP. Measures that have been shown to be effective in reducing BP and CVD risk include:

- weight reduction in obese subjects
- reduction in alcohol intake
- smoking cessation
- regular physical activity
- moderate reduction in dietary sodium (salt) intake
- healthy eating plan
- management of obstructive sleep apnoea.

Strategies to reduce stress may also be beneficial.

Pharmacological measures

The decision to commence drug therapy to lower BP should be based on the patient's overall cardiovascular risk, rather than the level of BP alone (see Section 1 Cardiovascular risk assessment).

Medication to lower BP should be commenced promptly, in addition to non-pharmacological measures, in patients with a markedly elevated BP of $\geq 180/110$ mm Hg.

In patients with less severe hypertension (systolic BP 140–179 mm Hg or diastolic BP 90–109 mm Hg), drug treatment should also be commenced promptly if the patient has:

- established cardiovascular disease
- an absolute CVD risk of $\geq 30\%$ (see Section 1)
- diabetes
- renal impairment
- evidence of target organ damage (e.g. retinopathy, left ventricular hypertrophy)
- strong family history of premature CVD.

In all other patients with mild to moderate hypertension (stage 1 and 2), non-pharmacological measures should be instituted prior to consideration of drug therapy. If these measures do not reduce BP to $<140/90$ mm Hg after 3 months, drug treatment may be commenced according to absolute cardiovascular risk assessment (see Table 1). In patients at moderate absolute CV risk ($20\text{--}30\%$) drug therapy is likely to be appropriate. Patients at lower risk levels may be managed with ongoing non-pharmacological measures alone after discussion of the likely risk/benefit considerations with the patient. (See Box 5 for treatment targets.)

Box 5 — Treatment targets for hypertension¹⁶

- General adult population: BP $<140/90$ mm Hg.
- Older adults (>60 years): BP $<150/90$ mm Hg may be more appropriate.
- Established CVD, diabetes, or chronic kidney disease: BP $\leq 130/80$ mm Hg.

Medications used in the treatment of hypertension

The major medication classes used to treat hypertension are:

- angiotensin converting enzyme inhibitors (ACEI)
- angiotensin II receptor blockers (ARB)
- calcium channel blockers
- thiazide, thiazide-like diuretics, and frusemide
- beta blockers.

Overall, these drug classes have similar efficacy in reducing BP in patients with hypertension. The choice of initial therapy is influenced by individual patient factors, such as associated medical conditions, and the risks of adverse effects of the drug (see Table 5 following).

For uncomplicated hypertension in non-pregnant adults, ACEI, ARB, calcium channel blockers, and thiazide and thiazide-like diuretics are the drugs of first choice.

Beta blockers are not recommended as first-line therapy for patients with uncomplicated hypertension because they are less effective than other first-line drugs in reducing the risk of stroke. However, they are useful in patients with hypertension and coronary artery disease.

Loop diuretics (frusemide) should not be used long-term for hypertension except in patients with severe refractory hypertension, those with advanced kidney disease (eGFR <30 mL/min), or those with heart failure or other fluid overload states.

Ideally, target levels of BP should be achieved using one drug and once-daily dosing to enhance patient compliance. This might not always be possible in practice, and drug combination is often required.

5.2 Guidelines for selecting initial drug treatment of hypertension

Table 5 — Initial hypertension treatments¹⁷

Drug class	Conditions favouring use	Contraindications
Angiotensin converting enzyme inhibitors (ACEI) e.g. enalapril	<ul style="list-style-type: none"> left ventricular hypertrophy or dysfunction post-myocardial infarction atherosclerotic arterial disease heart failure glucose intolerance diabetic nephropathy nondiabetic nephropathy microalbuminuria 	<ul style="list-style-type: none"> pregnancy angioedema hyperkalaemia bilateral renal artery stenosis severe obstructive valvular heart disease such as MS, AS

Angiotensin II receptor blockers e.g. losarten	<ul style="list-style-type: none"> • left ventricular hypertrophy • post-myocardial infarction • heart failure • glucose intolerance • diabetic nephropathy • microalbuminuria • ACEI-induced cough 	<ul style="list-style-type: none"> • pregnancy • hyperkalaemia • bilateral renal artery stenosis • severe obstructive valvular heart disease such as MS, AS
Calcium channel blockers <ul style="list-style-type: none"> • dihydropyridines e.g. nifedipine, amlodipine • nondihydropyridines e.g. diltiazem, verapamil 	<ul style="list-style-type: none"> • isolated systolic hypertension (elderly) • stable angina • left ventricular hypertrophy • atherosclerosis • pregnancy • black people of African origin • stable angina • supraventricular tachycardia • atherosclerosis 	Possible: <ul style="list-style-type: none"> • tachyarrhythmias • heart failure • atrioventricular block (second- or third-degree) • heart failure
Thiazide diuretics e.g. hydrochlorothiazide, thiazide-like diuretics, frusemide	<ul style="list-style-type: none"> • isolated systolic hypertension (elderly) • heart failure • black people of African origin 	<ul style="list-style-type: none"> • gout • possible: <ul style="list-style-type: none"> ▪ glucose intolerance ▪ pregnancy
Beta blockers* e.g. atenolol, propranolol * Beta blockers are not usually recommended as first-line therapy for uncomplicated hypertension.	<ul style="list-style-type: none"> • stable angina • post-myocardial infarction • compensated heart failure • tachyarrhythmias (including atrial fibrillation) • glaucoma • pregnancy (labetalol) 	<ul style="list-style-type: none"> • asthma • atrioventricular block (second- or third-degree) • possible <ul style="list-style-type: none"> ▪ glucose intolerance ▪ athletes and physically active people • chronic obstructive pulmonary disease

Treatment should start with a single medication, usually at a low dose and increasing as needed.

Options are:

- enalapril 2.5 mg orally once daily, increasing as necessary to a maximum of 20 mg twice daily

OR

- hydrochlorothiazide 12.5 mg orally once daily, increasing as necessary to a maximum of 25 mg daily

OR

- amlodipine 5 mg orally once daily, (2.5 mg once daily if elderly or secondary agent), increasing as necessary to a maximum of 10 mg once daily

OR

- atenolol 25 mg orally once daily, increasing as necessary to a maximum of 100 mg daily.

For patients who are intolerant of enalapril due to cough, consider:

- losartan 25 mg orally once daily, increasing as necessary to maximum of 50 mg twice daily (currently unavailable on the Fiji EML).

Switching to a medication of a different class is required if adverse effects occur. If initial management with a single medication at adequate doses is ineffective, the options are:

1. Changing to a different medication from a different class ('sequential monotherapy').

OR

2. Adding a small dose of a second medication from a different class and titrating the dose to response ('stepped care').

The following combinations are effective and pharmacologically complementary:

- a thiazide diuretic with an ACEI, ARB, or beta blocker
- an ACEI or ARB with a calcium channel blocker
- a beta blocker with a dihydropyridine calcium channel blocker (e.g. amlodipine).

For patients with severe hypertension the 'stepped care' approach is more appropriate, as they are unlikely to be controlled on a single agent.

Practice points

- In patients with haemodynamically significant renal artery stenosis, ACEIs and ARBs can precipitate acute deterioration in kidney function. Where available, all patients commenced on an ACEI or an ARB should have electrolytes and

creatinine measured at baseline and then 2 weeks after commencing therapy (particularly patients with kidney disease or diabetes, and older people). A small decline in estimated glomerular filtration rate eGFR is common. If the acute decrease in eGFR is <25% below the baseline and stabilises within 2 months of starting therapy, the therapy may be continued. If the decrease in eGFR is >25% below the baseline, stop the ACEI and consider referral for investigation of possible bilateral renal artery stenosis. A rise in serum potassium of up to 0.5 mmol/L is expected.

- Second line medications include hydralazine and methyldopa. Hydralazine should rarely be used on its own. It produces headache, reflex tachycardia (both prevented by beta-blockade), and fluid retention (prevented or treated by a thiazide diuretic). Methyldopa should seldom be used as first-line treatment in non-pregnant hypertensives, as it may produce mental depression, impotence in males, and rarely autoimmune haemolytic anaemia. It is occasionally useful where response to other agents is inadequate or other antihypertensive drugs are not available.

5.3 Hypertension in patients with kidney disease

Adequate control of hypertension slows the progression of chronic kidney disease (CKD). ACEIs and ARBs are first-line therapy in people with chronic kidney disease or diabetes, as they are associated with a reduction in proteinuria and slowing of the rate of progression of kidney failure.

ACEIs and ARBs can be safely prescribed in patients with any stage of kidney disease, bearing in mind the following points:

- There is a significant risk of hyperkalaemia. Therefore, in patients in stages 4 or 5 of CKD (eGFR <30 mL/min) these drugs should only be used where close monitoring of serum electrolytes is available. Stop the ACEI or ARB if potassium concentration is >6 mmol/L and does not respond to dose reduction, diuretic therapy, and dietary potassium restriction.
- Monitor eGFR as per practice points above with reference to acute deterioration if bilateral renal artery stenosis.
- Take particular care with a patient with kidney disease treated with either an ACEI (or ARB) and a diuretic. Do not add a nonsteroidal anti-inflammatory drug to this combination, as this can cause acute kidney failure.

- Most ACEIs are renally excreted, and therefore lower doses are likely to be needed to control hypertension. Most ARBs are predominantly excreted by the liver, so no dose adjustment is necessary.
- Calcium channel blockers are effective in BP control in patients with kidney disease, and are effective in slowing progression of kidney failure. They are usually added to ACEI or ARB therapy, or used as an alternative to ACEIs or ARBs in patients who are intolerant of these drugs. Dosage regimens of calcium channel blockers are unaffected by kidney disease.
- At significantly reduced levels of kidney function (eGFR <30 mL/min) loop diuretics are used, because thiazide diuretics are no longer effective. The dose should be adjusted according to the level of kidney function, commencing with frusemide 40 mg/day, increasing gradually to a maximum frusemide dose of 500 mg/day. High doses carry a risk of ototoxicity and should only be considered in consultation with a specialist physician.
- Atenolol is renally excreted, and dosage adjustment may be necessary in kidney disease.

5.4 Hypertensive emergency (urgent blood pressure reduction)

Hypertensive emergencies are uncommon, and treatment must balance the risks of lowering blood pressure too rapidly with those of persistent hypertension. Urgent reduction of BP is necessary in hypertensive encephalopathy, acute hypertensive heart failure, and aortic dissection. Eclampsia is a special circumstance, as is hypertension in the context of an evolving stroke. BP is often elevated after an acute ischaemic stroke, but in most instances this settles spontaneously. Aggressive drug treatment should generally be avoided in the first week of an acute ischaemic stroke.

The initial goal in hypertensive emergencies is to reduce BP by no more than 25% within the first 2 hours, then towards 160/100 mm Hg within 2–6 hours. It is best not to lower BP further until the patient has adjusted to this level for at least 24 hours. Lowering BP too rapidly can cause renal, coronary, or cerebral ischaemia.

Patients requiring urgent control of hypertension should be admitted to hospital for expeditious BP reduction, with careful monitoring to ensure BP is not reduced too quickly.

While the BP may respond to oral agents, initial parenteral treatment may be needed in addition to oral.

Use:

- hydralazine 5 mg bolus intravenously over 5 minutes and repeated every 10 minutes up to a maximum of 20 mg, followed by intravenous infusion of hydralazine (refer to Annex C for infusion protocols).

OR

- labetalol (100 mg per 20 mL); initial dose of 20–40 mg given intravenously over 1–2 minutes and repeated at intervals of 5–10 minutes until 200 mg have been given. Alternatively, labetalol may be given as a continuous intravenous infusion at a rate of 2 mg per minute (refer to Annex C for infusion protocols).

Once the BP is stabilised, the patient should be changed to oral treatment for maintenance.

Opening a nifedipine 10 mg capsule and giving it sublingually **should not** be undertaken as emergency treatment. It delivers an uncertain dose, and unexpected rapid falls in BP can result in stroke or myocardial infarction. In Fiji, nifedipine 10 mg capsule is restricted to obstetric and paediatric practice only.

5.5 Monitoring

Once patients have been stabilised on regular treatment they should have their absolute CV risk re-calculated and be followed up accordingly. Home BP monitoring should be encouraged where possible.

Monitoring for target organ damage is also important. Consider:

- Kidneys: serum creatinine and electrolytes should be measured within the first 2 months of diagnosis and annually thereafter (unless more frequent monitoring is indicated).
- Heart: electrocardiogram (ECG) at diagnosis, and then as required.
- Eyes: ophthalmology review if required.

5.6 Resistant hypertension

Apparent resistance to antihypertensive drugs may be due to several different causes and these should be explored. They include:

- Non-compliance with treatment (almost certainly the most common cause).
- Failure to detect a secondary cause, especially renal artery stenosis or primary hyperaldosteronism.
- Ingestion of drugs interacting with the antihypertensive treatment, e.g. NSAIDs, steroids.
- Ingestion of a large sodium (salt) load or consumption of excessive alcohol.

Where hypertension remains uncontrolled despite the combination of 3 drugs, referral to a specialist is appropriate.

5.7 Hypertension in children

Pre-hypertension: Average systolic BP or diastolic BP that are $\geq 90^{\text{th}}$ percentile but $< 95^{\text{th}}$ percentile for age, sex, and height on ≥ 3 occasions.

Hypertension: Average systolic BP and/or diastolic BP that is $\geq 95^{\text{th}}$ percentile for age, sex, and height on ≥ 3 occasions.

Suspect hypertension and measure BP in a child with:

- Obesity.
- Haematuria and periorbital puffiness (acute glomerulonephritis).
- Generalised oedema with or without proteinuria (nephrotic syndrome/Cushing's syndrome).
- Known diabetes.
- Afebrile seizure (hypertensive encephalopathy).
- Altered consciousness **with or without** other signs of raised intracranial pressure.
- A sudden impairment or loss of vision **with or without** epistaxis (hypertensive encephalopathy).
- Growth failure **with or without** family history of kidney diseases (chronic kidney disease).

Management of hypertension in the Subdivisional Hospital:

- Measure weight and height of the child.
- Refer and discuss with the Divisional paediatric team, which will guide you in defining, categorising, and managing hypertension based on the standard BP chart for age, sex, and height. See Table 6 for a simple guide.
- If the child is unstable, discuss with the paediatric team at the Divisional Hospital.
- Diagnostic work-up for the underlying aetiology and evaluation for end organ damage will be carried out in the Divisional Hospital.

Table 6 — Age-specific BP based on the 90th percentile for BP and 50th percentile for height¹⁸

Age (years)	Boys		Girls	
	Systolic BP (mm Hg)	Diastolic BP (mm Hg)	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
1–5	99–108	52–68	100–106	40–68
6–10	110–115	70–75	108–115	70–74
11–14	117–125	76–78	115–122	74–78

5.8 Hypertension in pregnancy

Onset of hypertension before 20 weeks of pregnancy is due to either chronic hypertension, or chronic hypertension with superimposed pre-eclampsia.

Onset of hypertension after 20 weeks of pregnancy can be due to:

- pregnancy-induced hypertension (PIH) — hypertension without proteinuria
- mild pre-eclampsia
- severe pre-eclampsia
- eclampsia.

Mild pre-eclampsia

Mild pre-eclampsia is defined as hypertension that occurs after 20 weeks of pregnancy and is characterised by the following:

- two readings of diastolic BP of 90–110 mm Hg taken at least 4 hours apart.

PLUS

- proteinuria 2+ and
- no signs or symptoms of severe disease (see below).

It is recommended that patients be admitted if any of the following apply:

- BP $\geq 150/100$ mm Hg on two occasions
- symptoms of severe disease (see below)
- there is concern about foetal wellbeing
- follow-up and accessibility of obstetric care is a concern.

Mild pre-eclampsia does not usually require treatment. However, if hypertension is significant enough to warrant antihypertensive medication, use:

- methyldopa 250–500 mg orally two–three times a day.

AND, if necessary, ADD

- hydralazine 25 mg orally three times daily.

It is recommended that BP should be maintained at 130–140/80–90 mm Hg.

Severe pre-eclampsia

Severe pre-eclampsia is defined as hypertension that occurs after 20 weeks of pregnancy and is characterised by the following:

- diastolic BP >110 mm Hg
- proteinuria 3+
- presence of epigastric tenderness, headache, visual changes, hyperreflexia, pulmonary oedema, oliguria, and convulsions.

Severe pre-eclampsia needs urgent referral to obstetrics and gynaecology team and transfer to hospital. In hospital, the management of severe eclampsia includes the following:

If the diastolic BP >110 mm Hg, use:

- nifedipine 10 mg orally stat and repeat dose as necessary to maintain diastolic BP at 90–109 mm Hg

OR

- hydralazine 5 mg slow IV, over 5 minutes, repeat BP after 20 minutes; if still high repeat dose. If BP remains uncontrolled, commence hydralazine infusion as per Obstetrics and Gynaecology protocol.

Then:

- Start intravenous fluids, e.g. 500 mL plasma expander over one hour.
- Maintain strict fluid balance chart.
- Monitor BP, pulse, and respiration regularly.
- Insert indwelling catheter and maintain urine output at >30 mL/hr.

For **maintenance** of blood pressure, use:

- nifedipine 10–20 mg orally as required to a maximum of 60 mg daily to keep diastolic BP <110 mm Hg

OR

- hydralazine by slow intravenous infusion, as per Obstetrics and Gynaecology protocol.

It is not necessary to reduce BP to normal levels, rather it is more important to maintain BP at a 'safe' level of diastolic BP of <110 mm Hg. The definitive treatment for pre-eclamptic toxemia (PET) is delivery of the baby. This should be undertaken as soon as it is practicable, preferably in a referral hospital.

If a **convulsion** occurs or is imminent, administer magnesium sulphate as described below.

- If infusion pump **is available**, use:

Magnesium sulphate 50%, 4 grams as loading dose diluted in 100 mL of dextrose 5% to be infused slowly over 20 minutes. This is to be followed by maintenance dose of magnesium sulphate 12.5 grams in 100 mL of dextrose 5% to be infused at 1 gram per hour.

- If infusion pump is **NOT available**, use:

Magnesium sulphate 50%, 4 grams (8 mL) diluted in 12 mL of dextrose 5%, intravenously over 10–15 minutes.

PLUS

Magnesium sulphate 50% (10 mL) intramuscularly mixed with 0.5 mL 1% lignocaine in each buttock.

After delivery of the baby (24–48 hours) when the patient's condition is stable, BP can be maintained with either:

- methyldopa 250–500 mg orally two–three times daily

OR

- hydralazine 25–50 mg orally three times daily.

In the subdivisional setting, oral anti-hypertensive treatment is only provided for cases of pre-existing hypertension. Cases of pre-eclampsia that need oral anti-hypertensive treatment need to be referred to the Divisional Hospital.

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6. Dyslipidaemia

Dyslipidaemia is an important risk factor for all forms of CV disease. The level of risk is associated not just with the total cholesterol level, but also the relative proportions of the different forms. An increased CV risk is associated with increased total cholesterol (TC), increased low-density lipoprotein (LDL) cholesterol, decreased high-density lipoprotein (HDL) cholesterol, and increased triglyceride (TG) levels.

While only total cholesterol levels are used in the absolute CV risk assessment calculator, where available, the breakdown is important to consider also. TC may overestimate CV risk if HDL-C is raised (as this fraction is cardioprotective), and may underestimate risk if triglycerides are raised (as these are not measured within TC levels, but are independently associated with increased CV risk). Predictive value is significantly improved by considering LDL-C and HDL-C independently.

The importance of dyslipidaemia is increased in the presence of other cardiovascular risk factors, such as smoking, diabetes mellitus, hypertension, or a family history of premature cardiovascular disease. Therefore, as discussed in the previous section on absolute risk assessment, treatment should be more vigorous in the presence of multiple risk factors.

Measurement of lipids

A fasting lipid profile is desirable where possible, but is not essential. A non-fasting lipid profile is adequate for measurement of TC and HDL-C levels and for directly measured LDL levels. However, a fasting specimen is required for accurate measurement of TG and calculated LDL levels.

6.1 Non-pharmacological management

Non-pharmacological intervention is recommended for all patients with dyslipidaemia. It is important to promote dietary modification, which should continue even if drug therapy is required. Effective dietary changes for improving lipid levels include:

- Reducing saturated and trans fats; replace with monounsaturated and polyunsaturated fats.

- Increasing soluble fibre.
- Introducing plant sterol-enriched milk, margarine, or other food products. This is the most effective dietary measure (approximate LDL-C reduction of 10–15%).

Limiting alcohol intake, losing weight (if overweight or obese), and increasing physical activity are also beneficial for improving lipid levels. Increasing physical activity and losing weight are the most effective interventions for increasing HDL-C levels. For prescribed exercises, see 'Physical activity' in Section 4.2.

6.2 Pharmacological management

The decision to commence drug therapy to treat dyslipidaemia should be based on the patient's overall cardiovascular risk rather than the lipid level alone (see Section 1 Cardiovascular risk assessment).

Regardless of baseline lipid levels (i.e. even if within the 'normal' range), drug treatment should be commenced promptly, in addition to non-pharmacological measures, in patients with:

- established CVD
- high absolute CVD risk (i.e. people with a $\geq 30\%$ risk of CV disease over the next 10 years)
- diabetes and age >40 years with one or more other CV risk factors (including albuminuria).

Drug therapy should also be commenced early in patients with:

- Serum total cholesterol >7.5 mmol/L.

In all other patients with abnormal lipid profile, non-pharmacological measures should be instituted prior to consideration of drug therapy. If these measures do not reduce lipids to target levels after 3 months, drug treatment should be considered. In patients at moderate absolute CV risk ($20\text{--}30\%$), or with a family history of premature CVD (i.e. first-degree relative who developed CVD before age 55 years in males or 65 years in females), drug therapy is likely to be appropriate. Patients at lower risk levels may be managed with ongoing non-pharmacological measures alone after discussion about the likely risk/benefit considerations.

Treatment of dyslipidaemia is generally lifelong. Before starting drug therapy, confirm that the dyslipidaemia is not secondary to a treatable problem, e.g. hypothyroidism, nephrotic syndrome, cholestasis.

The best drug therapy for raised total cholesterol levels is an HMG-CoA reductase inhibitor ('statin').

Use:

- simvastatin 10 mg orally daily at night, increasing if required to a maximum dose of 40 mg daily.

There are other statins available on the market, e.g. atorvastatin, but these are currently unavailable on the EML. Additional lipid agents may be required where adequate control is not achieved with a statin alone.

Although statins are generally well tolerated, care is required in patients with muscle or hepatobiliary disease. For advice on monitoring for adverse effects of statins, see below.

Monitoring for adverse effects of statin therapy

Although generally well tolerated, statin therapy can cause liver dysfunction and muscle problems. These adverse effects are more common at higher doses.

Liver and muscle biochemistry (alanine aminotransferase [ALT] and creatinine kinase [CK]) should be tested at baseline, as well as when the response of lipids to treatment is assessed (1–2 months after initiation or dosage adjustment). Subsequently, routine monitoring of this test is not necessary unless patients develop signs and symptoms.

Patients who experience mild muscle symptoms still benefit from the maximum dose of statin they can tolerate. Low-dose intermittent therapy (alternate day or twice weekly) is often effective and well tolerated.

Stop statin therapy or reduce dose if:

- Previously normal ALT is persistently >3 times the upper limit of normal
- CK is >10 times the upper limit of normal
- CK is >5 times the upper limit of normal and patient has muscle symptoms
- Patient has persistent unexplained muscle pain or weakness.

If CK remains elevated after stopping statin therapy, consider other causes for myopathy (e.g. asymptomatic hypothyroidism, neuromuscular diseases).

Target lipid levels

Achieving target lipid levels is more important in secondary prevention and in patients with high absolute CV risk. Target total cholesterol level for patients on lipid-modifying therapy is <4.0 mmol/L. However, the LDL-C level remains the primary target of lipid-modifying therapy, and the target for LDL-C level is <2.0 mmol/L.

Most lipid levels respond to therapy within 2–3 weeks and usually stabilise within 1–3 months.

Note that intervention studies have not been designed to determine lipid targets. Movement towards these levels, even if they are not reached, is likely to be beneficial in reducing CVD risk.

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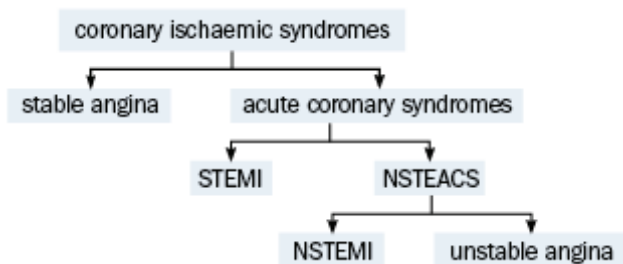
7. Coronary heart disease

Patients with coronary heart disease are classified by the pattern of their presenting symptoms (see Figure 1). Patients with new or increasing symptoms are labelled as suffering an acute coronary syndrome (ACS), whereas those with chronic symptoms are classified as stable angina. This distinction recognises the prognostic and therapeutic implications of an accelerated or new pattern of symptoms. While stable angina is usually due to a relatively fixed coronary obstruction produced by stable atherosclerotic plaque, ACS results from unstable atherosclerotic plaque that has been complicated by acute thrombus formation and vasospasm.

Patients with ACS are further subdivided by the presence or absence of ST elevation on their initial ECG into:

- ST elevation myocardial infarction (STEMI), which is a medical emergency. Urgent reperfusion therapy needs to be considered.
- Non-ST elevation acute coronary syndrome (NSTEMACS). Subsequent investigation divides NSTEMACS into:
 - non-ST elevation myocardial infarction (NSTEMI): patients with myocardial infarction as determined by elevated cardiac markers
 - unstable angina: patients without myocardial infarction.

Figure 1 — Classification of coronary ischaemic syndromes¹⁹



7.1 Acute coronary syndromes

An ECG should be performed urgently in all patients presenting with new or worsening chest pain or suspected myocardial infarction.

Therapy is guided by the initial ECG findings. Seek the opinion of a colleague if there is any doubt in interpreting the ECG. See sample Emergency Department Chest Pain Pathway (refer to Annex D).

ST elevation myocardial infarction

ST elevation myocardial infarction (STEMI) is due to the acute thrombotic occlusion of a coronary artery. This is a life-threatening event. If the coronary occlusion is not relieved, myocardial infarction will progress over the next 6–12 hours. The emergency treatment of a STEMI is aimed at reperfusing the ischaemic myocardium, minimising infarct size, relieving symptoms, and preventing complications.

Immediate management of STEMI

Give:

- aspirin 300 mg, chewed or dissolved before swallowing
- glyceryl trinitrate 600 microgram tablet sublingually with a repeat dose every 5 minutes if pain persists, up to a maximum of 1800 micrograms (3 tablets)*
- morphine 2.5–5 mg intravenously with repeat doses every 5–10 minutes if required for ongoing pain[#]
- oxygen by mask if the patient is hypoxic (O₂ saturation <94%) or if oxygenation cannot be measured
- clopidogrel 300 mg orally stat[^] (currently unavailable on the Fiji EML)

If indicated (see 'Reperfusion therapy' on the next page), give:

- thrombolytic therapy — streptokinase or tissue plasminogen activator (tPA). Where available, alternative thrombolytic agents (e.g. alteplase, reteplase, tenecteplase) may be used.

*Glyceryl trinitrate should not be given if hypotension (systolic BP <90 mm Hg) or right ventricular infarction is suspected (see 'Right ventricular infarction' in Section 7.3).

[#]Where morphine is given, the patient's conscious state and respiratory rate should be closely monitored.

[^]Combination antiplatelet therapy carries a significant risk of bleeding, and should not be used if the patient has any evidence of current active bleeding.

Unless the patient is very anxious, routine use of a sedative drug (e.g. diazepam) is not recommended.

Reperfusion therapy

It is important to re-open the artery and re-establish flow as soon as possible. This may be achieved by:

- thrombolytic therapy (streptokinase or tPA)

OR

- percutaneous coronary intervention (PCI) — transluminal coronary balloon angioplasty and stenting.

Patient outcomes are adversely affected by delays in reperfusion; thrombolysis should be initiated as rapidly as possible and ideally be given within 30 minutes of arrival in hospital.

In centres where thrombolysis is not available, all other above measures should be instituted and the patient discussed urgently with the Divisional Hospital.

All patients with acute myocardial infarction should be admitted to a coronary care unit where available for monitoring of acute events.

Thrombolytic therapy

The thrombolytic agent currently used in Fiji is streptokinase. Indications for thrombolytic therapy are shown below (see Box 6):

Box 6 — Indications for thrombolytic therapy

Patients should be considered for thrombolytic therapy only if all of the following are present:

- Ischaemic/infarction symptoms of longer than 20 minutes. This would include not only chest pain but also other symptoms of myocardial infarction, such as chest discomfort or pressure, shortness of breath, pulmonary oedema, sweating, dizziness, and light-headedness.
- Symptoms commenced less than 12 hours ago.
- ST elevation or presumed new left bundle branch block on ECG.
- No contraindications to reperfusion therapy (see Box 7).

In patients presenting 12–24 hours after the onset of symptoms, myocardial infarction may already be complete, but reperfusion should still be considered if there are signs of continuing ischaemia (persistent or recurrent pain with ST segment elevation), viable myocardium (preservation of R waves in infarct-related ECG leads), or major complications (e.g. cardiogenic shock).

Contraindications to thrombolytic therapy for patients with ST elevation myocardial infarction (STEMI) (see Box 7) can be absolute or relative. Patients with an absolute contraindication should not be administered a thrombolytic agent. With relative contraindications, the risks and benefits of treatment must be weighed up.

When indicated, use streptokinase as follows:

- streptokinase 1.5 million international units (IU) by IV infusion over 60 minutes (refer to Annex C and D for streptokinase protocols and ED Acute STEMI Checklist).

Significant arrhythmias including ventricular fibrillation are not uncommon at the time of reperfusion. During and after the administration of thrombolytic therapy, patients should be closely monitored by staff suitably trained in the management of acute cardiac patients.

Allergic reactions can also occasionally occur. Severe allergic reactions should be treated as for anaphylaxis.

For **mild or moderate allergic reactions to streptokinase**, give:

- hydrocortisone 100 mg intravenously stat

WITH or WITHOUT

- promethazine 12.5 mg intravenously slowly (beware of hypotension).

Severe allergic reactions to streptokinase should be treated as for anaphylaxis:

- adrenaline 1 in 1,000 solution, 0.5–1 mL (0.5–1 mg) intravenously over 5 minutes.

If response is poor, increase dose to:

- adrenaline 1 in 1,000 solution 2 to 5 mL (2–5 mg) intravenously over 5 minutes

AND ADD

- hydrocortisone 100 mg intravenously stat

WITH or WITHOUT

- promethazine 25 mg intravenously slowly (beware hypotension).

Box 7 — Contraindications to thrombolytic therapy in STEMI

Absolute contraindications

Risk of bleeding

- active bleeding or bleeding diathesis (excluding menses)
- significant closed head or facial trauma within 3 months
- suspected aortic dissection (including new neurological symptoms).

Risk of intracranial haemorrhage

- any prior intracranial haemorrhage
- ischaemic stroke within 3 months
- known structural cerebral vascular lesion (e.g. arterio-venous malformation)
- known malignant intracranial neoplasm (primary or metastatic).

Relative contraindications

Risk of bleeding

- current use of anticoagulants: the higher the international normalised ratio (INR), the higher the risk of bleeding
- non-compressible vascular punctures
- recent major surgery (within 3 weeks)
- traumatic or prolonged (more than 10 minutes) cardiopulmonary resuscitation
- recent (within 4 weeks) internal bleeding (e.g. gastrointestinal or urinary tract haemorrhage)
- active peptic ulcer.

Risk of intracranial haemorrhage

- history of chronic, severe, poorly controlled hypertension
- severe uncontrolled hypertension on presentation (more than 180 mm Hg systolic or more than 110 mm Hg diastolic)

- ischaemic stroke more than 3 months ago, dementia, or known intracranial abnormality not covered in absolute contraindications.

Other

- pregnancy.

Streptokinase should be given based on clinical judgement or upon the advice of the cardiology team where:

- streptokinase therapy has been administered between 2 weeks to 4–5 years previously
- previous hypersensitivity to streptokinase.

Where available, an alternative thrombolytic agent should be given to these patients.

Subsequent management of STEMI

Further management of STEMI should be based on the patient's clinical course. Following a STEMI, most patients benefit from combination therapy with long-term antiplatelet therapy, beta blockers, ACEIs (or ARBs), and statin therapy. Some patients require anticoagulation.

Antiplatelet therapy

Provided that there are no contraindications to antiplatelet therapy, continue:

- aspirin 100–150 mg orally, daily

PLUS

- clopidogrel 75 mg orally, daily (currently unavailable on the Fiji EML).

Available evidence shows that up to 12 months of dual antiplatelet therapy is beneficial. However, beyond 12 months the benefit is reduced so that the risk of bleeding generally outweighs the benefit. Clopidogrel therapy should therefore be stopped after 12 months. Aspirin should be continued indefinitely.

Beta blockers

Beta blockers offer prognostic benefit following myocardial infarction, particularly in high-risk patients (such as those with ongoing ischaemia or with left ventricular dysfunction). Beta blockers should be started during hospital admission unless

contraindicated. They should not be started in patients with decompensated heart failure, heart block, or significant bradycardia (or asthma). Orally administered beta blockers can be initiated after heart failure and bradycardia have resolved.

Use:

- atenolol 25 to 100 mg orally, daily

OR

- metoprolol tartrate 25 to 100 mg orally, twice daily (currently unavailable on the Fiji EML).

Doses should commence at the lower end of the range, and aim to titrate doses to the maximum tolerated dose in the recommended range, provided that the systolic blood pressure does not fall below 95 mm Hg and the heart rate does not fall below 55 beats per minute.

The benefit of beta-blocker therapy persists long-term and beta blockers should be continued indefinitely in high-risk patients.

The usual contraindications to the use of beta blockers apply. Patients with significant left ventricular dysfunction should be observed closely for the development of congestive heart failure.

Angiotensin converting enzyme inhibitors

ACEIs improve outcome after acute myocardial infarction.

Use:

- enalapril 2.5–20 mg orally, daily.

Start ACEI therapy within 24 to 48 hours of acute myocardial infarction where not contraindicated. Contraindications to early ACEI use include haemodynamic instability and hypotension (systolic blood pressure less than 100 mm Hg). Use ACEI with caution in the presence of kidney dysfunction.

The initial dose should be low and BP closely monitored. While the patient is in hospital, kidney function and plasma electrolytes should be monitored closely. If the maintenance dose has not been achieved at discharge, the dose will need to be increased more slowly as an outpatient (e.g. weekly), with kidney function and plasma electrolytes checked where available before each increase in dose. ACEI should be continued long-term, particularly in patients with a low ejection fraction.

Angiotensin II receptor blockers

ARBs are currently unavailable on the Fiji EML and their effect following myocardial infarction has not been studied as extensively as the effect of ACEIs. Therefore, ACEIs remain the treatment of choice following a myocardial infarct. However, ARBs can be used in patients who are intolerant to ACEI due to severe cough.

Aldosterone antagonists

Patients with ongoing severe heart failure despite appropriate use of frusemide and ACEI therapy should be discussed with the Divisional Hospital for consideration of aldosterone antagonist therapy.

Where recommended, use:

- spironolactone 12.5 mg orally, daily, increasing to a maximum of 50 mg daily after 8 weeks.

Spironolactone should be used with caution in patients with raised creatinine or potassium concentration because of the risk of precipitating kidney failure and hyperkalaemia. Patients on this drug should have their kidney function and potassium concentration closely monitored. Avoid use where laboratory monitoring is not available.

Statins

Statin therapy has been shown to reduce premature death, myocardial infarction, and other cardiovascular events following acute myocardial infarction. Statin therapy should be continued or initiated during the hospital admission, no matter what the cholesterol level. Use:

- simvastatin 40 mg orally, daily, at night.

Alternative statin agents (e.g. atorvastatin) can be used where available, but are currently unavailable on the Fiji EML. See Section 6 Dyslipidaemia for more details about statin therapy.

Calcium channel blockers

The use of calcium channel blockers should be reserved for patients who require treatment for ongoing post-myocardial infarction angina and have a contraindication to a beta blocker. The drug of choice is:

- diltiazem 30–60 mg orally tds (currently unavailable on the Fiji EML).

Anticoagulants

Long-term anticoagulation with warfarin to prevent emboli from left ventricular mural thrombus should be considered in patients who have suffered a large myocardial infarction. These patients should be referred for echocardiogram. If a large akinetic/dyskinetic area is present, or if a left ventricular mural thrombus is demonstrated by echocardiography, warfarin may be appropriate where practical. This should be discussed with the medical team in the Divisional Hospital. Where warfarin therapy is initiated, the need for ongoing therapy should be reassessed at 3 months by repeat echocardiogram.

Ongoing pain post-STEMI

Where **significant ischaemic chest pain persists or recurs post treatment for a STEMI**, appropriate measures include:

- oxygen if the patient is hypoxic (O_2 saturation $<94\%$) or if oxygenation cannot be measured
- morphine therapy 2.5–5 mg intravenously with repeat doses every 5–10 minutes as necessary
- glyceryl trinitrate 600 microgram tablet sublingually with a repeat dose every 5 minutes if pain persists, up to a maximum of 1800 micrograms (3 tablets).

Where pain persists, the addition of long-acting nitrate therapy should be considered. Options include:

- isosorbide dinitrate 10–20 mg orally, three times daily

OR

- isosorbide mononitrate extended-release 30–60 mg orally once daily, up to a maximum of 120 mg once daily (currently unavailable on the Fiji EML)

OR

- glyceryl trinitrate infusion 10 mcg/min increasing by 10 mcg per minute every three minutes until pain is controlled, provided systolic BP is ≥ 90 mm Hg (currently unavailable on the Fiji EML)

OR

- glyceryl trinitrate 5–15 mg patch transdermally, once daily, applied for a maximum of 14 hours in a 24-hour period (currently unavailable on the Fiji EML).

Blood pressure should be closely monitored during nitrate therapy, and therapy reduced or ceased if systolic BP falls below 90 mm Hg.

Anticoagulation with heparin infusion or therapeutic low molecular weight heparin should be considered if the above measures fail (refer to Annex E for heparin infusion protocol).

All patients with STEMI should be discussed with the Medical/Cardiac Unit at the Divisional Hospital.

7.2 Non–ST elevation acute coronary syndrome

Patients with acute myocardial ischaemia without ST elevation on their presenting ECG are classified as non-ST elevation acute coronary syndrome. This category includes those with non-ST elevation myocardial infarction (non-STEMI), characterised by an elevation in cardiac biomarkers such as troponin, and unstable angina (no elevation cardiac biomarkers). Patients are differentiated into high, intermediate, or low risk categories depending on the nature of their chest pain, and the presence or absence of ECG changes or elevated troponin levels (see Box 8).

Treatment of NSTEMACS

Box 8 — Features associated with high-risk, intermediate-risk, and low-risk NSTEMACS

High-risk features

Presentation with clinical features consistent with acute coronary syndrome (ACS) and any of the following high-risk features:

- repetitive or prolonged (>10 minutes) chest pain or discomfort
- elevated level of ≥ 1 cardiac biomarker (troponin or creatinine kinase-MB isoenzyme)
- persistent or dynamic ECG changes of ST-segment depression ≥ 0.5 mm, or new T-wave inversion ≥ 2 mm
- transient ST-segment elevation (≥ 0.5 mm) in > two contiguous leads
- haemodynamic compromise — systolic BP <90 mm Hg, cool peripheries, diaphoresis, heart failure, and/or new-onset mitral regurgitation

- sustained ventricular tachycardia
- syncope
- left ventricular systolic dysfunction (left ventricular ejection fraction <0.40)
- prior percutaneous coronary intervention within 6 months or prior coronary artery bypass surgery
- presence of known diabetes (with typical symptoms of ACS)
- chronic kidney disease (eGFR <60 mL/minute)(with typical symptoms of ACS).

Intermediate-risk features

Presentation with clinical features consistent with ACS and any of the following intermediate-risk features AND NOT meeting the criteria for high-risk ACS:

- chest pain or discomfort within the past 48 hours that occurred at rest, or was repetitive or prolonged (but currently resolved)
- age >65 years
- known coronary heart disease — prior myocardial infarction with left ventricular ejection fraction >0.40 , or known coronary lesion $>50\%$ stenosed
- no high-risk changes on ECG (see high-risk features above)
- ≥ 2 of the following risk factors: known hypertension, family history, active smoking or hyperlipidaemia
- presence of known diabetes (with atypical symptoms of ACS)
- chronic kidney disease (estimated glomerular filtration rate <60 mL/min) (with atypical symptoms of ACS)
- prior aspirin use.

Low-risk features

Presentation with clinical features consistent with ACS without intermediate-risk or high-risk features. This includes onset of anginal symptoms within the last month, or worsening in severity or frequency of angina, or lowering of anginal threshold.

High-risk patients

Patients with NSTEMI/ACS at high risk should be treated as per 'Immediate management of STEMI' (see Section 7.1), **EXCEPT thrombolytic therapy (e.g. streptokinase and tPA) should NOT be given**. Anticoagulation with intravenous unfractionated heparin or therapeutic low molecular weight heparin (LMWH) is used in its place. Use:

- unfractionated heparin 5000 units IV bolus, followed by 1000 units/hour IV infusion, adjusted according to APTT (refer to Annex E for heparin infusion protocol)

OR

- enoxaparin 1 mg/kg SC, twice daily, (once daily if eGFR <30 mL/min) (currently unavailable on the Fiji EML).

The advantages of LMWH are that it can be given subcutaneously and it has a more predictable effect so that constant monitoring is not required. The fact that its effect cannot easily be reversed is a disadvantage. Care should be taken in older patients.

Parenteral anticoagulants should be administered for a minimum of 3 days and possibly longer, depending on the clinical response.

Bleeding with anticoagulation

Occasionally, bleeding may occur following treatment with heparin. If significant bleeding (e.g. intracranial or GIT haemorrhage) does occur:

- cease heparin infusion
- reverse heparin with protamine (even if a LMWH has been used)
- give blood and blood products as necessary.

Anti-platelet therapy, beta-blocker therapy, and a statin should be given as per 'Subsequent management of STEMI' in Section 7.1. ACEI should also be used if there is evidence of LV dysfunction/failure.

Intermediate-risk patients

Patients with NSTEMI/ACS who are deemed to be at intermediate risk (see Box 8) should be monitored and have a reassessment of clinical status, ECG, and biochemical markers. They can then be reclassified depending on results of these investigations into high risk or low risk.

Low-risk patients

Patients with NSTEMACS who are at low risk (see Box 8) need further cardiac assessment. This involves stress testing, and patients with a positive test should proceed to further investigation and management. Patients should be treated with antiplatelet therapy (usually aspirin) while being assessed.

All patients with NSTEMACS should be discussed with the Medical/Cardiac Unit at the Divisional Hospital.

Recurrent pain in NSTEMACS

For isolated episodes of ischaemic pain, use:

- glyceryl trinitrate tablet 300–600 micrograms sublingually; repeat the dose every 5 minutes up to a maximum dose of 1800 micrograms (3 tablets) if required and BP adequate.

If pain persists consider long-acting nitrate therapy as per 'Ongoing pain post-STEMI' in Section 7.1.

For patients already started on a beta blocker, verapamil or diltiazem, the dose should be maximised.

If ischaemic chest pain recurs in a patient already on the maximum dose of a beta blocker, a dihydropyridine calcium channel blocker may be added. Use:

- amlodipine 5–10 mg orally, once daily.

Beta blockers **should not** be combined with verapamil or diltiazem.

Recurrent pain should lead to re-evaluation of risk category and management accordingly.

7.3 Management of complications following myocardial infarction

Left ventricular failure

The cause of left ventricular failure is most commonly a large infarct or recent infarction on top of previous left ventricular damage. Mechanical complications must also be considered, particularly when decompensation is abrupt and unexpected. Ventricular septal defect or mitral regurgitation is suggested by a

prominent systolic murmur, often with pulmonary oedema, right heart failure, hypotension, or shock.

A mild episode of acute pulmonary congestion in a patient who has recently suffered a myocardial infarction usually responds to a diuretic. In more severe episodes, administer:

- oxygen 4–6 L/minute via a mask

PLUS

- frusemide 40–80 mg IV, repeated 20 minutes later if necessary

PLUS

- glyceryl trinitrate 600 microgram tablet sublingually; repeat the dose every 5 minutes (up to a maximum of 1800 micrograms — 3 tablets) if there is not an adequate clinical response and depending on blood pressure.

Consider giving a dose of morphine if necessary. Use:

- morphine 1–2.5 mg IV as a single dose (use lower end of the dose range in the elderly).

Monitor conscious state and respiratory rate for patients on morphine. Digoxin should not generally be used for the treatment of heart failure in patients who are in sinus rhythm immediately following myocardial infarction. Rather, its use should be reserved for patients who have atrial fibrillation. The risk of toxicity is considerable, particularly in a patient undergoing a substantial diuresis, which can cause potassium depletion.

More florid left ventricular failure may require ventilatory support, including continuous positive airway pressure (CPAP).

Cardiogenic shock

Cardiogenic shock is a syndrome caused by a significant reduction in cardiac output, resulting in hypotension with signs of impaired perfusion, including oliguria. Even with aggressive supportive therapy, mortality in patients with cardiogenic shock is very high. Management of hypotension may include inotropic support. Use:

- noradrenaline IV infusion, titrated to blood pressure (refer to Annex C for adrenaline/noradrenaline intravenous infusion calculations).

Noradrenaline should ideally be administered through a central venous catheter or at least a large antecubital vein. Alternative inotropic drugs include dobutamine or dopamine. Adrenaline may be used where other options are not available.

The possibility of cardiac rupture should be considered if there is sudden clinical deterioration. Immediate confirmation of cardiac tamponade by echocardiography, with urgent pericardiocentesis, can be lifesaving.

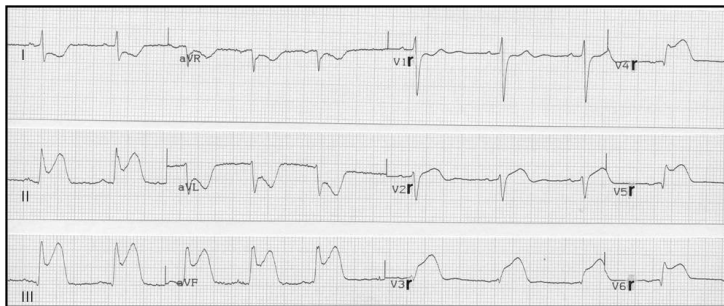
Right ventricular infarction

Right ventricular infarction may accompany inferior myocardial infarction. The cardinal features are:

- raised jugular venous pressure (JVP)
- hypotension, oliguria, and possibly shock
- clear chest on auscultation.

Right ventricular infarction is suggested by ECG evidence of ST elevation in lead V3-4R in the context of an inferior infarct (see Figure 2), and is confirmed by echocardiography.

Figure 2 — Right ventricular infarction ECG trace²⁰



Such patients should be given a gentle intravenous fluid challenge, beginning cautiously, using:

- sodium chloride 0.9% solution 200 mL aliquot IV, over 30 minutes, repeat as required.

During fluid loading, the patient must be observed closely for deteriorating haemodynamic status and development of left ventricular failure. Haemodynamic monitoring is helpful to guide therapy when hypotension and oliguria fail to

respond promptly, when inotropic support is needed, and when the relative contribution of left versus right ventricular dysfunction is unclear. Referral to CCU or ICU may be required.

Vasodilators (nitrates and ACEI) and beta blockers should be avoided acutely in patients who are suspected or proven to have right ventricular infarction as they may precipitate cardiogenic shock.

7.4 Secondary prevention of cardiovascular events post ACS

Post ACS, patients should have ongoing pharmacological and non-pharmacological treatment to prevent further cardiovascular events.

Consideration should be given to further cardiac evaluation, including referral for exercise stress testing, echocardiography and coronary angiography, and revascularisation. Discuss with the Medical/Cardiac Units at the Divisional Hospitals.

Pharmacological treatment

Patients should continue long-term on combination therapy with beta blockers, statins, antiplatelet drugs, and ACEIs and ARBs, as initiated above.

Due to the need for ongoing polypharmacy, encouraging full adherence with therapy is a long-term imperative. Shared medical management models that encourage active patient participation, such as self-monitoring of BP, can be associated with improved adherence.

7.5 Lifestyle modification

The non-pharmacological management of each risk factor is critical to long-term survival.

Smoking cessation

Smoking is a strong independent risk factor for cardiovascular disease. Smoking cessation is one of the most effective lifestyle interventions for preventing future myocardial infarction, stroke, and premature death.

The risk of acute myocardial infarction increases with every additional cigarette smoked per day. In patients with coronary heart disease, smoking cessation is associated with a 36% reduction in the risk of all-cause mortality.

Exercise therapy

Exercise therapy benefits patients with angina, recent myocardial infarction, coronary artery bypass, and coronary angioplasty **provided these conditions are stabilised with optimum medical and surgical therapy.**

Aerobic exercise should be carefully and individually prescribed with clear advice given to each patient. For example, a plan may include:

- **duration:** 30 to 60 minutes per day.
- **frequency:** at least five times per week.
- **intensity:** using either the subjective Borg rating scale (aiming for 13 to 15) or an objective heart rate of 70% of maximum, building to 85% of maximum (equivalent to 220 minus age) by 3 months. For example, for a 57 year old it would be:

$$220 - 57 \text{ years} = 163 \times 85/100 = 143 \text{ beats per minute.}$$

Increase in heart rate will be unreliable in patients taking beta blockers. Such patients may be advised to exercise to the level of moderate breathlessness that still allows conversation.

Aerobic exercise should maximise the development of collateral coronary circulation (e.g. brisk walking, running, swimming, cycling). Isometric exercise (e.g. weight lifting), which produces a rapid rise in BP, should be avoided.

It is recommended that patients undertake ten-minute periods of warm-up exercises to generate a gradual tachycardia and prevent musculoskeletal injury, as well as warm-down exercises to prevent ventricular arrhythmia. A patient commencing an exercise-training program should start with low-intensity exercise and increase the intensity gradually.

Diet

Advice should be specific and individualised, and emphasise that any dietary changes need to be maintained long-term. Refer to Section 2.2 for further details.

Evidence shows that there is no benefit from folic acid supplementation, and evidence for risk reduction through vitamin B and E supplementation is lacking. A

meta-analysis of available data suggests no benefit for antioxidant vitamin supplementation.

7.6 Cardiac rehabilitation programs

A cardiac rehabilitation (CR) program is a coordinated system of care to help people with heart disease return to an active and satisfying life. CR improves clinical and behavioural outcomes. These include fewer hospital admissions, better adherence to pharmacotherapy, enhanced functional status, improved risk profile, less depression, better quality of life, and improved exercise tolerance and survival rates.

Where available, all patients with cardiovascular disease should be provided with CR as soon as possible following hospital admission for any cardiovascular event.

The core components of a cardiac rehabilitation program include:

- patient (and family or carer) reassurance and psychosocial support
- baseline clinical, psychosocial, and risk factor assessment
- screening for depression
- explanation of treatment plan
- health education specific to the individual patient risk factor profile
- a written medication list that includes indications for each drug and the intended duration of therapy to optimise adherence to pharmacological therapy
- individualised physical activity and exercise training programs
- advice regarding resumption of work, driving, and sexual activity
- counselling support promoting behavioural change and addressing specific psychosocial and emotional issues
- peer and group support.

References

Therapeutic Guidelines Limited. (March 2015). *eTG complete* [online resource]. Melbourne: Author.

Yanowitz, F.G. (n.d.). Myocardial infarction. *ECG Learning Center*. Retrieved 9 December 2014, from: <<http://ecg.utah.edu/lesson/9>>.

¹⁹ Therapeutic Guidelines Limited. (March 2015). *eTG complete* [online resource]. Melbourne: Author.

²⁰ Yanowitz, F.G. (n.d.). Myocardial infarction. *ECG Learning Center*. Retrieved 9 December 2014, from: <<http://ecg.utah.edu/lesson/9>>.

8. Stable angina

Angina occurs when myocardial oxygen demand exceeds supply. Demand is typically increased by exercise or emotion. Supply is restricted by atherosclerotic obstruction of the coronary arteries and anaemia.

The pain of stable angina is typically transient, lasting less than 10 minutes, and subsides promptly with rest. The pain usually bears a predictable relationship to walking and other activities involving physical effort or emotional stress. A careful history is critical to diagnosis.

Angina is categorised as stable if the pattern of symptoms has not changed during the past month, such as the distance walked before the development of angina (allowing for terrain, meals, and cold weather).

Not all patients experience typical retrosternal cardiac chest pain, which is constricting and radiates to the neck, jaw, or arm. Some experience atypical pain, or shortness of breath or light-headedness (angina-equivalent). Others, especially elderly patients or patients with diabetes mellitus, may have no symptoms (silent ischaemia). Significant comorbidities such as anaemia, smoking, aortic stenosis, hypertension, thyrotoxicosis, and hypertrophic cardiomyopathy should be considered and treated appropriately.

8.1 Management of stable angina

Patients with a new diagnosis of stable angina should be referred to the Medical/Cardiac Unit at the Divisional Hospital for further evaluation, e.g. exercise stress testing, echocardiography, or coronary angiogram.

It is important to motivate patients to work towards clear and agreed goals and targets, and to develop an action plan for acute exacerbations. It is reassuring to remind patients and their families that much can still be done to inhibit the further progression of ischaemic heart disease.

In addition to drug therapy, reversible risk factors must be assessed and optimally managed, e.g. hypertension, smoking, dyslipidaemia, obesity, and diabetes.

Management options for treatment of stable angina should include the medications recommended for secondary prevention of cardiovascular events, as

well as those listed to treat episodes of angina and to prevent symptoms of angina (see Sections 8.2 and 8.3 following).

Advice should be given regarding the value of a graded program of regular moderate exercise and the need to avoid heavy, sudden, and unaccustomed isometric exertion and acute emotional stress.

8.2 Treatment of acute episodes of angina

The patient should stop activities as soon as pain is felt. Before taking medication, they should sit or lie down, particularly when first using glyceryl trinitrate, because of the possibility of hypotension. To shorten the attack, use:

- glyceryl trinitrate tablet 600 micrograms sublingually, repeat every 5 minutes if pain persists, up to a maximum of 1800 micrograms (3 tablets).

If pain persists for more than 10 minutes despite taking two doses, the patient should be advised to take a third dose and immediately go to the nearest hospital emergency department.

All patients should be instructed on the use of the glyceryl trinitrate as prescribed and warned of the possible adverse effects. Consider giving a single trial dose under supervision when asymptomatic so that the patient will recognise the effect.

8.3 Treatment to prevent symptoms of angina

The aims of continuing therapy are to reduce myocardial oxygen demand and increase oxygen supply, increase effort tolerance, and prevent the development of symptoms and complications.

Beta blockers

Beta blockers enhance effort tolerance by reducing myocardial oxygen demand. For patients in whom a beta blocker is **not** contraindicated, use:

- atenolol 25 to 100 mg orally, daily.

Calcium channel blockers

Nondihydropyridine calcium channel blockers (diltiazem and verapamil) reduce heart rate and can be used as an alternative to a beta blocker if the patient has a contraindication to beta blockade. They should not be administered in

combination with beta blockers because of the risk of severe bradycardia and heart failure.

For patients in whom there is a contraindication to a beta blocker use:

- verapamil 40–120 mg orally, two to three times daily

OR

- diltiazem 30–60 mg orally, three times daily (currently unavailable on the Fiji EML).

A dihydropyridine calcium channel blocker (e.g. amlodipine) can be added to beta-blocker therapy, but not to verapamil or diltiazem. It can also be used alone for angina, but caution should be exercised because of the possibility of increased sympathetic tone and heart rate secondary to arteriolar dilation.

For patients in whom a beta blocker alone does not prevent angina, add:

- amlodipine 5–10 mg orally, once daily.

Nitrates

Long-acting nitrates can provide symptomatic relief of angina. However, tolerance to all forms of nitrate therapy develops rapidly. No evidence indicates that long-acting nitrates improve survival in patients with coronary artery disease. If considered appropriate, use:

- isosorbide dinitrate 10–20 mg orally, three times daily

OR

- isosorbide mononitrate extended-release 30–60 mg orally once daily, up to a maximum of 120 mg once daily (currently unavailable on the Fiji EML)
- OR
- glyceryl trinitrate 5–15 mg patch transdermally, once daily, applied for a maximum of 14 hours in a 24-hour period (currently unavailable on the Fiji EML).

Short-acting nitrates can be used prophylactically before exertion that is likely to provoke angina.

For patients on sildenafil therapy, the addition of nitrates is contraindicated.

Coronary artery stents

Acute stent thrombosis is a rare but serious complication of coronary artery stenting. The incidence of late stent thrombosis may be less with the latest generation of drug-eluting stents than with previous generations of stents.

To minimise the risk of stent thrombosis, patients with coronary stenting are routinely treated with aspirin and clopidogrel. Aspirin should be continued indefinitely following stenting.

Dual antiplatelet therapy (aspirin and clopidogrel) is recommended for 6 weeks after deployment of a bare metal stent and for 12 months after a drug-eluting stent (DES). Clopidogrel is currently unavailable on the Fiji EML.

Patients presenting with ischemic chest pain within 24 hours of stent insertion may have stent thrombosis. They should be discussed urgently with the cardiology team.

References

Therapeutic Guidelines Limited. (March 2015). *eTG complete* [online resource].
Melbourne: Author.

9. Pericardial disease

9.1 Pericarditis

Symptoms and signs of pericarditis may include:

- A prodrome of fever and malaise.
- Sharp retrosternal or left-sided chest pain. The pain is often eased by leaning forward and is worse in the supine position.
- Friction rub on auscultation, often transient.
- Tachycardia (often).

There may also be evidence of the underlying cause, e.g. malar rash in SLE.

Pericarditis may be associated with pericardial effusion. Additional signs may include:

- Low volume pulse
- Hypotension
- Paradoxical pulse (systolic BP decrease by >10 mm Hg during inspiration)
- Raised JVP
- Muffled heart sounds.

Cardiac tamponade is characterised by the above features plus signs of shock.

The most common causes of pericarditis are viral or idiopathic, but pericarditis/pericardial effusion can also occur as a complication of myocardial infarction, autoimmune connective tissue disorders, neoplasia, bacterial infection (including tuberculosis), or uraemia. Pericarditis can be dry, fibrinous, or effusive regardless of the underlying cause.

Urgent considerations when assessing patients with suspected acute pericarditis are:

- To differentiate it from other life-threatening causes of chest pain, including acute coronary syndrome, pulmonary thromboembolism, and aortic dissection.
- To identify clinically significant pericardial fluid accumulation that may progress to cardiac tamponade.

Prompt echocardiography may be required to determine the presence and amount of pericardial fluid. When cardiac tamponade is present, urgent pericardiocentesis is required. Patients with suspected pericarditis should be discussed with the Divisional Hospital Medical/Cardiac Unit.

9.2 Pericarditis management

The treatment of acute pericarditis depends on the underlying cause. Specific treatments may be required; for example in patients with connective tissue disorders (immunosuppression), tuberculosis (anti-TB medications with steroids), uraemia (dialysis), or purulent pericarditis (antibiotics and drainage).

For acute viral pericarditis (one of the most common causes of pericarditis), use a NSAID unless otherwise contraindicated.

Use:

- ibuprofen 400–800 mg orally, three times daily for 1–2 weeks depending on response.

NSAIDs may exacerbate renal impairment and in this situation paracetamol is often used, although it is less effective.

Occasionally pericarditis can be recurrent or inadequately controlled by NSAIDs. The addition of colchicine may reduce symptoms and the recurrence of pericarditis.

Use:

- colchicine 0.5 mg twice daily for up to three months.

Glucocorticoids may be considered in patients who do not respond to the above medications. Use:

- prednisone 0.25–0.5 mg/kg per day as a single dose for one week and reduce over another week depending on response.

Pericarditis is a relative contraindication to the use of anticoagulants because haemorrhagic effusion can cause cardiac tamponade. However, pericarditis can complicate large myocardial infarcts, where there is a strong indication for anticoagulation. Hence, anticoagulation may be continued with caution, being prepared to discontinue promptly if clinical signs and/or echocardiography suggest cardiac compression.

References

Therapeutic Guidelines Limited. (2015). *eTG complete* [online resource].
Melbourne: Author.

10. Heart failure

Heart failure is a complex syndrome most frequently seen in older persons. Therapies are targeted towards symptom control and improvement of survival; therapies that have been shown to reduce mortality in heart failure include angiotensin converting enzyme inhibitors, angiotensin II receptor blockers, beta blockers, and aldosterone antagonists.

Heart failure can be predominantly left ventricular, with pulmonary congestion and dyspnoea, or predominantly right ventricular, with elevated venous pressure, peripheral oedema, and liver congestion. Usually both coexist in the classical syndrome of congestive, or biventricular, heart failure. Isolated right ventricular failure can be a consequence of pulmonary hypertension, secondary to lung disease, recurrent pulmonary embolism, mitral stenosis, or congenital heart disease.

Heart failure is generally a consequence of myocardial damage leading to left ventricular systolic dysfunction (HF-LVSD), previously known as systolic heart failure.

However, sometimes patients (particularly the elderly and patients with hypertension or diabetes) present with classical symptoms and signs of heart failure, but investigation reveals normal or near-normal systolic function (ejection fraction greater than 40%). In these cases there are two possibilities:

- The patient does not have heart failure; consider alternative differentials, e.g. fluid overload, kidney disease, chronic liver disease, severe lung disease, pericardial effusion, and pericardial constriction.
- The patient has heart failure with preserved left ventricular ejection fraction (HFPEF), previously known as diastolic heart failure.

There are minor differences in how management is approached in patients with HFPEF compared with those with HF-LVSD (see below).

10.1 Causes and specific therapies

A major goal of management of heart failure is to identify underlying causes and/or precipitating factors that may be reversed by specific therapy. Early treatment of potential causes of heart failure can delay or prevent heart failure from developing, or slow progression. When treating a patient with heart failure, a specific diagnosis of the underlying cause should be sought. Consider:

- coronary artery disease
- valvular heart disease
- hypertension
- diabetes
- obstructive sleep apnoea
- excess alcohol use
- hypertrophic cardiomyopathy
- hyperthyroidism
- chronic lung disease with cor pulmonale
- pulmonary embolism
- chronic constrictive pericarditis.

Often the underlying cause of heart failure is apparent from clinical assessment together with an ECG and chest X-ray. However, other investigations (non-invasive and invasive) may be required for diagnosis and assessment of severity and prognosis.

If possible, all patients with heart failure should have a transthoracic echocardiogram, which can give diagnostic quantification of their ejection fraction and can assess valvular function.

10.2 Precipitating or exacerbating factors

Regardless of the underlying cause, heart failure may have a precipitating factor requiring specific therapy. Precipitating factors include:

- lack of adherence to treatment, particularly to diuretics
- dietary lapse (e.g. excessive fluid, salt, alcohol intake)
- fluid overload

- tachyarrhythmias such as atrial fibrillation, atrial flutter, or atrial or ventricular tachycardia
- bradyarrhythmias such as sinus bradycardia or heart block
- myocardial ischaemia or infarction
- acute valvular dysfunction (e.g. rupture of chordae tendineae to mitral valve, mechanical valve dysfunction, perforated valve)
- perforated interatrial or interventricular septum
- medication therapy, e.g. negatively inotropic drugs (verapamil) or salt-retaining drugs (corticosteroids, nonsteroidal anti-inflammatory drugs)
- infection (e.g. bronchopneumonia, urinary tract infection, endocarditis)
- pulmonary embolism
- anaemia
- hyperthyroidism or excessive thyroxine therapy.

10.3 Non-pharmacological management of heart failure

General lifestyle measures are important.

Diet

A general healthy dietary plan should be followed. Further dietary modifications may be required for associated comorbidities, e.g. diabetes, coronary artery disease.

Sodium restriction advice should be given for all:

- A low salt diet (60–100 mmol salt per day) should be recommended.
- More severe salt restriction may be necessary in patients with severe heart failure. The use of diuretics reduces the need for strict sodium restriction in many patients.

Fluid restriction

Fluid restriction may be of benefit for patients where intake is excessive or where hyponatremia is present. It may also be required with severe heart failure. Fluid intake should be limited to 1.5 litres per day or less in patients with hyponatraemia, particularly in those in whom the serum sodium concentration falls below 130 mmol/L.

Weight reduction

Weight reduction should be advised for overweight patients.

Physical activity

Physical activity is important. Patients should be strongly encouraged to be active when symptoms are absent or mild. However, bed rest may have a marked diuretic effect and, in general, patients should be rested when symptoms are severe.

Tobacco consumption

Tobacco consumption should be ceased and alcohol consumption restricted to recommended levels. Stress management is important.

10.4 Pharmacological management of heart failure

Combination drug therapy in HF-LVSD improves prognosis, reduces hospital admissions, and controls symptoms. The best combination therapy is with an ACEI, a beta blocker (see next page), and a diuretic.

In general, it is important to start with low doses of an ACEI (and beta blocker if used) and to increase the dose slowly, while not being afraid of an asymptomatic fall in BP (providing systolic BP remains ≥ 90 mm Hg), a small rise in serum creatinine, or a slight rise in serum potassium.

Optimisation of therapy may take several months and requires close monitoring of symptoms, fluid status, and kidney function and electrolyte concentrations.

A patient presenting with severe biventricular failure will usually require frusemide therapy initially. Diuretics can also be added to ACEI therapy at any stage to help control congestive symptoms and signs. Spironolactone should also be considered in any diuretic regimen, as it has been shown to improve survival and reduce complications in more severe heart failure.

Angiotensin converting enzyme inhibitors

All patients with HF-LVSD should receive an ACEI as initial therapy unless there are contraindications.

Patients with HFPEF may benefit from ACEIs, and this is often indicated for a comorbidity (e.g. hypertension, diabetes, ischaemic heart disease), but there is insufficient evidence of effectiveness to recommend general use in this condition.

The risk of first-dose hypotension can be minimised by starting therapy with low doses. This risk is increased in patients:

- of older age
- with dehydration
- with postural hypotension
- on high doses of potent diuretics or on diuretic combinations
- with significant hyponatraemia
- with severe or acutely decompensated heart failure
- on multiple other vasoactive drugs, e.g. for hypertension.

In patients already taking high doses of potent diuretics, or combinations of diuretics (e.g. loop diuretic plus thiazide diuretic), the dose(s) of diuretic(s) should be reduced 24 to 48 hours before commencing ACEI therapy.

Use:

- enalapril 2.5 mg orally, daily, followed by gradual increments to a maximum of 20 mg twice daily.

If enalapril is not tolerated because of a cough, an angiotensin receptor blocking drug can be substituted, e.g.:

- losartan 25 mg orally, once daily, increasing as necessary to 50 mg twice daily (currently unavailable on the Fiji EML).

Beta blockers

Clinical trials have demonstrated unequivocally the beneficial effects of some beta blockers (in combination with ACEI) in patients with HF-LVSD. Beta-blocker therapy should therefore ideally be added to ACEI therapy for all patients with HF-LVSD where no contraindications exist. However, the beta blockers currently recommended for heart failure therapy (bisoprolol, carvedilol, metoprolol CR, and nebivolol) are currently unavailable on the Fiji EML.

Retrospective data suggests a possible class effect²¹ with benefit also from atenolol, but the evidence is not yet conclusive; therefore, its use cannot be routinely recommended in Fiji at this point.

Where available use:

- metoprolol succinate controlled-release (XL) 23.75 mg orally, once daily. Dose may be doubled every 2–4 weeks providing the patient is stable, aiming to increase to the highest tolerable dose up to a maximum of 190 mg once daily (currently unavailable on the Fiji EML).

Carvedilol or bisoprolol may also be used, but are considerably more expensive and currently unavailable on the Fiji EML.

Patients with heart failure are often very sensitive to beta blockers. Complications of beta-blocker therapy in patients with heart failure that may arise include initial worsening of the failure, hypotension, and bradyarrhythmias.

Beta-blocker therapy **should not** be commenced in patients with decompensated heart failure until the fluid overload state has been resolved. The complications of beta-blocker therapy are due to the drug blocking sympathetic nervous system support for the failing heart and can be minimised by:

- **not** initiating beta-blocker therapy during a period of acute decompensation
- starting therapy with very low doses
- increasing the dose very gradually (no faster than a dose increase every 2–4 weeks)
- monitoring the patient closely
- adjusting the dose of other drugs, such as diuretics and ACEI, to compensate for any tendency to increased heart failure
- avoiding simultaneous addition of vasodilator drugs
- avoiding concomitant use of verapamil.

The best advice is to ‘start low and go slow’.

Prior to commencing beta-blocker therapy, patients should be discussed with the Medical/Cardiac Unit at the Divisional Hospital.

Limited studies have not shown benefit of beta-blocker therapy over placebo in patients with HFPEF. However, beta blockers may be used where otherwise indicated in these patients, particularly in the setting of atrial fibrillation, where there is a fast resting heart rate, or with coexisting ischaemic heart disease.

Frusemide

Frusemide is commonly used to treat the symptoms of fluid retention in heart failure, including pulmonary oedema and peripheral oedema. A mild increase in serum creatinine (fall in eGFR) is commonly observed in patients with heart failure when they are started on combined ACEI and diuretic therapy. This is not usually an indication to stop the ACEI therapy, but requires monitoring (with weight, kidney function, and electrolytes), and may require (diuretic) dose titration.

Use:

- frusemide 40 mg orally, daily titrating as required for symptom control.

The maximal dose of frusemide that can be used is 500 mg twice daily; however, patients requiring higher doses should be discussed with the Medical/Cardiac Unit at the Divisional Hospital.

Note: frusemide is available in 40 mg and 500 mg tablets for convenience.

Daily weight charts are a useful indicator of fluid retention or loss. When starting a patient on diuretic therapy for acute heart failure, or when adjusting doses, a maximum weight loss of 2–3 kg per day is appropriate.

Spirolactone

Spirolactone therapy has outcome benefits (improved survival, reduced hospitalisations) in patients with more advanced heart failure. In patients with HF-LVSD whose symptoms are not controlled on a combination of optimal doses of an ACEI and a loop diuretic, consider adding an aldosterone antagonist. Use:

- spironolactone 12.5–50 mg orally, daily.

Note that adding spironolactone to an ACEI (or ARB) can cause life-threatening hyperkalaemia in patients with renal impairment; close monitoring of renal function and potassium is required.

Digoxin

There are two indications for the use of digoxin in patients with heart failure:

- patients with atrial fibrillation to control rapid ventricular rate
- patients with sinus rhythm when heart failure is not adequately controlled by optimal doses of ACEI, beta blocker, loop diuretic, and aldosterone antagonist.

Most patients can be started on low-dose digoxin and don't need a loading dose.

Use:

- digoxin 62.5–250 micrograms orally, daily, according to age, eGFR, and plasma digoxin concentration.

In patients with normal kidney function, the half-life of digoxin is at least 24 hours. Following initiation or change in digoxin dose, it takes at least 5 days to achieve a steady state. In patients with impaired kidney function, the half-life of digoxin may be greatly prolonged. These patients take much longer to reach a steady state and their maintenance dose is lower. Digoxin plasma concentration should be monitored where possible (tests for serum digoxin levels are available at CWMH and Lautoka Hospital).

Warfarin

Oral anticoagulation with warfarin may be considered to prevent stroke and systemic embolism in patients with severe left ventricular systolic dysfunction and a previous unexplained systemic embolism and/or LV thrombus on echocardiogram. However, the INR may be less stable in the presence of heart failure, making therapy more difficult to control.

Patients with heart failure with preserved left ventricular ejection fraction

Some drugs can have deleterious effects in patients with HFPEF and significant diastolic dysfunction, and should be used with care:

- Patients with HFPEF generally have normal left ventricular volume and are very sensitive to diuretics. Excessive diuresis can easily produce severe reductions in cardiac output and blood pressure.
- Venodilators (e.g. isosorbide dinitrate) can cause severe reductions in cardiac output and blood pressure.

Digoxin and other inotropic drugs **should be avoided** in these patients, unless they are in atrial fibrillation.

10.5 Acute cardiogenic pulmonary oedema

Acute cardiogenic pulmonary oedema is a medical emergency that requires urgent treatment. This treatment may be initiated at the Health Centre, but the patient should be transferred to a Subdivisional or Divisional Hospital for further assessment and management.

Immediate treatment

The patient should be reassured that their condition can be quickly treated. They should be managed sitting as upright as possible. Use:

- oxygen 15 L/minute via an oxygen mask fitted with a reservoir to maximise inspired oxygen delivery

PLUS

- frusemide 20–40 mg IV, repeated 20 minutes later if necessary. An initial higher dose should be given if the patient is on long-term high dose frusemide therapy.

IF systolic BP is >100 mm Hg, also give:

- glyceryl trinitrate 600 microgram tablet sublingually. Repeat the dose every 5 minutes up to a maximum of 1800 micrograms (3 tablets) if there is not an adequate clinical response and depending on BP.

Intravenous glyceryl trinitrate infusion may also be used where pulmonary oedema is severe and not responding to the above measures (providing systolic BP is >100 mm Hg) (currently unavailable on the Fiji EML).

Where non-invasive ventilation (CPAP) is available, it should be commenced early in addition to the above measures.

Insert an indwelling catheter to monitor urine output. If urine output has not been established, consider further doses of diuretic (frusemide).

Acute pulmonary oedema can be associated with acute anxiety and distress. In addition, the patient may have difficulty tolerating non-invasive ventilation. For these situations, use:

- morphine 2.5 mg IV, as a single dose.

Monitor conscious state and respiratory rate where morphine is used.

If the patient is in atrial fibrillation with rapid ventricular rate and it is thought to be a contributing factor to poor cardiac output, use:

- digoxin: load with 250–500 micrograms (in 20 mL of normal saline infused slowly over 10 minutes), repeated po/IV every 6 hours to a maximum dose of 1.5 mg, then maintenance dose of 62.5–250 micrograms orally daily depending on age and eGFR.

Alternatively, where cardiac monitoring is available, consider:

- amiodarone 5 mg/kg loading dose in 250 mL 5% Dextrose IV infusion, over 1 hour (refer to Annex C for infusion protocols).

If the patient is in atrial fibrillation with rapid ventricular rate and is not responding to treatment or is deteriorating, consider electrical cardioversion.

If the patient is unresponsive to the above measures, intubation and admission to an intensive care unit is necessary. Clinical indications include:

- patient exhaustion
- declining level of consciousness
- increasing confusion and agitation
- rising partial pressure of carbon dioxide (PaCO_2)
- failure to maintain an adequate partial pressure of oxygen (PaO_2).

Underlying aetiology and precipitating factors must be identified and treated. Patient education is important.

10.6 Arrhythmias in heart failure

Arrhythmias causing heart failure

Occasionally, arrhythmias are the primary cause of heart failure in a patient with an otherwise normal heart. The clearest example is supraventricular tachycardia persisting for several weeks to months. Control of the arrhythmia can completely reverse heart failure.

More commonly, arrhythmias are secondary to underlying heart disease, but are also an important contributing cause of worsening heart failure. Examples are major bradyarrhythmias (e.g. complete heart block) and tachyarrhythmias (e.g. atrial fibrillation with rapid ventricular response). Treatment of heart failure must include appropriate treatment of the arrhythmia. Often it is not possible to

determine how much the heart failure was due to the arrhythmia and how much to the underlying heart disease until the arrhythmia has been controlled for some time.

Arrhythmias secondary to heart failure

All arrhythmias are more frequent in patients with heart failure. In general, the more severe the underlying heart disease and the heart failure, the more severe and frequent the arrhythmias.

There are a number of principles underlying the approach to the treatment and prevention of arrhythmias in patients with heart failure:

- Avoid potassium depletion from diuretic therapy. Maintain serum potassium between 4–5 mmol/L. Avoid magnesium depletion from diuretic therapy; monitor where possible where high doses of diuretics are used.
- Use ACEI in all patients and at the maximum tolerated doses, given their proven effect in reducing arrhythmias and sudden death.
- Avoid using long-term cardiac stimulants (such as oral salbutamol and theophylline) because of their proarrhythmic actions.

References

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²¹ Chatterjee, S., Biondi-Zoccai, G., Abbate, A., D'Ascenzo, F., Castagno, D., & Van Tassell, B. (2013). Benefits of β blockers in patients with heart failure and reduced ejection fraction: Network meta-analysis. *British Medical Journal*, 346, 55.

11. Acute management of arrhythmias

Options for managing arrhythmias include:

- no specific therapy and/or supportive care
- antiarrhythmic drugs
- electrical cardioversion.

Options not routinely available in Fiji include radiofrequency ablation, surgical techniques, pacemakers, and implantable cardioverter defibrillators.

Careful consideration should be given to the **no therapy** option in view of the relatively benign nature of many arrhythmias, the adverse effects of antiarrhythmic drugs, and the fact that some arrhythmias may be infrequent, self-limiting, and/or asymptomatic.

Treatment should never be instituted for palpitations alone without an ECG diagnosis.

Always consider underlying abnormalities and causes. These include electrolyte disorders (e.g. hypokalaemia), myocardial ischaemia, sepsis, hypoxia, and proarrhythmic drugs (which includes many drugs used to treat arrhythmias). If identified, they should be corrected.

Symptomatic hypoperfusion, hypotension, or instability associated with a tachyarrhythmia should always be regarded as a medical emergency, which may require urgent electrical cardioversion. Other signs or features of instability include ongoing chest pain, altered mental state, acute left ventricular failure, hypoxia, and acidosis. Instability seldom occurs with a heart rate of <150 beats per minute. If heart rate is <150 beats per minute, other causes of the instability should be considered.

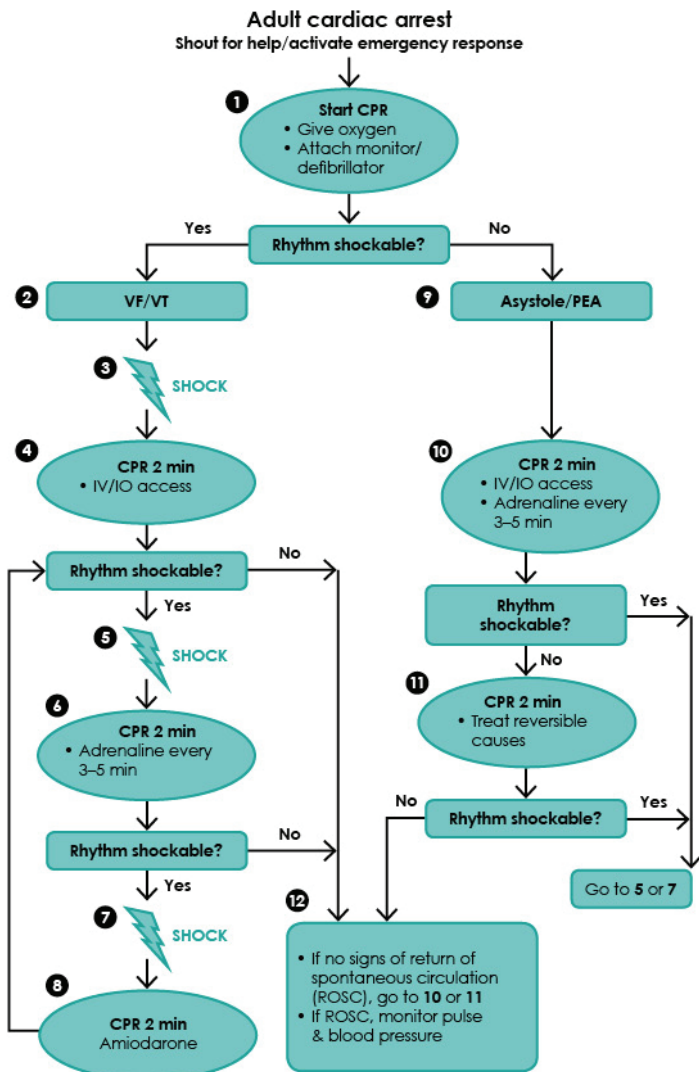
Similarly for bradycardia, always treat the patient and not the rate. Some patients can be stable and asymptomatic with heart rates <50 beats per minute, while other patients will be unstable.

Management should be based on an accurate diagnosis of the arrhythmia. The following should be taken into account:

- the current ECG and rhythm strip
- past ECGs
- past pattern of arrhythmias and treatment responses
- risk factors such as age, ischaemia, and structural heart disease.

Some patients may have had previous electrophysiological studies. Consultation is advised if there is uncertainty. The precise diagnosis may be difficult on occasions, particularly for regular wide complex tachycardia.

The following algorithms (Figures 3–6) give some guidance on the acute management of tachyarrhythmias.

Figure 3 — Cardiac arrest algorithm²²

Modified doses/details for the cardiac arrest algorithm (Figure 3)

CPR quality

- 'Push hard (≥ 2 inches [5 cm]) and fast (≥ 100 /min) and allow complete chest recoil
- Minimise interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio'.²³

Return of spontaneous circulation (ROSC)

- Monitor pulse and blood pressure.²⁴

Shock energy

- **Biphasic:** Manufacturer recommendation (e.g. Initial dose of 120–200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent and higher doses by be considered.
- **Monophasic:** 360 J.²⁵

Drug therapy²⁶

- **Adrenaline IV/IO dose:** 1 mg every 3–5 minutes
- **Vasopressin IV/IO dose:** 40 units can replace first or second dose of **adrenaline**
- **Amiodarone IV/IO dose:**
 - **First dose:** 300 mg bolus
 - **Second dose:** 150 mg.

Advanced airway

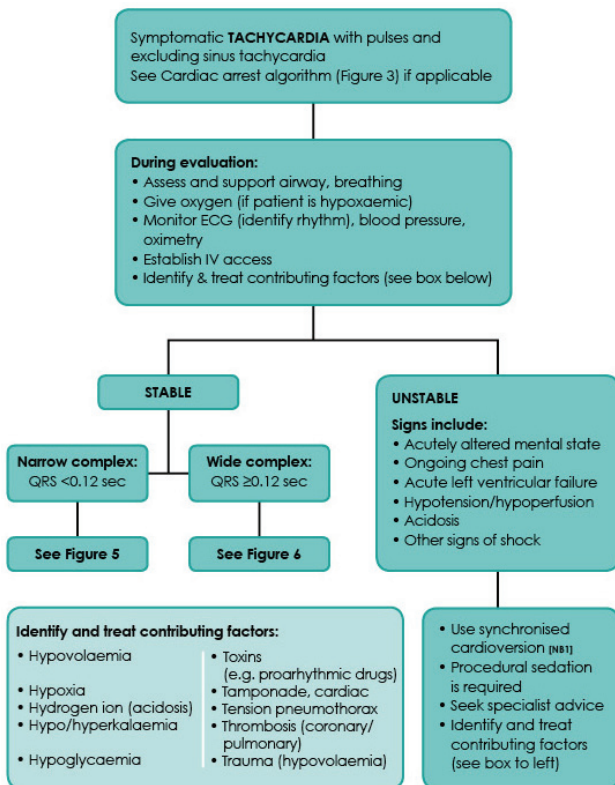
- 'Supraglottic advanced airway or endotracheal intubation'.²⁷
- '8–10 breaths per minute with continuous chest compressions'.²⁸

Reversible causes

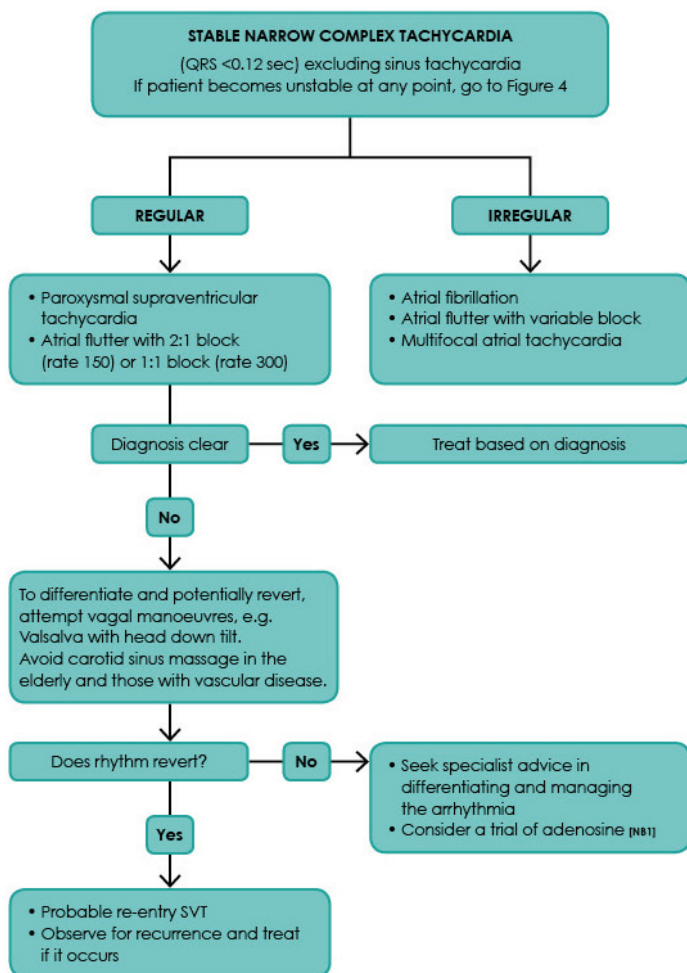
- 'Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypothermia

- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary'.²⁹

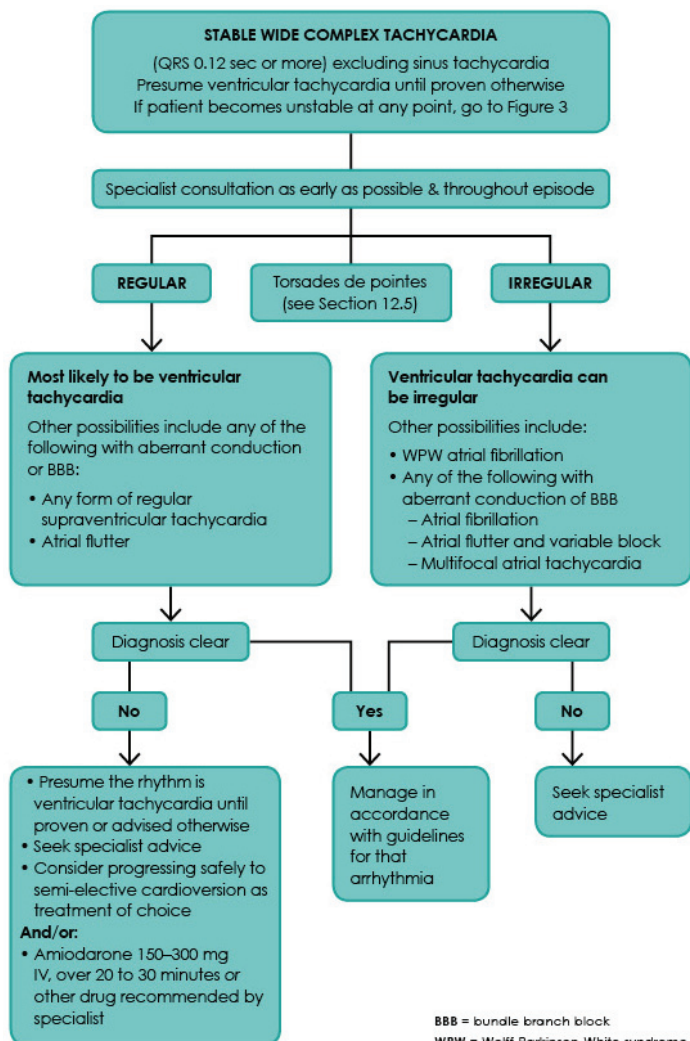
Figure 4 — Modified initial management of any tachycardia algorithm³⁰



NB1: The energy delivered is dependent on whether this is biphasic or monophasic. Biphasic is effective in lower doses than monophasic. The underlying sensitivity of the arrhythmia is important, with supraventricular tachycardia and atrial flutter generally needing less energy than atrial fibrillation and sometimes ventricular tachycardia. If in doubt 100 joules is a reasonable starting point in an adult and this can be increased stepwise.

Figure 5 — Modified acute management of stable narrow complex tachycardia algorithm³¹

NB1: Adenosine will not revert atrial flutter. When using adenosine, monitor the patient and ensure there is ready access to resuscitation equipment, as there have been case reports of serious acceleration of ventricular response following the initial atrioventricular blockade.

Figure 6 — Acute management of stable wide complex tachycardia³²

References

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²³ Ibid., p.S736.

²⁴ Ibid.

²⁵ Ibid., p.S736.

²⁶ Ibid., p.S736.

²⁷ Ibid., p.S736.

²⁸ Ibid., p.S736.

²⁹ Ibid., p.S736.

³⁰ Sourced and adapted from: Therapeutic Guidelines Limited. (March 2015). *eTG complete* [online resource]. Melbourne: Author.

³¹ Sourced and adapted from: Ibid.

³² Sourced and adapted from: Ibid.

12. Tachyarrhythmias

12.1 Sinus tachycardia

The management of sinus tachycardia involves treating the cause (e.g. pain, hypovolaemia, heart failure, thyrotoxicosis, sepsis, and anxiety). Patients without an obvious underlying factor generally need no pharmacotherapy (see Figure 7 for ECG trace).

Figure 7 — Sinus tachycardia ECG trace³³

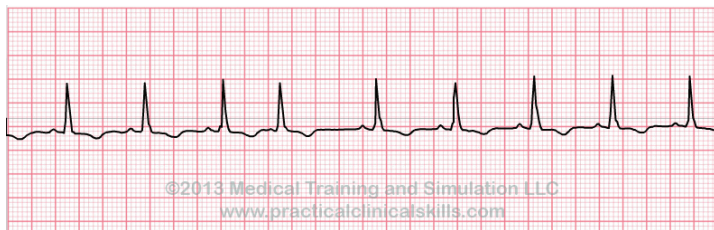


12.2 Atrial tachyarrhythmias

Atrial premature complexes

Treatment for atrial premature complexes is rarely required (see Figure 8 for ECG trace). For intolerable symptoms, use:

- atenolol 25–100 mg orally, daily
- OR
- propranolol 40–80 mg twice daily or three times daily
- OR
- verapamil 40–80 mg orally, twice daily.

Figure 8 — Atrial premature complexes ECG trace³⁴

Atrial flutter

Atrial flutter usually presents with 2:1 atrioventricular block and a regular ventricular rate of 150 beats per minute. It is often misdiagnosed as supraventricular tachycardia, but a ventricular rate of **exactly** 150 with narrow QRS complexes should always alert the clinician to the likelihood of atrial flutter. Greater degrees of atrioventricular (AV) block may be present, giving ventricular rates of 100 (3:1 block) or 75 (4:1 block) (see Figure 9).

Figure 9 — Atrial flutter ECG trace³⁵

In general, the pharmacotherapeutic approaches to atrial fibrillation and flutter are very similar. However, atrial flutter commonly responds very easily to a low-energy direct current (DC) shock and is often relatively insensitive to antiarrhythmic drugs. Therefore, referral to a Divisional Hospital for electrical treatment should be considered earlier in patients with flutter not responding to medical therapy.

Atrial fibrillation

Atrial fibrillation usually presents with an irregular ventricular rate of around 160–180 beats per minute in untreated patients with a normal AV node (see Figure 10). In patients presenting for the first time, an attempt should be made to identify and manage underlying causes (e.g. hypertension, mitral valve disease, thyrotoxicosis, and heart failure).

Figure 10 — Atrial fibrillation ECG trace³⁶

Apart from the first episode, where the natural history is not clear, atrial fibrillation tends to fall into one of three clinical patterns (the so-called ‘three Ps’), with patients sometimes progressing from one to another:

- **Paroxysmal atrial fibrillation**, where episodes come on suddenly and generally revert spontaneously within 24–48 hours without any intervention.
- **Persistent atrial fibrillation**, where episodes have a similar abrupt onset, but persist for days or weeks unless active measures are taken to revert the patient to sinus rhythm.
- **Permanent (or chronic) atrial fibrillation**, where the patient has demonstrated inability to sustain sinus rhythm for any length of time.

Patients with paroxysmal or persistent atrial fibrillation have a similar risk of thromboembolism to patients with permanent atrial fibrillation; likewise, atrial flutter carries an equivalent risk.

Management

The treatment of atrial fibrillation/flutter needs to be considered under four separate headings:

- rate control
- rhythm control
- prophylaxis against thromboembolic complications
- treatment of underlying aetiology.

Any patient with a new diagnosis of atrial fibrillation should be discussed with the Medical/Cardiac Unit of the Divisional Hospital to facilitate decision-making. At an early stage in the management of a patient with atrial fibrillation/flutter, consideration should be given to whether the major goal of therapy is control of ventricular rate to improve haemodynamic status and reduce symptoms (target of

<100 beats per minute), or whether attempts are to be made to obtain and maintain sinus rhythm (cardioversion).

There is no proven difference in mortality or in quality of life between the two approaches, and in the majority of patients a rate control strategy is most appropriate.

However, a small subset of patients may benefit from cardioversion to sinus rhythm. These are most commonly those with haemodynamic compromise due to AF, younger patients with normal/near-normal hearts who have a high likelihood of remaining in sinus rhythm post cardioversion, or those who tolerate atrial fibrillation poorly with significant symptoms despite rate control.

Rate control

In a majority of circumstances, this is the chosen goal. To obtain and maintain long-term control of ventricular rate, use:

- atenolol 25 to 100 mg orally, daily

OR

- verapamil 40–80 mg orally, twice daily, increasing to a maximum of 120 mg three times daily if required.

Ventricular rate has traditionally been controlled with digoxin, and in the elderly sedentary patient this may suffice. Digoxin is also useful in patients with both atrial fibrillation and heart failure, where other drugs may be contraindicated or may need to be introduced very slowly (e.g. beta blockers). Use:

- digoxin 62.5 to 250 micrograms orally, daily, according to age, eGFR, and plasma digoxin concentration.

Ideally a serum potassium level should be checked prior to commencing digoxin. Digoxin alone usually fails to control exercise-induced tachycardia in younger patients and more active patients. An alternative or additional therapy (as above) to control ventricular rate is generally indicated.

The intravenous route is rarely necessary and oral therapy is usually sufficient, but if more urgent rate control is desired, consider use of the following with careful blood pressure monitoring:

- verapamil 1 mg/minute IV, up to a maximum dose of 15 mg.



Intravenous digoxin is seldom required and offers little therapeutic advantage over oral dosing.

Rhythm control

If the patient has a compromised haemodynamic state, immediate cardioversion should be considered, either through electrical or pharmacological means. Use:

- amiodarone 150–300 mg IV infusion, over 20 minutes to 2 hours (refer to Annex C Infusion protocols)

OR

- synchronised electrical cardioversion: DC shock, starting with 120–200 joules (biphasic) or 200 joules (monophasic) in an average adult. Atrial flutter generally requires much less current; start with 50 joules (biphasic) or 50–100 joules (monophasic).

Cardioversion (either electrical or pharmacological) is associated with a risk of thromboembolism in patients who have been in atrial fibrillation/flutter for longer than 48 hours. In these patients elective cardioversion should only be attempted after the patient has been therapeutically anticoagulated for at least 3 weeks; in the haemodynamically unstable patient this delay may not be possible, but anticoagulation should be started immediately following cardioversion.

In the uncommon circumstances where elective cardioversion is planned, this should only be performed at the Divisional Hospital. Use:

- DC reversion, as above

OR

- amiodarone 200–400 mg orally, 3 times daily for 1 week; then twice daily for 1 week; then 100–200 mg orally, daily as an ongoing dose.

Decisions with regard to maintenance therapy with antiarrhythmics (amiodarone, sotalol, or flecainide) and anticoagulants post cardioversion are complex and should be made at a specialist level.

Anticoagulation

Atrial fibrillation itself rarely causes death or serious morbidity **except** through thromboembolic complications, especially stroke.

All patients in whom atrial fibrillation is discovered should be considered for long-term anticoagulation (usually with warfarin), whether discovery is because of



symptoms or a chance finding. An individual assessment should be made for each patient based on level of risk of thromboembolic events, risk of anticoagulant-induced bleeding, capacity for INR monitoring, and likelihood of compliance.

All patients with atrial fibrillation and valvular heart disease (including rheumatic heart disease) should be recommended for long-term anticoagulation where not contraindicated.

In non-valvular atrial fibrillation, the CHADS₂ score is the most widely used means of estimating thromboembolic risk and gives levels of risk based on a score ranging from 0 to a maximum of 6 — one point each for age >75 years, hypertension, diabetes, and heart failure; and two points for a past stroke or TIA. No treatment is recommended if the score is 0. Treatment with aspirin is recommended if the score is 1, and treatment with warfarin is recommended if the score is 2 or higher.

Regardless of the estimated risk of systemic thromboembolism, long-term anticoagulation will not always be the correct strategy for the individual patient. However, the issue should always be specifically considered and discussed with the patient, and any reasons for not anticoagulating should be documented. In most patients in the chronic setting, particularly ambulatory patients in whom cardioversion is not planned, it is reasonable to start oral anticoagulation without first initiating treatment with heparin.

If uncertainty exists as to whether to introduce oral anticoagulation, transthoracic echocardiography can help stratify risk by identifying additional echocardiographic risk factors, such as an enlarged left atrium or left atrial thrombus.

When a decision about the need for antithrombotic therapy has been made based on the risk assessment, then therapy is given as follows:

If aspirin is indicated, use:

- aspirin 100–300 mg orally, daily.

If oral anticoagulation is indicated, discuss with the Medical/Cardiac Unit at the Divisional Hospital. Use:

- warfarin orally, daily, adjusted according to the INR to a target INR of 2–3.

Alternatively, in non-valvular atrial fibrillation **only**, where warfarin therapy is not logistically possible due to inability to monitor INR, consider using:

- dabigatran 150 mg orally, twice daily (110 mg twice daily if age ≥ 75 years or potentially higher risk of major bleeding. Do **not** use if eGFR < 30 mL/min). (Currently unavailable on the Fiji EML.)

Dabigatran belongs to a new class of drugs known as direct thrombin inhibitors. It is overall of equivalent efficacy to warfarin in stroke prevention in non-valvular atrial fibrillation (its efficacy has not yet been studied in patients with haemodynamically significant valvular heart disease), but has the advantage of a fixed dose with no blood monitoring (INR) required. Direct thrombin inhibitors are currently unavailable on the Fiji EML.

12.3 Paroxysmal supraventricular tachycardia

Acute management

Narrow complex paroxysmal supraventricular tachycardia (PSVT) (see Figure 11) may be converted to sinus rhythm by manoeuvres that enhance vagal tone.

Examples of these manoeuvres are:

- Breath holding
- Valsalva manoeuvre: e.g. have patient bear down like having a bowel movement
- Carotid sinus massage: use with caution in the elderly or those with known atherosclerotic disease due to the risk of precipitating embolic stroke.

Figure 11 — Supraventricular tachycardia (abnormal) ECG trace³⁷



If these are ineffective, monitor blood pressure carefully and use:

- adenosine 6 mg IV bolus, over 5 to 10 seconds. If this is unsuccessful, then 2 minutes later give a second bolus of 12 mg. If this is ineffective but well tolerated, a further dose of 12 mg may be given. If ineffective but well tolerated, a final bolus of 18 mg may be given. Each bolus should be followed promptly by a bolus of 5–10 mL normal saline

OR

- verapamil 1 mg/minute IV, up to maximal dose of 15 mg.

Both adenosine and verapamil restore sinus rhythm in most patients. If PSVT persists, the patient should be discussed with the Medical/Cardiac Unit of the Divisional Hospital, as intravenous amiodarone or direct current (DC) cardioversion may be required.

Adverse effects with adenosine are common but transient; flushing, dyspnoea, and chest pain are the most frequently observed. Adenosine is relatively contraindicated in asthmatics and those with acute bronchospasm.

Verapamil is generally safe in adults, with the main concern being its ability to produce profound depression of contractility and/or heart rate in occasional patients. The danger of such an adverse response is also considerably greater in patients taking beta blockers or with myocardial disease.

Verapamil must never be given to a patient with an undiagnosed wide-complex tachycardia.

Preventive treatment

Patients who experience only occasional episodes of PSVT generally do not require preventive treatment. For frequent episodes use:

- atenolol 25–100 mg orally, daily

OR

- verapamil 40–80 mg orally, twice daily, up to a maximum dose of 120 mg three times daily.

If the above drugs fail, and in patients debilitated by recurrent symptoms, refer to the Medical/Cardiac Unit of the Divisional Hospital for consideration of:

- amiodarone 200 to 400 mg orally, 3 times daily for 1 week; then twice daily for 1 week; then 100 to 200 mg orally, daily as an ongoing dose

OR

- referral to an overseas centre for electrophysiological studies and consideration of radiofrequency ablation.

Investigation for and treatment of any underlying conditions is important.

12.4 Ventricular arrhythmias

Premature ventricular ectopics

Occasional premature ventricular complexes (PVCs) occur in normal subjects and may cause symptoms. They are not of prognostic significance (see Figure 12).

Frequent PVCs, usually defined as ≥ 1 /minute, may also occur in normal subjects, but are of prognostic significance in patients with underlying heart disease, particularly those with advanced left ventricular dysfunction. Patients with frequent PVCs should be referred for further cardiological assessment.

Reduction of caffeine or alcohol intake may lessen ectopic activity. In general, treatment with antiarrhythmic drugs does not improve prognosis, and some drugs can worsen it; usually specific drug treatment is not required. If treatment is needed for symptomatic relief, beta blockers may be effective. Use:

- atenolol 25–100 mg orally, daily.

Figure 12 — Premature ventricular contractions ECG trace³⁸

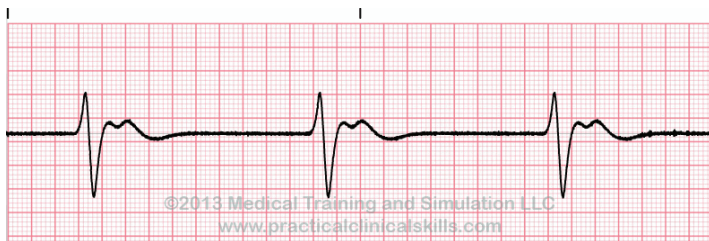


Accelerated idioventricular rhythm

Accelerated idioventricular rhythm is defined as three or more consecutive ventricular complexes at a rate between 60–100 beats per minute (see Figure 13). It may be seen after myocardial infarction, particularly inferior infarction, and following coronary reperfusion. It rarely causes symptoms or proceeds to life-threatening ventricular arrhythmias.

Antiarrhythmic therapy is usually not indicated. If the arrhythmia is recurrent or persistent and sinus bradycardia is a predisposing factor, use:

- atropine 0.6 mg IV every 3–5 minutes to a maximum of 1.8 mg IV.

Figure 13 — Idioventricular rhythm ECG trace³⁹

Ventricular tachycardia

Ventricular tachycardia (VT) is a regular broad complex tachycardia involving 3 or more consecutive ventricular beats at a rate of >120 beats per minute (see Figure 14). It may be either sustained or non-sustained; non-sustained VT persists for <30 seconds.

Figure 14 — Ventricular tachycardia abnormal ECG trace⁴⁰

Non-sustained ventricular tachycardia

For acute treatment of non-sustained ventricular tachycardia in an inpatient setting (usually monitored by ECG) treat only prolonged episodes with haemodynamic compromise, or if significant symptoms are present. Correct any underlying causes such as ischaemia or electrolyte disturbances (e.g. hypokalaemia). Treatment is otherwise similar to that for sustained ventricular tachycardia.

When non-sustained ventricular tachycardia is diagnosed outside the hospital setting, antiarrhythmic therapy is not always indicated. Attention should be paid to possible underlying heart disease (particularly coronary artery disease); referral for further cardiological assessment is appropriate. If the episode was associated with symptoms or haemodynamic compromise, use:



- atenolol 25 to 100 mg orally, daily.

If unacceptable symptoms persist, consider:

- amiodarone 200 to 400 mg orally, 3 times daily for 2 weeks as a loading dose, followed by 200 mg orally, daily.

Sustained ventricular tachycardia

Sustained ventricular tachycardia may initiate cardiac arrest.

In patients who are haemodynamically unstable, use:

- synchronised direct current cardioversion 120–200 joules (biphasic) or 360 joules (monophasic); additional shocks may be required.

DC cardioversion should also be considered at an early stage in all cases and/or if acute drug therapy is unsuccessful.

In patients who are haemodynamically stable, use:

- amiodarone 150 to 300 mg IV infusion, over 20 to 30 minutes, followed by 900 mg IV infusion over 24 hours if required (refer to Annex C for infusion protocols)

OR

- lignocaine 1 to 1.5 mg/kg (usually 75 to 100 mg) IV, over 1 to 2 minutes followed, if successful, by IV infusion (refer to Annex C for infusion protocols).

Sinus rhythm may be maintained by continuing amiodarone orally. Breakthrough episodes require increased dosage or an empirical change to an alternative drug.

If a decision is taken to continue with long-term oral drug treatment to maintain sinus rhythm, use:

- amiodarone 200 to 400 mg orally, 3 times daily for 2 weeks as a loading dose; followed by 200 mg orally, daily, increasing up to 400 mg orally, daily if necessary.

WITH or WITHOUT

- atenolol 25 to 100 mg orally, daily; use with caution due to risk of bradycardia and heart block.



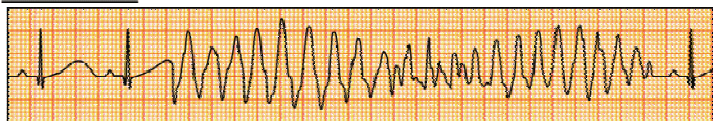
Where affordable, consideration should be given to referral overseas for electrophysiological studies and/or insertion of an implantable cardioverter defibrillator (ICD).

12.5 Torsades de pointes

Torsades de pointes is a form of polymorphic ventricular tachycardia in which the QRS axis is constantly shifting; it occurs most often in patients with a prolonged QTc interval (more than 450 milliseconds) (see Figure 15). It may occur spontaneously, or during therapy with various drugs or combinations of drugs. Updated lists of these drugs are available on the Arizona CERT website (at <www.azcert.org>). Torsades de pointes is frequently self-limiting; however, it can cause haemodynamic collapse or lead to cardiac arrest and death.

Figure 15 — Torsades de pointes ECG trace⁴¹

Torsades de pointes



The mainstay of treatment involves immediate cessation of any drug suspected of causing the arrhythmia, and correction of electrolyte abnormalities. Serum potassium should be checked urgently and intravenous potassium chloride administered to attain and maintain a serum concentration of 5 to 5.5 mmol/L.

If there is an underlying bradycardia, use atropine:

- atropine 0.6 mg IV repeated every 3–5 minutes to a maximum of 1.8 mg.

The following have been reported to be successful in terminating the condition:

- magnesium sulphate 50% solution 4 mL (2 g) IV infusion, over 10 to 15 minutes followed, if indicated, by 1 to 1.5 mL (0.5 to 0.75 g) per hour IV infusion for 12 to 24 hours

OR

- lignocaine 75 to 100 mg IV, over 1 to 2 minutes followed, if successful, by IV infusion (refer to Annex C for infusion protocols).



Magnesium sulphate is reasonably safe, although its efficacy is not well documented in clinical trials.

Antiarrhythmic therapy with amiodarone should be avoided in patients with torsades de pointes.

If torsades de pointes is associated with haemodynamic collapse, treat as ventricular fibrillation.

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⁴⁰ SJW. op cit.

⁴¹ Implantable cardioverter defibrillator related arrhythmia. (n.d.). *Torsades de pointes*. Retrieved 9 December 2014, from: <<http://www.eonet.ne.jp/~hidarite/pm/ecg05.html>>.



13. Bradyarrhythmias

Bradycardia is defined as a heart rate below 60 beats per minute (see Figure 16). However, slow heart rates are often found in normal people, especially at rest or if very fit.

The important pathological causes of bradycardia include:

- Coronary artery disease.
- Degenerative cardiac disease.
- Drugs (e.g. digoxin, beta blockers, verapamil, diltiazem, and amiodarone).
- Toxins and electrolyte disturbances.
- Hypothyroidism.

Figure 16 — Sinus bradycardia ECG trace⁴²



Degenerative cardiac diseases that result in bradycardia include:

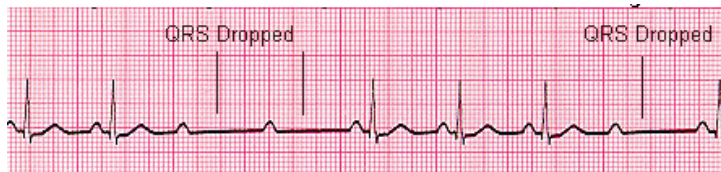
- Sinus node dysfunction (formerly called sick sinus syndrome), which is characterised by sinus bradycardia, sinus pauses, and junctional or ventricular escape rhythms. It is often associated with paroxysmal atrial fibrillation ('tachy-brady' syndrome).
- AV block, which is classified as:
 - **First-degree block**, which has a prolonged PR interval (more than 0.2 seconds) (see Figure 17). This is usually benign and does not require treatment, however the underlying cause should be considered.

Figure 17 — First degree AV block ECG trace⁴³

- **Second-degree block**, which has intermittent AV conduction, i.e. intermittent dropped beats. This can be:
 - ♦ Mobitz 1 or Wenckebach block, which involves progressive prolongation of the PR interval prior to a dropped beat (see Figure 18). It is usually transient, asymptomatic and benign, and does not require treatment.

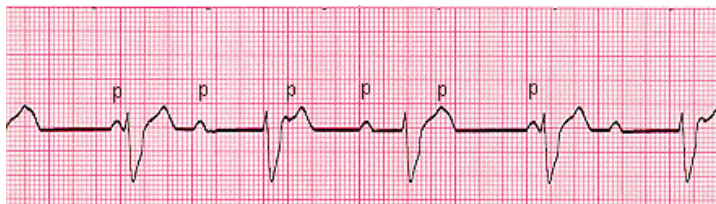
Figure 18 — Second-degree block — Wenckebach block ECG trace⁴⁴

- ♦ Mobitz 2 block, which involves intermittently non-conducted P waves, generally in a fixed ratio, with no preceding change in PR interval (see Figure 19). It is usually symptomatic and progresses on to complete heart block.

Figure 19 — Second-degree block Mobitz type 2 ECG trace⁴⁵

- **Third-degree block (complete heart block)**, which is due to complete interruption of AV conduction (see Figure 20). Block may be transient or permanent, and may or may not be symptomatic.

Figure 20 — Third-degree block ECG trace⁴⁶



Bradycardia may frequently be asymptomatic. Significant bradycardia can cause symptoms including fatigue, shortness of breath, dizzy spells and syncope, and may result in acute haemodynamic compromise (altered conscious state, hypotension, hypoperfusion, ischaemic chest pain, and heart failure).

13.1 Management

Patients with asymptomatic bradycardia usually need no treatment. Patients with symptomatic bradycardia should be referred to the Medical/Cardiac Unit at the Divisional Hospital for further cardiological assessment and management.

Management of chronic symptomatic bradyarrhythmias

- Assess for underlying cause (e.g. ischaemic heart disease, hypothyroidism) and treat where appropriate.
- Correct electrolyte disturbances.
- Identify and cease where possible drugs contributing to bradycardia (e.g. beta blockers, verapamil). Note, however, that these drugs may be required to treat co-existent tachyarrhythmias and so cannot be readily stopped.
- Patients with syncope, other symptoms and/or haemodynamic compromise due to bradycardia, or with high risk bradyarrhythmias (e.g. Mobitz II 2nd degree block, or 3rd degree AV block) should be urgently considered for pacemaker implantation if available.

Management of acute symptomatic bradyarrhythmias

Acute management is the same for all bradyarrhythmias. Acute bradyarrhythmias should only be treated if they are causing significant haemodynamic compromise with signs of decreased perfusion (hypotension, altered conscious state, ischaemic chest pain, heart failure). Use chronotropic drugs, such as adrenaline, dopamine and isoprenaline, with caution because they can provoke serious ventricular arrhythmias.

Early consultation with the Medical/Cardiac Units at the Divisional Hospital is appropriate.

If acute treatment is required, use:

- atropine 0.6–1.8 mg IV, repeated after 15 minutes if necessary to a maximum dose of 1.8 mg.

If atropine is ineffective, consider the use of:

- adrenaline 2 to 10 micrograms/minute IV infusion, titrated according to clinical response (refer to Annex C for infusion protocols)

OR

- dopamine 2–10 mcg/kg per minute IV infusion, titrated according to clinical response (refer to Annex C for infusion protocols)

OR

- isoprenaline 10 to 20 micrograms IV, repeated according to clinical response, followed by an infusion at 1 to 4 micrograms/minute (refer to Annex C for infusion protocols).

Occasionally higher doses of isoprenaline may be required, particularly in patients who have been taking beta blockers. Adrenaline is preferred if systolic blood pressure is very low (less than 80 mm Hg), as isoprenaline can sometimes further reduce blood pressure.

Where available, consider transcutaneous or temporary transvenous pacing where appropriate for acute symptomatic bradyarrhythmias not responding to atropine. In inferior myocardial infarcts, the AV block is usually at the level of the AV node and is transient and not haemodynamically significant. Atropine may be required.

In anterior myocardial infarcts, the AV block is at the level of the distal conducting tissues in the ventricle and is likely to be permanent and may be associated with haemodynamic compromise. Emergency temporary pacing is usually required in such cases.

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⁴³ Ibid.

⁴⁴ Ibid.

⁴⁵ Ibid.

⁴⁶ Ibid.

14. Rheumatic heart disease

Rheumatic heart disease (RHD) is a significant global health problem. In the most recent data available for Fiji, the prevalence of RHD confirmed by echocardiography in children aged 5–14 years is 35.4 per 1000.⁴⁷ It is the second most common cause of maternal death in Fiji and causes significant morbidity and mortality through childhood and into early adulthood.

RHD is the main sequel of acute rheumatic fever (ARF). All patients with suspected ARF must have an echocardiogram to assess for carditis. Valve repair and valve replacement surgery is done in Fiji by visiting cardiothoracic teams. Bio-prosthetic or mechanical valves are used for valve replacement surgery, and all patients who are taking anticoagulants (i.e. warfarin) following valve replacement must be followed-up at hospitals that measure INR levels for warfarin monitoring.

14.1 Acute rheumatic fever

ARF occurs most frequently in patients aged 5–15 years. It is preceded by Group A Streptococcal (GAS) infection of the throat or skin and is characterised by the following clinical manifestations (modified Jones/WHO criteria):

Major manifestations⁴⁸

- Migratory arthritis (predominantly large joints) or aseptic mono-arthritis
- Pan-carditis and valvulitis, including sub-clinical carditis (echo)
- Sydenham's chorea
- Erythema marginatum
- Subcutaneous nodules.

Minor manifestations⁴⁹

- Arthralgia
- Fever
- Elevated ESR or CRP
- Prolonged PR interval on ECG.

Box 9 — Diagnosing ARF⁵⁰

A diagnosis of ARF requires **one** of the following:

- 2 major manifestations

OR

- 1 major manifestation and 2 minor manifestations

OR, if recurrent ARF only:

- 3 minor manifestations

PLUS

Evidence of a recent GAS infection (positive throat swab or elevated antistreptolysin O [ASO] titre).

In Fiji, chorea without the other manifestations is diagnosed as ARF.

Table 7 — Age-specific upper limit of normal (ULN) for ASO titres⁵¹

Age group (years)	ASO titre: ULN (U/mL)
1–4	170
5–14	276
15–24	238
25–34	177
≥35	127

Prevention of ARF

Primary prophylaxis (treatment of acute GAS infections, e.g. strep. tonsillitis) reduces the risk of ARF and should be given when GAS throat infection is suspected. Penicillin remains the choice of antibiotic for GAS throat infection.

For adults, use:

- benzathine penicillin 1.2 million units (900 mg) IM single dose

OR

- penicillin V 500 mg orally, twice daily for **10 days**

OR, where penicillin allergy:

- erythromycin 500 mg orally, twice daily for **10 days**.

For children, use:

- benzathine penicillin (see Table 8) IM single dose

OR

- penicillin V 15 mg/kg up to 500 mg, twice daily for **10 days**

OR, where penicillin allergy:

- erythromycin 12.5 mg/kg up to 500 mg, twice daily for **10 days**.

Table 8 — IM benzathine penicillin single IM dose

Weight	Dose
3 to <6 kg	0.3 million units (225 mg)
6 to <15 kg	0.45 million units (337.5 mg)
15 to <20 kg	0.6 million units (450 mg)
20 to <30 kg	0.9 million units (675 mg)
≥30 kg	1.2 million units (900 mg)

‘In cases of severe sore throat [infection], procaine penicillin may be required’.⁵²

Management of established ARF

All patients with suspected acute rheumatic fever should be admitted or referred to the Divisional Hospital for confirmation of the diagnosis and treatment.

Antibiotic therapy to eradicate GAS infection/colonisation should be given.

Benzathine penicillin is the drug of choice, as adherence to oral antibiotics is difficult and often erratic. Use:

- benzathine penicillin 1.2 million units (0.6 million units if weight <20 kg) IM single dose

OR

- penicillin V 500 mg (child 250 mg) orally, twice daily for 10 days

OR, where proven penicillin allergy:

- erythromycin 500 mg (child 12.5 mg/kg up to 500 mg), twice daily for 10 days.

The symptoms of acute rheumatic fever should be managed as follows:

1. Paracetamol and/or codeine should be used to control arthritis, fever, and other acute symptoms **until** the diagnosis of ARF is confirmed. Once confirmed, high dose salicylates (aspirin) are the preferred choice, although other NSAIDs (e.g. ibuprofen) may be equally effective. Steroids may rarely be needed. Use:
 - aspirin 60–100 mg/kg/day, orally, given in 4 divided doses (maximum of 8 g/day) for 1–2 weeks, then wean according to clinical response and inflammatory markers (CRP, ESR): usual duration 6–8 weeks but longer duration may be required.
2. Carditis resulting in heart failure is treated with standard therapies (diuretics, ACEI), and cardiac arrhythmias that may develop are treated accordingly (see Section 11 Acute management of arrhythmias).

Steroids have been used, but conclusive evidence of their efficacy is limited. Where a decision is made to use steroids in severe carditis, use:

- prednisolone 1–2 mg/kg/day to a maximum dose of 80 mg daily: therapy is usually continued for 1–3 weeks; where >1 week is required, wean by 20–25% each week.

In severe disease, bed rest is recommended.

3. Chorea is usually managed conservatively, however carbamazepine and sodium valproate may be used for control.

Acute rheumatic fever is a notifiable disease. Prior to discharge, complete the Notifiable Disease Form and dispatch it to the Health Information Unit.

Further, ensure that all items on the ARF/RHD pre-discharge form are completed and that patient details are sent to the National RHD Prevention and Control program for inclusion in the national RHD database. Call 331 9348 or email <fijirhd@gmail.com>.

Secondary prophylaxis

Secondary prophylaxis (see Table 9) is vital to prevent further streptococcal infections and/or progression of pre-existing RHD. Penicillin is the preferred choice of antibiotic. Use:

- benzathine penicillin 1.2 million units (0.6 million units if weight <20 kg) IM, given every 4 weeks, or if recurrent ARF while on secondary prophylaxis, then every 3 weeks.

OR, **only** where penicillin allergy:

- erythromycin 250 mg orally, twice daily.

Table 9 — Duration of secondary prophylaxis⁵³

Category	Definition of category	Duration
All persons with ARF or RHD ¹		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 co-existing 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*

¹ Patients >25 years of age who are diagnosed with RHD, without any documented history of prior ARF, should receive prophylaxis until the age of 35 years. At this time, they should be reassessed to determine whether prophylaxis should be continued. [^] Decisions to cease secondary prophylaxis should be based on clinical and echocardiographic assessment. * Risk of recurrence is extremely low in people aged >40 years. In some cases, for example, when the patient decides that they want to reduce even a minimal risk of recurrence, prophylaxis may be continued beyond the age of 40 years, or even for life.

Continue prophylaxis for life (benzathine penicillin where not allergic) after valve replacement surgery.

14.2 Rheumatic heart disease

Rheumatic heart disease (RHD) is a chronic heart condition characterised by valvular lesions caused by rheumatic fever. It might be subclinical or suspected on clinical auscultation of the heart. Diagnosis requires confirmation by echocardiogram. Patients with mild disease are usually asymptomatic and those with moderate to severe disease often present with symptoms of heart failure. The other complications of RHD include atrial fibrillation, stroke, and infective endocarditis. Regular follow-up of patients with RHD is vital to monitor adherence to secondary prophylaxis and progression of valve disease, either clinically or by echocardiogram, to determine whether surgical intervention is necessary.

Management of RHD

All patients with a new or suspected diagnosis of RHD should be referred to the Medical/Cardiac or Paediatric Units at the Divisional Hospital for further assessment and management.

Secondary prophylaxis (see Table 9) is necessary to prevent progression of valve disease.

The complications of RHD are treated according to the severity of presentation (see Section 10 Heart failure, and Section 11 Acute management of arrhythmias).

Antibiotic prophylaxis for certain invasive procedures, including dental procedures, may be required; see Fiji Antibiotic Guidelines.

RHD has significant implications in pregnancy for both maternal and foetal wellbeing; early referral to the Divisional Hospital for assessment and echocardiography is essential.

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⁵³ Ibid., p.58.

15. Treatment of deep vein thrombosis and pulmonary embolism

Venous thromboembolism (VTE) encompasses deep vein thrombosis (DVT) and pulmonary embolism (PE). PE (symptomatic or asymptomatic) occurs in about 50% of patients with proximal (popliteal and above) DVT, and in about 5% of those with distal DVT. Post-thrombotic syndrome occurs in 60% of patients following DVT.

Clinical diagnosis of VTE is difficult, and objective testing must be performed to confirm the diagnosis, ideally before or as soon as possible after commencing treatment. Anticoagulation is highly effective in preventing pulmonary embolism and thus is indicated in most cases of DVT. However, most deaths from pulmonary embolism occur either before the pulmonary embolus has been diagnosed or before intervention has been able to be instituted. It is therefore important to optimise VTE prevention in any situation predisposing to VTE.

15.1 Deep vein thrombosis

The objective of treatment for established venous thrombosis is to prevent thrombus extension, pulmonary embolism, post-thrombotic syndrome, and recurrent VTE.

Compression stockings

Graduated compression stockings (currently unavailable on the clinical products catalogue) reduce the incidence and severity of post-thrombotic syndrome and, where available, should be used in all patients with deep vein thrombosis (DVT). Graduated compression stockings should be worn for up to 18 months, and indefinitely if post-thrombotic syndrome is present. Encourage patients to mobilise using a compression stocking as soon as possible.

Anticoagulation

Before anticoagulant therapy is instituted, blood should be collected for activated partial thromboplastin time (APTT), international normalised ratio (INR), full blood count, and liver function tests.

Initial anticoagulation should be with parenteral drugs. Options include:

- unfractionated heparin 5000 units IV bolus, followed by 1000 units per hour IV infusion, adjusted according to APTT (refer to Annex E for heparin protocol)

OR

- unfractionated heparin 330 units/kg loading dose SC, followed by 250 units/kg SC, twice daily

OR

- enoxaparin 1 mg/kg SC, twice daily, OR for outpatient use 1.5 mg/kg SC, daily.

Intravenous unfractionated heparin (UFH) requires intensive laboratory monitoring. The anticoagulant effect of UFH administered by infusion requires monitoring by activated partial thromboplastin time measurement. Following dose adjustments, the APTT should be measured 6 hours later. Once stable, the frequency of monitoring may be reduced to daily.

Weight adjusted subcutaneous (SC) UFH does not require APTT monitoring.

LMWH has the advantage of not requiring routine laboratory monitoring and of allowing management in a hospital outpatient or primary care setting in selected cases.

The platelet count should be monitored after 3 days of heparin therapy and conduct further monitoring as appropriate. (This is to detect the important, although uncommon, syndrome of heparin-induced thrombocytopenia.)

Oral anticoagulation may be started on the same day as parenteral therapy; use:

- warfarin orally, daily, dose adjusted to a target INR of 2 to 3 (refer to Annex F for initiation of warfarin therapy protocol).

Parenteral therapy should be given for a minimum of 5 days **and** until the INR has been above 2.0 on 2 consecutive days. The INR should be monitored daily and the warfarin dose adjusted accordingly until a therapeutic INR is achieved (2 to 3).

Warfarin should not be started alone for treatment of VTE (i.e. without parenteral anticoagulant therapy), as this is associated with a high rate of thrombus extension.

The duration of anticoagulation depends on the risk of recurrent VTE (see Table 10) and the risk of bleeding.

Table 10 — Suggested duration of therapy to prevent recurrent venous thromboembolism⁵⁴

Clinical situation	Duration
VTE provoked* by a transient major risk factor	3 months [#]
Unprovoked** distal DVT (below knee)	3 months [#]
First unprovoked proximal DVT (above knee) or PE	6 months [#]
First unprovoked VTE plus: <ul style="list-style-type: none"> • active cancer • multiple thrombophilias • antiphospholipid antibody syndrome 	Indefinite
Recurrent unprovoked VTE	Indefinite

VTE = venous thromboembolism; DVT = deep vein thrombosis; PE = pulmonary embolism *Provoked VTE where there is a clear precipitating factor, such as recent surgery or prolonged immobility. **Unprovoked VTE where no precipitating cause is evident. [#] Consider longer duration depending on risk of bleeding, patient reference, and the presence of additional risk factors for recurrence.

Deep vein thrombosis at sites other than the lower limb

Axillosubclavian deep vein thrombosis is associated with pulmonary embolism in 30% of cases and therefore requires anticoagulation with parenteral therapy and warfarin (see above). Mesenteric venous thrombosis and cerebral sinus thrombosis are rare and are commonly due to a thrombophilia. They should be treated with anticoagulation, possibly long-term.

15.2 Pulmonary embolism

Pulmonary embolism (PE) is frequently underdiagnosed and has a high mortality if untreated; continued suspicion of and urgent therapy for pulmonary embolism is therefore required. Outcomes in acute pulmonary embolism vary, depending on clinical signs at presentation.

Clinical features of PE

Typical symptoms of PE include: dyspnoea, chest pain, cough, haemoptysis, syncope, and palpitations.

Common signs of PE include: tachypnoea (>20/min), tachycardia (>100/min), fourth heart sound, diaphoresis, signs of pulmonary hypertension, fever, and pleural rub.

Investigations

Diagnosis of PE is challenging because symptoms and signs are nonspecific and diagnostic tests are not perfect. The following are useful adjunctive tests:

- Chest X-ray
- ECG
- Pulse oximetry/arterial blood gas
- Echocardiogram
- Doppler ultrasonography of the lower limbs
- D-dimer studies.

CT pulmonary angiography (CTPA) where available can provide a definitive diagnosis.

Pulmonary embolism without haemodynamic compromise

The mainstay of treatment of PE without haemodynamic compromise is:

- supportive medical care (particularly oxygen and analgesia) and
- therapeutic anticoagulation (parenteral anticoagulation and warfarin).

This should be started in hospital. See information on anticoagulation with UFH in 'Pulmonary embolism with haemodynamic compromise' below for detail.

Patients with evidence of right ventricular strain, as demonstrated by echocardiography or elevated troponin and/or severe hypoxaemia, have increased risk of adverse short-term outcomes, including increased mortality and pulmonary hypertension. Consideration should be given to fibrinolysis, as for patients with haemodynamic compromise.

Pulmonary embolism with haemodynamic compromise

Patients with sustained systolic BP <90 to 100 mm Hg associated with acute PE require:

- supportive medical treatment with oxygen at high flow rates and analgesia
- therapeutic anticoagulation.

Thrombolytic therapy may be of benefit in patients with acceptable risk of bleeding complications.

Anticoagulation with UFH via an infusion should be started as for DVT. Warfarin should be started within 48 hours using the regimen for treatment of deep vein thrombosis. The UFH should be continued for a minimum of 5 days **and** until the INR has been above 2.0 on 2 consecutive days.

The outcome in the majority of patients with major pulmonary embolism who receive only anticoagulant therapy is good. The role for fibrinolysis is limited and uncertain. It should be considered as discussed above for patients with ongoing hypotension, right heart failure or severe hypoxaemia, provided there are no contraindications.

15.3 Prevention of venous thromboembolism

Venous thromboembolism is more likely to develop in hospitalised patients, so the need for VTE prevention should be assessed in all inpatients on admission. In each patient, a risk assessment for development of VTE should be performed and the appropriate treatment given.

The risk of developing VTE during hospitalisation depends on factors related to both the individual patient and to the predisposing medical illness or surgical procedure performed.

Pharmacological prophylaxis is the preferred treatment in most at-risk patients because efficacy is superior to mechanical prophylaxis. However, mechanical prophylaxis (e.g. compression stockings) can be effective, and its effect is additive when combined with pharmacological prophylaxis.

Anticoagulants should not be used in patients with current active bleeding, or with risk of intracranial, spinal cord, or gastrointestinal bleeding because of recent bleeding or known lesions.

When used, VTE prophylaxis should continue until the patient is fully mobile and fit for hospital discharge. In certain high-risk clinical situations, including total hip replacement and hip fracture surgery, prolonged VTE prophylaxis may be appropriate (see Tables 11, 12, and 13).

Aspirin has only a weak effect in VTE prophylaxis and should not be considered adequate as sole prophylaxis.

15.4 Recommendations for venous thromboembolism prophylaxis

Table 11 — Venous thromboembolism prophylaxis for non-surgical patients⁵⁵

Conditions increasing risk of VTE	Prophylaxis and duration
<ul style="list-style-type: none"> Myocardial infarction Heart failure Ischaemic stroke with immobility Prior VTE Acute or acute-on-chronic lung infection (in older patients) Active cancer Acute inflammatory disease Critical illness 	LMWH or UFH Continue until resolution of acute medical illness, mobilisation, or hospital discharge.

Table 12 — Venous thromboembolism prophylaxis for surgical patients⁵⁶

Type of surgery	Prophylaxis and duration
Total hip replacement	<ul style="list-style-type: none"> LMWH or UFH; continue for 28 to 35 days PLUS <ul style="list-style-type: none"> Mechanical prophylaxis (if available) until fully mobile
Total knee replacement	<ul style="list-style-type: none"> LMWH or UFH; continue for up to 14 days PLUS <ul style="list-style-type: none"> Mechanical prophylaxis (if available) until fully mobile
Lower leg immobilisation due to injury	<ul style="list-style-type: none"> Consider LMWH or UFH if likely to be prolonged immobility; continue until fully mobile
Hip fracture surgery	<ul style="list-style-type: none"> LMWH or UFH; continue for 28 to 35 days Consider adding low dose aspirin
Major general surgery, e.g. abdominal, gynaecological, cardiac, thoracic, or vascular surgery	<ul style="list-style-type: none"> LMWH or UFH; continue for up to 1 week or until fully mobile PLUS <ul style="list-style-type: none"> Mechanical prophylaxis (if available) until fully mobile
Neurosurgery	<ul style="list-style-type: none"> Consider with caution, LMWH or UFH if not contraindicated due to high risk of bleeding

Spinal trauma or surgery	<ul style="list-style-type: none"> Starting 5 days after admission if haemostasis established; LMWH or UFH
Cancer patients having general, abdominal, pelvic, or neurosurgery	<ul style="list-style-type: none"> LMWH or UFH depending on bleeding risk; continue for at least 7 to 10 days postoperatively Consider 28 days of therapy in patients having major abdominal or pelvic surgery for cancer
Caesarean section	<ul style="list-style-type: none"> Consider LMWH or UFH for 5 to 7 days after delivery or until fully mobile (commence no earlier than 4 hours postoperatively and exercise care in women with an epidural catheter).

Table 13 — Dosage regimens of drugs for venous thromboembolism prophylaxis⁵⁷

Drug	Usual dose	Dose in renal impairment
		GFR less than 30 mL/min
enoxaparin	40 mg SC, daily	20 mg SC, daily
unfractionated heparin	5000 units SC, 8- or 12-hourly	5000 units SC, 8- or 12-hourly

GFR = glomerular filtration rate, calculated from Cockcroft-Gault equation

15.5 Specific issues related to prophylaxis

Thrombophilia

Thrombophilias are inherited or acquired conditions that increase an individual's risk of VTE, such as protein C, protein S, or antithrombin III deficiency. Patients with a recognised thrombophilia may require prophylaxis, even for lower-risk situations.

Pregnancy

Pregnancy and the postpartum period are associated with an increased risk of VTE (10- to 25-fold), although the absolute incidence is low, approximately 0.15%. Only women with additional risk factors for VTE should be considered for prophylaxis either during the pregnancy or after delivery. These include a history of prior VTE, an identified thrombophilia, marked obesity, or active cancer.

Women being treated with heparins (either LMWH or UFH) during pregnancy should discontinue them at the earliest onset of labour to minimise bleeding complications and to allow insertion of an epidural catheter, if required.

Postpartum haemorrhage is a contraindication to pharmacological VTE prophylaxis.

Active cancer

A diagnosis of cancer increases the risk of VTE 4- to 6-fold, because of cancer biology and/or effect of oncology treatment. This risk is increased in patients undergoing abdominal surgery, where the development of VTE may be delayed by more than 21 days postoperatively and prolonged prophylaxis is recommended. However, recognised contraindications to anticoagulants are commonly noted in patients with cancer, so careful consideration of these contraindications may be required before using prophylaxis.

Long-distance travel

Long-distance travel has been defined as travel by air, road, or rail for a duration of more than 4–5 hours. The risk of VTE is increased 2- to 3-fold, but the actual incidence is very low. Despite the lack of efficacy data, it is advised that all long-distance travellers:

- drink a sufficient amount of fluid to prevent dehydration, unless precluded by coexistent medical conditions
- perform calf contraction exercises for a number of minutes each hour
- avoid drinking excessive alcohol or taking sedative drugs.

The optimal VTE prophylaxis for long-distance travellers at greater than average risk is uncertain, and they should be advised to follow the above measures strictly.

In addition, for moderate-risk travellers it is reasonable to recommend the use of knee-length graduated compression stockings providing at least 20 mm Hg compression at the ankle. In travellers with a higher risk of VTE (e.g. multiple risk factors for thromboembolism or a history of previous VTE), it is reasonable to administer a stat dose of LMWH immediately before departure.

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⁵⁷ Ibid.

16. Peripheral arterial disease

16.1 Atherosclerotic peripheral arterial disease

Atherosclerosis is a systemic disorder. Peripheral arterial disease (PAD) is a marker for coronary and cerebral arterial events. The risk factors for the development of peripheral arterial disease are similar to those for atherosclerosis elsewhere.

Cigarette smoking (including passive smoking), diabetes, elevated blood pressure and dyslipidaemia are independent modifiable risk factors for peripheral arterial disease, with cigarette smoking and diabetes conferring the greatest risk.

Mild PAD may not cause any symptoms. More severe disease can present with:

- intermittent claudication
- rest pain
- critical limb ischaemia.

Intermittent claudication

Intermittent claudication is characterised by pain or an aching feeling in the legs that occurs during walking and is relieved by rest. More severe PAD may present with pain at rest. Intermittent claudication rarely progresses to require revascularisation or amputation. Considering the favourable prognosis, conservative therapy should be the primary approach, with a walking exercise program, podiatry supervision, and cardiovascular risk factor modification.

Management should include:

- a graduated walking program
- smoking cessation
- lipid-modifying therapy with a statin
- an angiotensin converting enzyme inhibitor (ACEI)
- an antiplatelet drug to reduce the incidence of cardiovascular events.

Aspirin is first-line therapy. Where there is allergy or contraindications to aspirin, clopidogrel should be considered. (Clopidogrel is currently unavailable on the EML.)

Invasive procedures (percutaneous transluminal angioplasty and bypass grafting) should be reserved for the treatment of limb-threatening ischaemic events or disabling symptoms.

Beta blockers are safe for other indications such as coronary artery disease unless PAD is severe.

Critical limb ischaemia

Chronic critical limb ischaemia is characterised by ulceration or gangrene of the foot or toes, or as persistently recurring ischaemic pain at rest requiring analgesia in patients with objectively proven peripheral arterial disease. Pain may not be present in the patient with diabetic neuropathy. Ankle–brachial index can be used to assess the objective severity, as shown below, if facilities are available:

- <0.4 = critical ischemia (sufficient to cause rest pain or gangrene)
- 0.4 to 0.8 = limiting ischemia (sufficient to cause claudication)
- >0.8 = normal to mild ischemia.

Management

The presence of critical limb ischaemia indicates that limb viability is threatened, and all patients require early surgical referral for consideration of active intervention, including angiography.

Provide regular analgesia and protect the limb by using a cage and a heel pad, but do not elevate it. Elevation of the head of the bed may reduce the severity of nocturnal rest pain. Pain is often severe and opioids may be required.

Signs of sepsis are masked by poor circulation. Antibiotics should be prescribed according to culture susceptibility results.

Acute limb ischaemia

Acute limb ischaemia is defined as sudden onset of severe ischaemia with associated sensory and motor loss, and intense pain. The condition is characterised by the 5 P's — pain, paralysis, paraesthesia, pulseless, and pallor.

The common causes are thrombosis superimposed on pre-existing atherosclerosis, thromboembolism from heart, aneurysm or atheroma, thrombotic occlusion of an aneurysm, and trauma. Embolism from the heart (e.g. atrial fibrillation) is an important cause and such a source should always be sought.

Acute ischaemia is a medical emergency; transport the patient immediately to a facility capable of providing angiography and vascular surgery. Urgent surgical consultation with the surgical unit in the Divisional Hospital and subsequent conjoint management is appropriate.

Protect the limb by using a cage and a heel pad, but do not elevate it.

Anticoagulation with unfractionated heparin should be initiated:

- unfractionated heparin infusion 5000 units IV bolus, followed by 1000 units per hour IV infusion, adjusted according to APTT (refer to Annex E for heparin protocol).

Long-term warfarin should be considered following embolism from a cardiac source; otherwise 3 to 6 months of warfarin may suffice. If the acute ischaemia is due to in situ thrombosis or atherosclerosis (acute on chronic), antiplatelet therapy (with aspirin) may be preferable. Acute on chronic disease may require more complex surgical treatment (e.g. surgical limb revascularisation) than an acute thrombotic event.

16.2 Raynaud phenomenon

Raynaud phenomenon results in episodic, often painful blanching, cyanosis, and erythema of digits. It may be primary (i.e. not associated with other diseases) or secondary to a connective tissue or other disease.

Avoidance of cold exposure is important in all cases and, in the absence of an underlying cause, the use of gloves and warm clothing is often sufficient to control symptoms. Strongly encourage patients to stop smoking. Avoid the use of beta blockers.

In more severely affected patients, particularly those with underlying connective tissue disease, vasodilator drugs may be needed to reduce vasospasm.

For first-line therapy, use:

- amlodipine 5–10 mg orally, once daily

AND/OR

- glyceryl trinitrate 2% ointment 0.5 cm applied at the base of the affected fingers.

Severe digital ischaemia or necrosis secondary to Raynaud phenomenon only occurs with connective tissue disorders.

Anticoagulants are used if there is evidence of recent vascular thrombosis or thromboembolism. Antibiotics may be required. All of these cases should be referred to the Divisional Hospitals.

Inadvertent intra-arterial injection

Severe peripheral ischaemia can follow the inadvertent intra-arterial injection of drugs. The pathophysiological basis for this sudden severe ischaemia probably involves three main mechanisms — vasospasm, chemical endarteritis, and drug-particulate embolisation and thrombosis. Therefore, the following triple therapy is suggested.

For **vasodilation**, use:

- amlodipine 5 to 10 mg orally, once daily.

To reduce **inflammation**, use:

- dexamethasone 4 mg IV, as a single dose

FOLLOWED BY

- prednisolone 50 mg orally, daily for 2 days, then taper dose rapidly over 1 week to cease.

For **anticoagulation**, use:

- unfractionated heparin infusion (refer to Annex E for heparin protocol)

OR

- aspirin 100 to 300 mg orally, daily.

References

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17. Perioperative and periprocedural management of patients with CVD in non-cardiac surgery

Appropriate assessment and management of patients with CVD who require procedures or surgery are critical if significant morbidity and mortality are to be avoided.

Preoperative or pre-procedural planning includes a full cardiovascular risk assessment. This takes into account:

- patient-related factors including functional capacity
- surgery-specific risk.

A detailed history and physical examination is required. A patient's cardiovascular status should be optimised, where possible, prior to surgery. For an urgent or emergency procedure, limited time (usually <24 hours) is available for evaluation and medical intervention, and following a risk:benefit assessment a decision will usually be made to proceed to theatre after rapid evaluation and optimisation. For elective procedures, surgery can be delayed if necessary following a cardiovascular risk assessment to allow time for further assessment and medical optimisation. Some elective procedures are however time sensitive, whereby a delay of >1–6 weeks is likely to negatively affect outcome, e.g. oncologic procedures.

17.1 Cardiac risk assessment

Patient factors that are associated with a high risk of perioperative cardiovascular events (active cardiac conditions) are identified in Box 10.

Box 10 — Patient factors associated with high risk perioperative CV events⁵⁸

- Unstable coronary syndromes, i.e. unstable or severe angina, recent myocardial infarction within 30 days, recent coronary revascularisation (coronary stent or bypass).
- Decompensated heart failure, i.e. new onset or worsening heart failure or NYHA IV.
- Severe valvular heart disease, e.g. severe aortic or mitral stenosis.
- Significant arrhythmias, e.g. uncontrolled AF (apical HR >100 b/min), ventricular arrhythmias, high grade AV blocks, or symptomatic bradycardia.
- Severe symptomatic uncontrolled hypertension: BP \geq 180/110 mm Hg.

The presence of any of the above factors should lead to a recommendation for deferment of non-emergency surgery. These patients should be referred to the Divisional Hospital for further assessment and management.

In the absence of the above major risk factors, quantification of cardiac risk involves consideration of:

1. Surgery specific risks

Different surgical procedures carry different degrees of cardiac risk, independent of patient related factors (see Table 14).

Table 14 — Estimated cardiac risk* for surgical procedures⁵⁹

Low risk (<1%)	Intermediate risk (1–5%)	High risk (>5%)
Eye surgery (e.g. cataract)	Intra-peritoneal and intra-thoracic surgery	Aortic and other major vascular surgery
Dental procedures	Head and neck surgery (including complicated dental extractions)	Peripheral arterial surgery

Endocrine surgery (e.g. thyroid)	Neurological surgery — major	Limb amputation for ischaemia or sepsis
Breast surgery	Orthopaedic surgery — major	
Gynaecological surgery	Urological surgery — major, including prostate	
Plastic and reconstructive surgery (e.g. skin grafts and flaps)	Peripheral arterial angioplasty	
Orthopaedic surgery — minor	Transplant surgery	
Urological surgery — minor	Carotid endarterectomy	
Endoscopic procedures		

* Risk of cardiac death or non-fatal myocardial infarction within 30 days of surgery.

2. Functional capacity

A patient's functional capacity (effort tolerance) is very important in determining their perioperative risk. Functional capacity can be formally assessed using a METS score. A patient with a METS score of <4 is at increased cardiovascular risk.

To achieve a METS score of 4 a patient should be able to walk up a flight of stairs or a moderate hill without stopping due to breathlessness. If functional capacity is unable to be assessed (e.g. patient unable to walk because of arthritis), then assume METS score of <4.

3. Calculation of formal cardiac risk index

The Revised Cardiac Risk Index (RCRI) can be used to predict the risk of major cardiac complications (cardiac death, non-fatal myocardial infarction, and non-fatal cardiac arrest) perioperatively.

Box 11 — Revised Cardiac Risk Index**One point for each feature⁶⁰:**

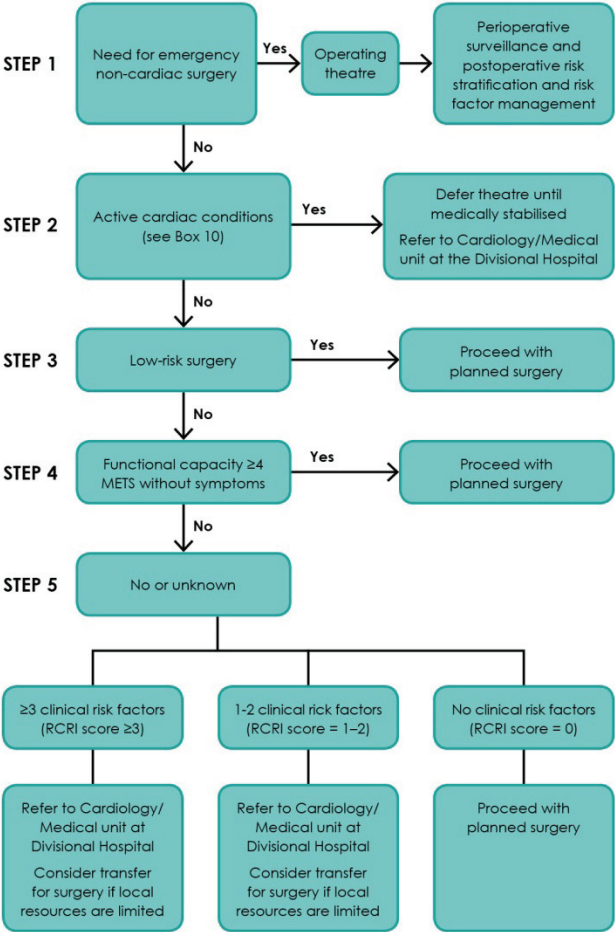
- High-risk type of surgery (see Table 14)
- History of ischaemic heart disease (any of: history of myocardial infarction, history of positive stress test, current complaint of chest pain consistent with ischemia, use of nitrate therapy, or pathological Q waves on ECG)
- History of heart failure
- History of cerebrovascular disease
- Diabetes mellitus requiring treatment with insulin
- Preoperative serum creatinine >177 micromol/L).

Estimated risk of major cardiac complications according to total points calculated:

- 0 points: low risk
- 1–2 points: intermediate risk
- ≥3 points: high risk (>5% chance of complication).

The information obtained in the steps above can be used to follow the algorithm (see Figure 21) to guide perioperative management.

Figure 21 — Modified algorithm for evaluating cardiac risk before non-cardiac surgery⁶¹



17.2 Perioperative cardiac management

Most cardiac drugs should be continued up to the time of surgery and restarted as soon as possible in the postoperative period. Medications can be given to the fasting patient even on the day of surgery (with no more than 20 mL of water).

Beta blockers

Patients who are already on beta blockers should remain on them perioperatively unless there is a contraindication, e.g. acute hypotension. Acute withdrawal of beta blockers has been associated with adverse outcomes.

Commencement of beta-blocker therapy perioperatively should be considered in all patients at high cardiovascular risk (see Box 11 Revised Cardiac Risk Index). The beta blocker should be started at least one week before surgery. Use:

- atenolol 25 mg orally, once daily, titrating to a heart rate of 60–70 beats per minute; but avoiding perioperative bradycardia and hypotension (maintain systolic BP >100–110 mm Hg).

17.3 Ischaemic heart disease

The common conditions encountered in clinical practice include:

- Angina
- Myocardial infarction
- PCI and CABG.

Angina control should be optimised before the procedure or surgery. All regular antianginal treatment should be continued to the time of the procedure or surgery, and restarted as soon as possible postoperatively or postprocedurally. Inadvertent omission of usual cardiac drugs may precipitate or worsen perioperative myocardial ischaemia.

The incidence of myocardial infarction is greatest during the third postoperative day. Where withheld, antianginal therapy should be restarted as soon as possible postoperatively, and adequate oxygenation ensured by attention to minimising atelectasis. Adequate analgesia is important to minimise haemodynamic fluctuations that may precipitate ischaemia.

Anti-platelet agents

Aspirin and clopidogrel increase the risk of bleeding, but are probably protective against myocardial ischaemia in the perioperative period. The decision regarding continuation of antiplatelet drugs is a balance of risk and benefits.

Patients with recent coronary angioplasty and stenting are at high risk of in-stent thrombosis in the first 30 days, with potentially serious consequences. Where possible, elective surgery should be deferred for a minimum of:

- 14 days post balloon angioplasty
- 30 days post insertion of a bare metal stent
- 12 months (minimum 6 months) post insertion of a drug-eluting stent.

Where surgery cannot be delayed, aspirin can often be continued, but clopidogrel may need to be ceased (see 'Antithrombotic therapy' in this section for specific information).

For other patients with established cardiovascular disease, but without recent coronary stent insertion, a risk:benefit decision should be made on an individual basis.

For patients at high risk of cardiac events (e.g. recent acute coronary syndrome), aspirin should generally be continued where the surgical bleeding risk is acceptable. For patients at low risk (e.g. stable angina), aspirin and clopidogrel can generally be safely withheld (see 'Antithrombotic therapy' in this section).

Beta blockers

See Section 17.2.

Statins

Lipid-modifying therapy with statins should be continued perioperatively.

Nitrates

Oral nitrates can cause hypotension and should be used with caution in the perioperative period.

ACE inhibitors

ACEIs (e.g. enalapril) and ARBs (e.g. losartan) should be withheld on the morning of surgery if there is a high risk of perioperative hypotension and renal dysfunction. Recommence postoperatively as soon as stable.

Recent acute myocardial infarction

As noted in Section 16.1, in the event of a recent myocardial infarction, non-emergency surgery should be delayed for a minimum of 30 days. The risk of perioperative ischaemia continues to decline for up to 6 months post-acute myocardial infarction. Where the surgical indication allows, elective surgery should therefore be delayed for this period of time.

Valvular heart disease

Perioperative recommendations will depend on the type and severity of the condition and the degree of cardiac decompensation that has occurred. The most significant VHD includes severe aortic stenosis and severe mitral stenosis. **Any patient with valvular heart disease should be referred to a Divisional Hospital for their surgery.**

Important aspects of perioperative/periprocedural management of patients with VHD include:

- haemodynamic consequences
- antibiotic prophylaxis against infective endocarditis
- anticoagulation therapy.

Patients with mechanical prosthetic valves or other thromboembolic risk factors (e.g. atrial fibrillation) necessitating warfarin need perioperative/periprocedural management of anticoagulation (see 'Antithrombotic therapy' in this section).

Before elective high-risk surgery, correction of severe VHD, particularly aortic and mitral stenosis, may be advisable. Patients with haemodynamically severe VHD may require perioperative invasive haemodynamic monitoring.

Hypertension

Good BP control in the weeks leading up to elective surgery is important, and elective surgery may be delayed if necessary to achieve this. Poor preoperative BP control is the single most important cause of postoperative BP instability. Elective surgery should be deferred in the presence of severe symptomatic uncontrolled hypertension (BP $\geq 180/110$ mm Hg).

Antihypertensive drugs should be long-acting and should be continued right up to, and be given on, the day of the procedure/surgery. Medications can be given to the fasting patient on the day of surgery (with no more than 20 mL water).

Postoperative management

Management of labile BP can be difficult postoperatively. Reversible or treatable causes of elevated BP, including pain, anxiety, hypothermia or hypoxaemia, should be considered and treated appropriately.

The primary aim is to restart oral antihypertensive drugs as soon as possible. A reasonable target in the first 24–48 hours would be a systolic BP of <180 mm Hg.

Heart failure

Patients with HF should have their condition optimised prior to surgery, where possible. As noted previously, non-emergency surgery should be deferred in patients with decompensated heart failure, e.g. new onset or worsening heart failure, NYHA IV.

Patients with heart failure taking beta blockers, digoxin, diuretics, ACEIs, or ARBs should continue them until the time of surgery. ACEIs and ARBs may be withheld in the 24 hours prior to surgery if hypotension is present, but they should be restarted as soon as possible after the surgery/procedure, provided the patient is euvolaemic and stable haemodynamically. Excessive diuresis to be avoided because of the risk of hypotension during surgery.

Patients with severe heart failure require close monitoring of their kidney function and may benefit from invasive monitoring.

Arrhythmias

Patients on antiarrhythmic drugs should continue them at the time of the procedure/surgery, unless there is evidence of hypotension and/or bradycardia.

Patients with atrial fibrillation may need their antithrombotic therapy temporarily ceased for surgery (see 'Antithrombotic therapy' in this section). AF should be controlled to an apical rate of <100 beats per minute for elective surgery.

Arrhythmias are common in the perioperative period. They should be treated in the same manner as usual.

Cardiac implanted electronic devices

Implantable cardioverter defibrillators (ICDs) and permanent pacemakers are cardiac implanted electronic devices (CIEDs). Surgical diathermy causes electrical interference, which can be interpreted by a CIED as a cardiac signal, causing inhibition of pacing, or triggering a shock. The diathermy also interferes with ECG monitoring and makes it difficult to determine the cardiac rhythm. CIEDs have

automatic protective mechanisms to minimise these problems, including a 'noise mode' during which pacing continues in spite of electrical interference.

Interference is more likely during chest or head/neck surgery because the diathermy circuit intersects the pacemaker sensing circuit. Diathermy applied below the umbilicus is less likely to cause interference. Electroconvulsive therapy (ECT) rarely causes interference.

Patients with a CIED should be clearly identified in the preoperative period so that necessary preparations can be made by the operating team.

**All cases should be discussed with the Cardiac/
Medical Unit at the Divisional Hospital.**

**Antibiotic prophylaxis is not required for
patients with CIEDs undergoing surgery.**

**Patients with CIEDs should have had their function checked
within the 3 months prior to surgery and postoperatively.**

Antithrombotic therapy

Antithrombotic drugs include anticoagulant drugs (e.g. warfarin) and antiplatelet drugs (e.g. aspirin, clopidogrel). The potential harm of continuing a drug that may cause bleeding in its own right, or increase the chance of bleeding from an intervention, should be balanced against the chance that stopping the drug could cause a fatal or incapacitating thromboembolic event. A risk:benefit assessment should be made for each individual patient, balancing the indication for antithrombotic therapy versus the risk of bleeding from the specific surgical procedure being performed.

Surgical procedures can be classified according to their risk of bleeding (e.g. most minor dental procedures or minor excisional skin surgery are low risk, whereas major surgery such as bowel resection is high risk).

**The surgical team should be consulted as to the anticipated
bleeding risk of the individual procedure planned.**

As a general rule, any patient having an elective procedure with a low risk of bleeding (as determined by the surgical team) should continue all regular antithrombotic drugs.

For surgery and procedures with a higher risk of bleeding, anticoagulant drugs usually require temporary discontinuation to reduce the risk of bleeding, whereas the cessation of antiplatelet drugs needs careful consideration of risks and benefits.

Aspirin in particular can often be continued where a risk:benefit assessment indicates that the risk of a coronary event exceeds the risk of bleeding.

Where warfarin is ceased, in most cases it can be restarted on the day after surgery or within the next few days. This approach leads to only a short period of time of a few days without an anticoagulant effect. The decision as to whether bridging therapy with heparin is required (while international normalised ratio [INR] is sub-therapeutic) depends on the likelihood of thromboembolism with short-term discontinuation of anticoagulation.

Conditions associated with low or high risk of thromboembolic events

Low risk of a thromboembolic event

Conditions associated with a low risk of thromboembolic events include:

- a bioprosthetic heart valve
- low-risk atrial fibrillation: **non valvular** with CHADS score <4.

High risk of a thromboembolic event

Conditions associated with a high risk of thromboembolic events include:

- high-risk atrial fibrillation (with rheumatic valvular heart disease, recent [<3 months] stroke/TIA, or CHADS score ≥4)
- a mechanical heart valve
- patients who have had a previous thromboembolic event
- patients with recent insertion of coronary artery stents (particularly drug-eluting stents)
- recent venous thromboembolism (DVT, PE within last 3 months).

Where possible, patients who have high-risk conditions and who are receiving temporary antithrombotic therapy (e.g. 3 months anticoagulation for treatment of deep vein thrombosis) should have elective procedures deferred until therapy is completed.

Warfarin

Recommendations for warfarin therapy depend on the level of risk of the surgical or other procedure, as follows.

Low risk of bleeding from the procedure (as determined by the surgical team):

- Warfarin may be continued ideally at the lower end of the therapeutic target range.

High risk of bleeding from the procedure, for a patient with a LOW risk of a thromboembolic event:

- Patient should stop warfarin for 5 days before the procedure and restart as soon as possible after the procedure. Bridging with heparin is not required.

High risk of bleeding from the procedure, for a patient with a HIGH risk of a thromboembolic event:

- Bridging therapy with a therapeutic dose of UFH or LMWH is often required.
- Warfarin should be stopped 5 days before the procedure.
- Start a therapeutic dose of heparin when the INR is less than 2.
- UFH can be stopped 6 hours before the procedure, LMWH should be stopped 24 hours prior (may need to be stopped earlier where there is significant renal impairment).
- Consensus must be reached with the surgeon regarding when to restart the UFH, based on the patient's risk of bleeding.
- Where surgery is uncomplicated, warfarin is generally restarted 24 hours after the procedure and heparin is ceased when the INR is in the therapeutic range.

Antiplatelet drugs

As discussed in Section 17.3, aspirin and clopidogrel increase the risk of bleeding, but are probably protective against myocardial ischaemia in the perioperative period.

Aspirin

Low risk of bleeding from the procedure:

- Continue aspirin.

Higher risk of bleeding from the procedure:

- A decision to discontinue aspirin for 5 days before the procedure should be balanced against the risk of cessation and cardiac benefits.
- See also the recommendation below for a patient taking clopidogrel who is undergoing a procedure with a high risk of bleeding and who has a high risk of a thromboembolic event. In that situation, aspirin may be continued.

Clopidogrel

Clopidogrel carries a higher risk of perioperative bleeding compared to aspirin. Ideally clopidogrel should be withheld perioperatively, but in patients with recent insertion of coronary stents (bare metal stent within 30 days, drug-eluting stent within 6–12 months) this carries a significant risk of in-stent thrombosis and acute myocardial infarction. Therefore, clopidogrel should only be ceased perioperatively in these patients where the risk of bleeding is felt to exceed the risk of in-stent thrombosis.

Where clopidogrel is used for other indications (e.g. post MI) it can generally be ceased perioperatively.

Recommendations for clopidogrel depend on the level of risk of the surgical or other procedure as follows:

Low risk of bleeding from the procedure:

- Clopidogrel may be continued.

High risk of bleeding from the procedure, for a patient with a LOW risk of a thromboembolic event, e.g. post MI or distant insertion of coronary stent:

- Clopidogrel may be discontinued for 7 days before the surgery/procedure.

High risk of bleeding from the procedure, for a patient with a HIGH risk of a thromboembolic event (e.g. recent coronary stent):

- If the procedure cannot be deferred, consider ceasing clopidogrel 7 days before the surgery or procedure.

If the clopidogrel is discontinued, aspirin should be continued (in the case of dual therapy) or substituted (in the case of clopidogrel monotherapy) where the bleeding risk allows. Restart clopidogrel as soon as possible.

Patients with the above conditions should be referred to the Divisional Hospital, and close consultation between the surgical and medical teams is advisable.

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⁶⁰ Sourced and adapted from: Scott et al. op cit., p.667.

⁶¹ Sourced and adapted from: Scott et al. op cit.

18. Antithrombotic therapy

Thrombosis may affect the arterial system, as in atherosclerosis, and the venous system, such as deep venous thrombosis and pulmonary embolism.

Antiplatelet drugs have greatest efficacy in the prevention of thrombus formation in arteries, where platelet activation is the predominant mechanism of thrombosis initiation. Anticoagulants have greater use in lower flow sites, such as within veins or the left atrial appendage in atrial fibrillation, where fibrin formation is predominantly initiated by activation of the coagulant protein cascade.

All antithrombotic therapy can cause bleeding. For all indications the potential benefit of therapy in reducing total thrombotic risk (arterial or venous) must be balanced against the risk of bleeding in the individual patient. A number of bleeding risk scoring systems have been published. Their use in clinical practice has not been established, but they are used by some clinicians.

18.1 Anticoagulants

Anticoagulant therapies have been proven to provide substantial benefits in thrombotic conditions and are extensively used in clinical practice. However, owing to the risk of bleeding, their use must be closely monitored.

Unfractionated heparin

Unfractionated heparin is a parenteral anticoagulant that can be given by continuous infusion or subcutaneously. The half-life of UFH is short, which allows for rapid offset of action, and is advantageous when tight control of anticoagulation is required, such as perioperatively.

Clinical indications

UFH has proven benefit in:

- prevention and treatment of venous thromboembolism
- acute coronary syndromes
- atrial fibrillation with systemic embolism
- anticoagulation during diagnostic and therapeutic cardiovascular procedures.

Initiating and monitoring

The anticoagulant effect of UFH administered by infusion requires monitoring by activated partial thromboplastin time measurement. Refer to the heparin protocol (refer to Annex E) for detail of initiation and management of infusion.

Risks of bleeding

The risk of bleeding during therapy with UFH is increased by the intensity of treatment (i.e. supratherapeutic APTT), recent surgery or trauma, kidney failure, advanced age (more than 75 years), female sex, and the use of concomitant drugs that affect haemostasis (including antiplatelet drugs).

Management of bleeding and/or over-anticoagulation

If bleeding occurs, cease heparin. Protamine reverses the effect of heparin and may be administered following overdose or if required to manage bleeding. The half-life of heparin is short and so the protamine dose required decreases with time.

The dose given **within 15 minutes after the heparin dose** is:

- protamine 1 mg per 100 units heparin, IV.

The dose **given 30–60 minutes after the heparin dose** is:

- protamine 0.5 mg per 100 units heparin, IV.

The dose given **2 hours after the heparin dose** is:

- protamine 0.25 mg per 100 units heparin, IV.

Heparin-induced thrombocytopenia

Heparin-induced thrombocytopenia (HIT) is an uncommon but dangerous complication of heparin therapy that is characterised by thrombocytopenia and the development of arterial and venous thrombosis. HIT is immune-mediated. The diagnosis is made by a combination of clinical features, which include a fall in the platelet count and the development of thrombosis, and by the laboratory demonstration of a specific antibody. Patients on heparin therapy should have a full blood count performed on day 3 of therapy and then thereafter as appropriate.

For confirmed HIT, it is imperative to discontinue heparin. Low molecular weight heparins can cross-react with the HIT antibody, and should not be used.

Low molecular weight heparins

Low molecular weight heparins have more predictable anticoagulant activity and a longer half-life than UFH. They are administered subcutaneously once or twice daily without the need for monitoring. LMWH is currently unavailable on the Fiji EML, but is available in retail pharmacy.

LMWHs have significant renal excretion and their activity may accumulate in renal impairment. Dose reduction (usually by 50%) for eGFR less than 30 mL/min is recommended. Heparin-induced thrombocytopenia is much less common with LMWH than with UFH, but may still occur.

Clinical indications

Indications are the same as for UFH.

Monitoring

LMWHs are predictable and there is no need for monitoring in most situations.

Risk of bleeding

The risk factors for bleeding during LMWH therapy are the same as those for UFH. Impaired kidney function is a much more important risk for bleeding with LMWH than with UFH.

Management of bleeding and/or over-anticoagulation

Protamine sulphate has less effect in reversing the anticoagulant effect of LMWH than of UFH, but may be used, in addition to supportive measures, in critical clinical situations.

Warfarin

Warfarin inhibits the production of the vitamin K-dependent coagulation factors II, VII, IX, and X, as well as the anticoagulant proteins C and S.

Clinical indications

Warfarin has proven benefit in:

- patients with atrial fibrillation and a high risk of stroke or systemic embolism
- treatment of venous thromboembolism
- prevention of thromboembolism in patients with mechanical prosthetic heart valves

- prevention of stroke in patients with other cardiac disease (e.g. cardiomyopathy) with visualised thrombus.

Monitoring

Warfarin therapy requires regular monitoring by measurement of the international normalised ratio. The INR is measured frequently at the start of therapy and less frequently (up to monthly) during stable chronic therapy.

The frequency of monitoring will vary according to:

- the stability of INR in individual patients
- the need to adjust the INR (e.g. to allow an invasive procedure)
- the presence of changing intercurrent illnesses and therapies.

For anticoagulation treatment of children, please contact the Medical/Paediatrics Department. For commencement and management of warfarin therapy in adults, refer to Annex F for warfarin protocol.

Factors that predict a lower maintenance dose include advanced age, severe liver disease, malnourishment, Asian ethnicity, known sensitivity to warfarin therapy, and concomitant therapy with drugs known to increase the sensitivity to warfarin.

Interactions

'Many drugs interact with warfarin; consider substituting an alternative non-interacting drug in a patient taking warfarin.

Administration with other drugs that can affect the clotting process may result in a greater risk of bleeding; monitor closely.

Avoid use with drugs affecting platelet function, except in selected patients at high risk for thromboembolism'.⁶²

The anticoagulant effect of warfarin may be increased by:⁶³

- | | | |
|-----------------|--------------------|---------------------------------------|
| • Amiodarone | • Ciprofloxacin | • Corticosteroids |
| • Metronidazole | • Paracetamol | • Simvastatin |
| • SSRIs | • Thyroid hormones | • Trimethoprim with sulfamethoxazole. |

Check relevant medication Product Information.

'Anticoagulant activity may also be increased by consuming large amounts or long-term consumption of alcohol, particularly in patients with impaired liver function'.⁶⁴

The anticoagulant effect of warfarin may be reduced by:⁶⁵

- Azathioprine
- Mercaptopurine
- Phenytoin
- Ritonavir
- Azoles
- Nevirapine
- Ribavirin
- St John's wort.
- Carbamazepine
- Phenobarbitone
- Rifampicin

Check relevant medication Product Information.

The anticoagulant effect of warfarin may also be decreased by:

- 'Vitamin K intake (such as enteral feeds or diet high in vitamin K, including large amounts of green leafy vegetables or milk or yoghurt products enriched with vitamin K)'.⁶⁶ Patients should be advised to consume these foods in moderation.

Risks of bleeding

The following are major risk factors for bleeding during warfarin therapy:

- INR level. Risk of bleeding increases significantly when INR >5.
- Duration of anticoagulant therapy. The risk of bleeding is highest during the first few months of anticoagulant therapy, then falls somewhat, but it always remains above baseline. As the risk remains elevated throughout therapy, duration of treatment determines bleeding rates.
- Patient characteristics. Factors that increase the risk of bleeding during warfarin therapy include:
 - Increased age (especially >75 years).
 - Presence of malignancy.
 - Uncontrolled hypertension.
 - Liver disease, or acute or chronic alcoholism.
 - Severe chronic kidney disease.
 - Poor drug monitoring or clinic attendance.
 - Prior stroke or intracerebral haemorrhage.
 - Presence of bleeding lesions (e.g. gastrointestinal blood loss).

- Bleeding disorder (coagulation defects, thrombocytopenia with platelet count $<75 \times 109/L$).
- Previous severe haemorrhage during treatment with warfarin when INR was in the therapeutic range.
- Concomitant therapy with drugs that affect haemostasis. Antiplatelet drugs (including aspirin and clopidogrel) increase the risk of bleeding during warfarin therapy without an increase in the INR. Nonsteroidal anti-inflammatory drugs increase the risk of gastrointestinal bleeding during warfarin treatment.

Management of bleeding and/or over-anticoagulation

The effect of warfarin can be reversed:

- Rapidly by the administration of replacement coagulation factors (prothrombin complex concentrates or fresh frozen plasma [FFP]).
- More slowly by administration of vitamin K.

The clinical situation will determine the desired rapidity of warfarin reversal and thus the agents used. The onset of the effect of vitamin K on the INR can be expected within 6–12 hours. The onset of FFP is immediate.⁶⁷

The anticoagulant effect of warfarin can be difficult to re-establish after large doses of vitamin K, so use the lowest possible dose of vitamin K if warfarin is to be restarted.

The management depends on the level of INR and whether there is bleeding, as shown in Table 15.

For patients with elevated INR, always carefully reassess the need for ongoing warfarin therapy and remove precipitating factor(s) if possible. The bleeding risk increases exponentially from INR 5–9. Closely monitor any patient with an INR more than 5.

Table 15 — Management of patients on warfarin therapy⁶⁸

With high INR and no bleeding	
Clinical setting	Recommendation
INR higher than therapeutic range but <5.0 and no bleeding	<ul style="list-style-type: none"> • Lower or omit the next dose of warfarin. • Resume warfarin at a lower dose when the INR approaches therapeutic range. • If INR is only minimally above therapeutic range (up to 10%), dose reduction is generally not necessary.
INR 5–<10.0 and no bleeding	<ul style="list-style-type: none"> • Withhold warfarin therapy. • Give low dose vitamin K 1–2 mg orally or 0.5–1.0 mg IV. • Measure INR in 24 hours. Resume warfarin at a reduced dose once INR approaches therapeutic range.
INR ≥10.0 and no bleeding	<ul style="list-style-type: none"> • Withhold warfarin therapy. • Give vitamin K 3–5 mg orally or IV. • Measure INR in 12–24 hours. Resume warfarin therapy at a reduced dose once INR approaches therapeutic range. • If bleeding risk is high, consider also giving FFP 150–300 mL.
With bleeding	
INR ≥1.5 with life-threatening (critical organ) bleeding or INR ≥2.0 with other clinically significant bleeding	<ul style="list-style-type: none"> • Withhold warfarin therapy. • Give vitamin K 5–10 mg IV. • Give FFP 10–15 mL/kg.
Any INR with minimal bleeding	<ul style="list-style-type: none"> • Withhold warfarin. • If INR above therapeutic range. Give low dose vitamin K: <ul style="list-style-type: none"> ▪ INR 5–<10 — give 1–2 mg orally or 0.5–1.0 mg IV ▪ INR ≥10 — give 3–5 mg orally or IV. • Repeat INR the following day and adjust warfarin dose to maintain INR in the target therapeutic range. • Investigate for a potential underlying cause and treat as appropriate.

Dabigatran

Dabigatran is an orally active direct thrombin inhibitor. It may cause nausea, but this rarely limits its use. Dabigatran is significantly renally excreted and is contraindicated in severe renal impairment (eGFR <30 mL/min).

Clinical indications

Dabigatran has proven benefit in:

- prevention of venous thromboembolism following hip or knee replacement
- thromboprophylaxis in non-valvular atrial fibrillation.

Monitoring

There are no current laboratory tests that guide therapy with dabigatran. Measurement of the activated partial thromboplastin time will help determine whether there is any effect of dabigatran present, but not the extent of haemostatic impairment.

Risks of bleeding

The risk of bleeding during therapy with dabigatran is increased by advanced age (≥ 75 years), low body weight (< 50 kg), and renal impairment (eGFR 30–50 mL/min). Dabigatran should be used with extreme caution in patients with risk factors for bleeding with other anticoagulants, such as recent surgery or trauma, kidney failure, bleeding diathesis, prior major bleeding, or the use of concomitant drugs that affect haemostasis, as it has not been well studied in these populations.

Management of bleeding and/or over-anticoagulation

There is no specific antidote for dabigatran. Supportive measures should be instituted. Establishing a diuresis may be of benefit. As dabigatran is renally excreted, consider high efficiency dialysis in extreme situations. Product information advises considering transfusion of fresh frozen plasma, but this will not reverse the anticoagulant effect.

Rivaroxaban

Rivaroxaban is an orally active direct factor Xa inhibitor. It is significantly renally excreted and is contraindicated in severe renal impairment (eGFR < 15 mL/min).

Clinical indications

Rivaroxaban has proven benefit in:

- prevention of venous thromboembolism following hip or knee replacement
- thromboprophylaxis in non-valvular atrial fibrillation
- treatment and secondary prevention of DVT and PE.

Monitoring

There are no current laboratory tests that guide therapy with rivaroxaban. Measurement of the prothrombin time will help determine whether there is any effect of rivaroxaban present, but not the extent of haemostatic impairment.

Risk of bleeding

Rivaroxaban should be used with extreme caution in patients with risk factors for bleeding with other anticoagulants, such as recent surgery or trauma, renal impairment, bleeding diathesis, prior major bleeding, or the use of concomitant drugs that affect haemostasis, as it has not been well studied in these populations.

Management of bleeding and/or over-anticoagulation

There is no specific antidote for rivaroxaban. Supportive measures should be instituted. Due to its high plasma protein binding, rivaroxaban is not expected to be dialysable. See product information for further detail.

18.2 Antiplatelet drugs

Antiplatelet drugs decrease platelet aggregation and inhibit thrombus formation predominantly in the arterial circulation. They act through different pathways, and so may be used singly or in combination to achieve optimal antithrombotic effect.

Aspirin

Aspirin decreases platelet aggregation and inhibits thrombus formation through inhibition of prostaglandin synthesis.

Clinical indications

Aspirin has proven benefit in:

- treatment of acute coronary syndromes
- primary prevention of stroke and acute myocardial infarction in high risk patients
- secondary prevention of stroke, transient ischaemic attacks, and ischaemic heart disease
- prevention of thromboembolism in low-risk patients with non-valvular atrial fibrillation.

Monitoring

Only clinical monitoring is required for the antithrombotic or adverse effects of aspirin, such as dyspepsia and peptic ulcer disease.

Determinants of bleeding

The most common adverse outcome of aspirin is bleeding. The risk of bleeding increases markedly when aspirin is combined with other drugs that affect haemostasis, such as other antiplatelet drugs, anticoagulants, and NSAIDs.

Management of bleeding

If clinically-significant bleeding occurs in a patient taking aspirin:

- Withhold the aspirin.
- Provide supportive therapy (e.g. blood transfusion where required).

There is no specific antidote for aspirin. In life-threatening bleeding, platelet transfusion should be administered.

Clopidogrel

Clopidogrel inhibits platelet aggregation by blocking the platelet P2Y₁₂ receptor.

Clinical indications

Clopidogrel has proven benefit:

- As an alternative anti-platelet agent in patients allergic to or otherwise intolerant to aspirin.
- In the prevention of vascular ischaemic events in patients with symptomatic atherosclerosis (recent ischaemic stroke, recent myocardial infarction, or peripheral arterial disease with intermittent claudication).

Clopidogrel, co-administered with aspirin, has proven benefit in:

- Acute coronary syndromes
- Prevention of thrombosis after percutaneous coronary intervention
- Recurrent cerebrovascular events (stroke or TIA) in patients on aspirin therapy.

Monitoring

Only clinical monitoring is required for the antithrombotic or adverse effects of clopidogrel.

Determinants of bleeding

The most common adverse outcome of clopidogrel therapy is bleeding. The risk of bleeding increases markedly when it is combined with other drugs that effect haemostasis, such as other antiplatelet drugs, anticoagulants, and NSAIDs.

Management of bleeding

If bleeding occurs in a patient taking clopidogrel:

- Withhold the clopidogrel.
- Provide supportive therapy (e.g. blood transfusion if required).

There is no specific antidote to clopidogrel. In life-threatening bleeding, platelet transfusion should be administered.

References

Australian Medicines Handbook. (2013). *Australian medicines handbook*. Adelaide: Author.

GlaxoSmithKline NZ. (n.d.). *Patient handbook — Your anticoagulant treatment*. Auckland: Author.

Therapeutic Guidelines Limited. (2015). *eTG complete* [online resource]. Melbourne: Author.

Tran, H.A., Chunilal, S.D., Harper, P.L., Tran, H., Wood, E.M., & Gallus, A.S. (2013). An update of consensus guidelines for warfarin reversal. *Medical Journal of Australia*, 198(4), 1–7. [© Copyright 2013 The Medical Journal of Australia — adapted with permission.]

⁶² Australian Medicines Handbook. (2013). *Australian medicines handbook* (p.953). Adelaide: Author.

⁶³ GlaxoSmithKline NZ. (n.d.). *Patient handbook — Your anticoagulant treatment*. Auckland: Author; Australian Medicines Handbook. op cit.

⁶⁴ GlaxoSmithKline. op cit., p.35.

⁶⁵ Australian Medicines Handbook. op cit.

⁶⁶ GlaxoSmithKline. op cit., p.35.

⁶⁷ Tran, H.A., Chunilal, S.D., Harper, P.L., Tran, H., Wood, E.M., & Gallus, A.S. (2013). An update of consensus guidelines for warfarin reversal. *Medical Journal of Australia*, 198(4), 1–7.

⁶⁸ Sourced and adapted from: Tran et al. op cit.

19. Patient education and self-management of drug therapy

Prescribers should always discuss with patients the reason they are taking their therapy and its expected benefits and potential harms.

A comprehensive medication list should be supplied at the start of therapy and be maintained to reflect the patient's current therapy. The information provided with the list of prescribed medication should include (but is not confined to):

- reason for prescribing
- intended duration of therapy
- common adverse effects
- when and what symptoms to report to the medical practitioner
- what action to take if a dose or doses are missed.

Specific education is required for all patients prescribed antithrombotic drugs. The education includes (but is not confined to):

- signs of bleeding, and what action to take
- timing of the dose
- timing of any blood test monitoring
- intended duration of therapy.

Written information should be provided to all patients prescribed antithrombotic drugs. A warfarin booklet should be provided to all patients on commencement of warfarin therapy.

For those on warfarin, this information should include the intended target INR, the frequency of blood tests, and the intended duration of therapy. For all of the antithrombotic drugs, this information should include what action to take if major dental work or any surgical procedure is required.

Adherence to drug therapy and lifestyle changes before initiating drug therapy for CVD:

- Identify patients who require drug therapy by assessing absolute CVD risk.
- Implement behavioural risk factor modification. Behavioural changes are always first-line therapy, even if a drug is required from the outset, as adverse lifestyle factors may counteract drug therapy and therapeutic targets. Emphasise to the patient that, as well as reducing CVD risk, behavioural changes are beneficial for the prevention of other chronic diseases and for general health and wellbeing.
- Adherence to lifestyle modification and drug therapy is vital.

Some measures to improve adherence to drug therapy include:

- Discuss the reasons for therapy, the need for lifelong therapy, and the consequences of non-adherence to therapy.
- Inform the patient of common adverse effects and what to do if they occur.
- Involve the support of family or friends where appropriate.
- Consider the financial burden and other system barriers that might deter the patient from filling their prescription.
- Provide specific written instructions and patient education materials in the language most appropriate for the patient.
- Give the patient a medication list that details the drug, dose, time, and frequency of administration, and indication. Provide an updated list whenever a regimen is changed.
- Enlist the support of your pharmacy colleagues to reinforce the importance of therapy.
- Use once-daily dosing where possible to reduce the number of tablets or capsules required per day.
- Fit the regimen to the patient's lifestyle by using routine daily activities as prompts (e.g. take morning medications after brushing teeth).
- Identify patients who are likely to be non-adherent. Major predictors of non-adherence are:
 - presence of depression and other mental illnesses
 - cognitive impairment
 - treatment of asymptomatic disease

- adverse effects of medications
 - lack of illness insight or belief in benefits of treatment
 - problems with delivery of care (e.g. inadequate planning and follow-up, poor doctor–patient relationship, missed appointments)
 - treatment complexity
 - barriers to care (access and cost).
- Ask about adherence regularly and non-judgmentally (e.g. ‘Do you sometimes forget to take your medication?’)
 - Investigate and address the reasons for non-adherence.

References

Therapeutic Guidelines Limited. (2015). *eTG complete* [online resource].
Melbourne: Author.

Annexes

Annex A	Modified optimal risk factor levels table
Annex B	The 12 S's to lessen stress
Annex C	Infusion protocols
Annex D	Emergency chest pain pathway
Annex E	Heparin protocol
Annex F	Initiation of warfarin therapy protocol

Annex A — Modified optimal risk factor levels table

Indicator	Optimal risk factor levels
Blood pressure (mm Hg)	<140/90 ≤130/80 in certain populations
*Body mass index (kg/m ²) Ideal BMI: 20–25 kg/m ²	18.5–24.9
Total cholesterol (mmol/L)	<4.0
HDL-cholesterol (mmol/L)	>1.0
LDL-cholesterol (mmol/L)	<2.0
Triglycerides (mmol/L)	<1.5
**HbA1c (%)	≤7.0: needs to be individualised

* BMI ranges recommended for Pacific Islanders are somewhat higher at 20.5–27.0.

**HbA1c — amount of circulating glycosylated haemoglobin, a measure of the overall control over preceding 3 months.

Schultz, D. (1999). *BMI cut-off for Pacific Islanders*. Suva: National Food and Nutrition Centre; Government of Fiji Ministry of Health. (2012). *Diabetes management guidelines* (3rd ed.). Suva: Author.

Annex B — The 12 S's to lessen stress

Fiji Association of Mental Health's 12 S's to Lessen Stress:

1. Smile
2. Stretch & exercise
3. Soothing & calming music
4. Sing & dance
5. Share worries & tasks
6. Spirituality (prayer/meditation)
7. Simplify & prioritise things
8. Sleep well
9. Self-care & esteem
10. Socialise
11. Slow & deep breathing
12. Spend (time & money) wisely

Government of Fiji Ministry of Health. (2012). *Diabetes management guidelines* (3rd ed.) (p.44). Suva: Author.

Annex C — Infusion protocols

Medication	Formulation	Preparation	Infusion rate
Amiodarone	150 mg/3 mL ampoule	<p>Loading dose: Add 300 mg (6 mL) of amiodarone to 94 mL of dextrose 5% in a metred chamber.</p> <p>Maintenance dose:</p> <ul style="list-style-type: none"> Discard 518 mL from a 1 L bag of dextrose 5%. Add 900 mg (18 mL) of amiodarone to the 482 mL of dextrose 5% remaining in the bag. 	<p>Loading dose: Administer loading dose preparation over 1 hour via infusion pump.</p> <p>Maintenance dose: Administer maintenance dose preparation over 24 hours via infusion pump.</p>
Dobutamine	250 mg/20 mL ampoule	<ul style="list-style-type: none"> Add 250 mg (20 mL) of dobutamine to 80 mL of normal saline or dextrose 5% in a metred chamber. Giving a concentration of 2.5 mg/mL or 2500 micrograms/mL. 	<p>Usual dose: 2.5–10 micrograms/kg/min.</p> <p>For example: for a 60 kg patient, the rate of the dobutamine infusion will be 4–15 mL/hr.</p>
Dopamine	200 mg/5 mL ampoule	<ul style="list-style-type: none"> Add 200 mg (5 mL) of dopamine to 95 mL of normal saline or dextrose 5% in a metred chamber. Giving a concentration of 2 mg/mL. 1 mL = 60 microdrops. 33 micrograms/microdrop. <p>For large volume infusion:</p> <ul style="list-style-type: none"> Add 1 g (25 mL) of dopamine to 475 mL of dextrose 5% in a metred chamber. Giving a concentration of 2 mg/mL. 	<p>To achieve enhanced renal perfusion: 2–5 micrograms/kg/min (For a 60 kg patient: 120–300 micrograms/min).</p> <p>For anti-hypotensive effect: 5–50 micrograms/kg/minute (For a 60 kg patient: 300–3000 micrograms/min).</p> <p>For example the infusion rate in a 60 kg patient will be:</p> <ul style="list-style-type: none"> Renal perfusion dose: 4–9 microdrops/min (4–9 mL/hr). Anti-hypotensive effect: 9–90 microdrops/min (9–90 mL/hr).

Dopamine infusion rate using 2 mg/mL (2000 microgram/mL) concentration											
		Dose (micrograms/kg/min)	2	4	6	8	10	15	20		
		Estimated body weight	Infusion rate (mL/hour)								
Hydralazine	20 mg/ampoule powder for reconstitution	40 kg	2.4	4.8	7.2	9.6	12	18	24		
		60 kg	3.6	7.2	10.8	14.4	18	27	36		
		80 kg	4.8	9.6	14.4	19.2	24	36	48		
		100 kg	6	12	18	24	30	45	60		
		120 kg	7.2	14.4	21.6	28.8	36	54	72		
N.B. Large volumes of fluid are being infused at higher infusion rates (Medical Unit 2008).											
Hydralazine	20 mg/ampoule powder for reconstitution	<ul style="list-style-type: none">Reconstitute 100 mg hydralazine by adding 10 mL of sterile water.Add the 10 mL of reconstituted hydralazine solution to 90 mL of normal saline in a metred chamber. Add this 10 mL of reconstituted hydralazine solution to 90 mL of normal saline in a metred chamber.Giving a final concentration of 1 mg/mL.									<p>Infuse initially at 0.2–0.3 mg/min (12–18 mL/hr) until BP is controlled, followed by maintenance dose.</p> <p>Maintenance dose: 0.05–0.15 mg/min (3–9 mL/hr).</p>
Isoprenaline	0.2 mg/mL ampoule (This is the only formulation available at the time of printing.)	<ul style="list-style-type: none">Add 2 mg (10 mL) of Isoprenaline to 90 mL of normal saline or dextrose 5% in a metred chamber.Giving a final concentration of 0.02 mg/mL OR 20 micrograms/mL).									<ul style="list-style-type: none">Via infusion pump, commence isoprenaline infusion at 2 micrograms/min (6 mL/hr).Increase infusion rate by 1 increment every 5 minutes until target HR is achieved (usually 60 beats/min).

Isoprenaline infusion dose and pump rate		
	Dose (micrograms/min)	Infusion pump rate (mL/hr)
	2	6
	3	9
	4	12
	5	15
	6	18
	7	21
	8	24
	9	27
	10	30
	20	60
Labetalol	100 mg/20 mL ampoule	<ul style="list-style-type: none"> Add 100 mg (20 mL) of labetalol to 80 mL of dextrose 5% in a metred chamber. Giving a final concentration of 1 mg/mL.
		<ul style="list-style-type: none"> Recommended dose: 0.5–2 mg/min. Infusion rate: 30 mL/hr (0.5 mg/min) initially then titrate until diastolic blood pressure stabilised, to a maximum dose of 120 mL/hr (2 mg/min).

Lignocaine 1%	1% solution (10 mg/mL) vial	<ul style="list-style-type: none">Discard 400 mL from 1 litre of dextrose 5% and add 4 grams (400 mL) of lignocaine 1%.Giving a final concentration of 4 mg/mL.	VT related to infarction <table><tr><th>Time</th><th>Rate (mL/hour)</th><th>Dose (mg/minute)</th></tr><tr><td>1st hour</td><td>60</td><td>4</td></tr><tr><td>2nd hour</td><td>45</td><td>3</td></tr><tr><td>After the 2nd hour for 24 hours</td><td>30</td><td>2</td></tr><tr><td colspan="3">Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.</td></tr></table> VT unrelated to infarction: 30 mL/hr (2 mg/min). Increase only if further VT at this dose.	Time	Rate (mL/hour)	Dose (mg/minute)	1 st hour	60	4	2 nd hour	45	3	After the 2 nd hour for 24 hours	30	2	Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.		
Time	Rate (mL/hour)	Dose (mg/minute)																
1 st hour	60	4																
2 nd hour	45	3																
After the 2 nd hour for 24 hours	30	2																
Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.																		
Lignocaine 2%	2% solution (400 mg/20 mL) vial	<ul style="list-style-type: none">Discard 200 mL from 1 litre of dextrose 5% and add 4 grams (200 mL) of lignocaine 2%.Giving a final concentration of 4 mg/mL.	VT unrelated to infarction: 30 mL/hour (2 mg/min). Increase only if further VT at this dose. VT related to infarction: <table><tr><th>Time</th><th>Rate (mL/hour)</th><th>Dose (mg/minute)</th></tr><tr><td>1st hour</td><td>60</td><td>4</td></tr><tr><td>2nd hour</td><td>45</td><td>3</td></tr><tr><td>After the 2nd hour for 24 hours</td><td>30</td><td>2</td></tr><tr><td colspan="3">Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.</td></tr></table>	Time	Rate (mL/hour)	Dose (mg/minute)	1 st hour	60	4	2 nd hour	45	3	After the 2 nd hour for 24 hours	30	2	Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.		
Time	Rate (mL/hour)	Dose (mg/minute)																
1 st hour	60	4																
2 nd hour	45	3																
After the 2 nd hour for 24 hours	30	2																
Usual duration of infusion 24 hours. Can be used for 48 hours if clinically indicated.																		

Cardiovascular Therapeutic Guidelines

Noradrenaline	1 mg/mL ampoule	<ul style="list-style-type: none"> • Add 6 mg (6 mL) of noradrenaline to 94 mL of dextrose 5% in a metred chamber. • Giving a concentration of 0.06 mg/mL. 	Run the infusion at 1–10 mL per hour to deliver 1–10 micrograms/minute.
Streptokinase	1.5 million International Unit vial for reconstitution	<ul style="list-style-type: none"> • Reconstitute 1.5 million International Units of streptokinase ampoule by adding 2 mL of normal saline. • Add the 2 mL of reconstituted streptokinase solution to 98 mL of normal saline in a metred chamber. 	Infuse at 100 mL/hr.



Annex D — Emergency chest pain pathway

Name:

Triage time:

Symptom onset time:

HPC:

☐ Chest pain☐ Diaphoresis☐ SOB☐ N/V☐ Radiation to:

HEART SCORE*

(Calculated by adding up all of the points shown in brackets below)

Age

☐ >65 years (2 points)☐ 45–65 (1 point)☐ <45 (0)Hx: Likelihood
ischaemic pain☐ High (2)☐ Moderate (1)☐ Slight (0)

Risk factors (circle):

HTN DM Smoker Dyslipidaemia FHxCAD Obesity BMI>27 kg/m²)

Risk factors:

☐ ≥3 (2)☐ 1–2 (1)☐ Nil (0)

ECG

☐ ST depression (2)☐ Non-specific (1)☐ Normal (0)

Troponin

☐ >3x normal (2)☐ 1–3 x normal (1)☐ Normal (0)

Past cardiac/other Hx

Previous ECG findings:

Usual meds:

Allergies:

At 5 mins:

• Baseline vital signs and pain score

• O₂ for SaO₂ 95%

• Continuous ECG monitor.

12 Lead ECG time: _____

☐ Show Medical Officer

If ST elevation/new LBBB <12 hours assess for thrombolysis — See Streptokinase Guideline

☐ Aspirin 300 mg PO☐ IV and bloods sent FBE, U&E, Troponin

GTN SL every 5 mins x 3 PRN until pain free. Reassess pain and vitals after each intervention. Morphine 2.5–10 mg IV PRN until pain free.

Troponin 1 result: _____ Troponin 2 time sent: _____ result: _____ ☐ rpt ECG(2nd troponin should be sent if 1st result normal or indeterminate and should be taken 4 hours after troponin 1)HEART SCORE /10 Time_____ Disposition ☐ Home ☐ Ward ☐ CCU ☐ ICU

* 0–3 Low risk (1%), 4–6 Intermediate risk (11%), 7–10 High risk (65%)

Risk for major cardiovascular event at 6/52 (MI, PCI, CABG, Death)

Based on scores used by Backus, B.E., Six, A.J., Kelder, J.C., Mast, T.P., van den Akker, F., & Mast, E.G. (2010). Chest pain in the emergency room: a multicenter validation of the HEART Score. *Critical Pathways in Cardiology*, 9(3), 164–169.

ED ACUTE STEMI CHECKLIST

- ☐ Patient placed on cardiac monitor, pulse oximetry and insert 2 large intravenous lines.
- ☐ Patient given the following:
- ☐ Oxygen titrate to >94% saturation
 - ☐ Aspirin 300 mg po TIME GIVEN: _____
 - ☐ Glyceryl trinitrate 0.6 mg sublingually every 5 minutes
 - ☐ (hold for SBP <100 mm Hg).
- ☐ Blood drawn for FBC, UE, INR, PTT and Troponin.

Time of Triage:

		:		
--	--	---	--	--

Time of Pain Onset:

		:		
--	--	---	--	--

Time of Initial ECG

		:		
--	--	---	--	--

- ☐ Patient informed of diagnosis and given risks/benefits of thrombolytics.
- ☐ ED physician identifies and documents any contraindications (see below).

If an absolute contraindication is identified, streptokinase is not to be given. If a relative contraindication is identified, discuss with the patient and medicine registrar.

If there is any concern regarding administration of streptokinase, please involve the medicine consultant.

Absolute contraindications

- History of any intracranial haemorrhage.
- History of ischemic stroke within the preceding three months.
- Presence of a cerebral vascular malformation or intracranial malignancy.
- Symptoms or signs suggestive of an aortic dissection.
- Bleeding diathesis or active bleeding, (with the exception of menses).
- Significant closed-head or facial trauma within the preceding three months.

Relative contraindications

- History of chronic, severe, poorly controlled hypertension or uncontrolled hypertension at presentation (blood pressure >180 systolic or >110 diastolic).
- History of ischemic stroke more than three months previously.
- Dementia.
- Any known intracranial disease that is not an absolute contraindication.
- Traumatic or prolonged (>10 min) cardiopulmonary resuscitation.
- Major surgery within the preceding four weeks.
- Internal bleeding within the preceding four weeks or an active peptic ulcer.
- Non-compressible vascular punctures.
- Pregnancy.
- Current warfarin therapy — the risk of bleeding increases as the INR increases.
- Prior exposure (more than five days previously) or allergy to streptokinase.
- Age >75 years.

Sourced and adapted from: Therapeutic Guidelines Limited. (2015). *eTG complete* [online resource]. Melbourne: Author.

☐ **Streptokinase dosage as follows:**

- ☐ **Strength:** 1 vial = 1,500,000 units (powder).
- ☐ **Reconstitute:** 2 mL normal saline into 1 vial of streptokinase.

- ☐ **Infusion preparation:** add reconstituted streptokinase to 98 mL normal saline in a metred chamber.
- ☐ **Infusion rate:** 100 mL/hour.

Time of streptokinase
administration:

		:		
--	--	---	--	--

- ☐ **ED nurse at bedside during entire infusion:** complete set of vital signs taken every 15 minutes. Blood pressure taken every 5 minutes.
- ☐ ED physician immediately available during entire infusion.
- ☐ Repeat EKG performed on completion of thrombolytics and 60 minutes after completion.

Complications: The ED physicians must be prepared to handle any complications that occur during streptokinase infusion. Complications for the following:

1. **Allergic reaction:** (i.e. fever, rash, rigor, bronchospasm). Stop infusion and give IV hydrocortisone 100 mg +/- IV promethazine 12.5 mg slowly (beware hypotension).
2. **Bleeding:** stop infusion and give fresh frozen plasma (and cryoprecipitate if available). Blood/FFP/cryoprecipitate transfusion if necessary.
3. **Hypotension (SBP <90 mm Hg):** interrupt infusion temporarily and place patient Trendelenburg position. Bolus 500 mL of normal saline.
4. **Sinus bradycardia:** reduce infusion (decrease it to 2 hours). Avoid intravenous atropine, if possible.
5. **Other side effects include:** headache, high temperature, and haemorrhages.

N.B. 'Slow VT'/ventricular ectopics or HR 110–140 with asymptomatic patients. Do not treat. This is due to reperfusion.

Annex E — Heparin infusion protocol

Heparin is an anticoagulant. It acts by binding to and potentiating the activity of antithrombin III, converting it to a rapid inactivator of thrombin and factor Xa (also XIIa, XIa, and IXa). The anticoagulant action of heparin is monitored using the APTT, aiming for an APTT of 50–75 seconds (or 1.5–2.5 times control). Coagulation will return to normal ~4–6 hours after cessation of heparin.

Indications

- Venous thromboembolism
- Non-ST elevation acute coronary syndromes (high risk patients)
- Acute limb ischaemia.

Seek consultant advice before using heparin post thrombolysis, or in other patients at high risk of bleeding.

Infusion protocol

1. Prepare heparin infusion by diluting 50,000 units heparin in 1,000 mL 5% dextrose OR normal saline solution (to create a 50 units per mL solution).

2. Take baseline bloods for coagulation profile (APTT/INR)* and FBC.

*Do not use these values to adjust the heparin infusion rate. If baseline levels are abnormal, discuss with Consultant.

3. Give an initial intravenous heparin bolus of 5,000 units stat.
4. Start infusion at a rate of 1,000 units per hour (20 mL per hour).
5. Check APTT 6 hours after commencement of the infusion* and adjust the infusion rate according to the following nomogram:

*When collecting blood for the APTT always ensure the venepuncture specimen is not taken from the limb into which the heparin infusion is running, as this can give spuriously high APTT results.

APTT	Action
APTT <35 secs	5,000 units IV bolus and increase infusion rate by 200 units per hour (4 mL per hr).
APTT 35 –50 secs	2,500 units IV bolus and increase infusion rate by 100 units per hour (2 mL per hr).
APTT 50–75 secs	No change.
APTT 75 –90 secs	Decrease infusion rate by 100 units per hour (2 mL per hr).
APTT >90 secs	Stop infusion for 2 hours then restart and decrease infusion rate by 200 units per hour (4 mL per hr).

6. Check the APTT again 12 hours after the initial commencement of the infusion. Thereafter, recheck the APTT 6 hours after any change to the rate of the infusion. Once the infusion is stable in the therapeutic range (APTT 50–75 secs) the APTT can be checked daily.

CWM Medical Unit, August 2007

Annex F — Initiation of warfarin therapy protocol

Pre-treatment: do baseline FBC, APTT, INR, and LFTs.

Dose and prescribing information:

1. Commence on 5 mg warfarin daily, given at 5 pm on the first and second days.
2. Check INR on the morning of the third day.
3. Give subsequent doses according to the dose adjustment guide below.
4. The INR should be repeated each morning and the warfarin dose adjusted until a stable INR in the desired therapeutic range (usually 2.0–3.0) is achieved.

CWMH's warfarin initiation dosage guide

Day	INR	Warfarin dose
1		5 mg
2		5 mg
3	<2.0	5 mg
	2.0–2.4	4 mg
	2.5–2.9	3 mg
	3.0–3.4	1.5 mg
	3.5–4.0	0.5 mg
	>4.0	Nil
4 and until stabilised	<1.4	10 mg
	1.4–1.6	7 mg
	1.7–1.9	6 mg
	2.0–2.5	5 mg
	2.6–3.0	4 mg
	3.1–4.0	3 mg
	>4.0	Omit for 2 days and restart at 1 mg

* Patients on warfarin therapy are at a higher risk of bleeding particularly if INR is excessively prolonged. Patients should be advised that if they notice any signs of bleeding then they should report this immediately and urgent INR should be done.

