

Australasian Health Facility Guidelines

Part B - Health Facility Briefing and Planning 0170 – Cardiac Investigation Unit

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Australasian Health Facility Guidelines

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01 INTRODUCTION

1.1 PREAMBLE

This Health Planning Unit (HPU) has been developed by the Australasian Health Infrastructure Alliance (AHIA). This revision has been informed by an extensive consultation process that was completed in 2019.

The document is intended to be used by design teams, project managers and end users to facilitate the process of planning and design.

1.2 INTRODUCTION

1.2.1 General

HPU 170 outlines the specific requirements for the planning and design of a Cardiac Investigation Unit (CIU) and incorporates cardiac catheter laboratories, cardiac diagnostics and specialist cardiac outpatient services. The document should be read in conjunction with the Australasian Health Facility Guidelines (AusHFG) generic requirements described in:

- Part A: Introduction and Instructions for Use;
- Part B Section 80: General Requirements and Section 90: Standard Components;
- Part C: Design for Access, Mobility, Safety and Security; and
- Part D: Infection Prevention and Control.

Other relevant AusHFG HPUs include:

- HPU 260 Cardiac Care Unit;
- HPU 340 Inpatient Accommodation Unit, e.g. for general cardiology inpatient units;
- HPU 360 Intensive Care Unit, where the Cardiac Care Unit may be a component of an intensive care unit; and
- HPU 520 Operating Unit, for requirements relating to cardiac surgery.

Paediatric services and facilities are excluded from this guideline. Paediatric studies are longer in duration and more complex, frequently requiring two physicians per study. It is particularly important that infants and all patients with complex congenital heart disease be catheterised only in centres with active paediatric cardiac surgical programs.

1.3 POLICY FRAMEWORK

Prior to undertaking a project, planners and project personnel are encouraged to familiarise themselves with relevant State and Territory specific policies, along with the following publication:

- Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI).

1.4 DESCRIPTION

1.4.1 Range of Services

This HPU addresses the following components of a cardiac investigation service primarily for secondary and tertiary healthcare facilities, although some components may be provided in smaller hospitals:

- cardiac catheter laboratories (CCL);

- cardiac diagnostic services:
 - echocardiography including transthoracic echocardiography (TTE) and transoesophageal (TOE);
 - electrocardiogram (ECG);
 - stress testing, including ECG and echo exercise stress testing and pharmacological stress testing;
 - holter monitoring;
 - ambulatory blood pressure monitoring;
 - pacemaker and defibrillator implantation check and follow-up;
 - tilt table testing;
 - computed tomography coronary angiography (CTCA);
 - cardiac device home monitoring services; and
- specialist cardiac outpatient clinics.

Cardiac Care Units (CCU) and general cardiology inpatient services are covered in other HPUs as noted in Section 1.2.1.

This HPU includes general diagnostic and interventional cardiac catheter laboratories, as well as electrophysiology (EP) laboratories used to treat complex arrhythmias. Hybrid labs that support both surgical and intravascular procedures are used for a range of structural heart interventions including aortic valve replacements, mitral valve repairs and atrial septal defect repairs. These highly specialised labs are commonly located in an operating theatre suite and are not included in the scope of this HPU. Project teams will need to refer to HPU 520 Operating Unit.

1.4.2 Model of Care

Cardiac investigation services are part of an overall cardiology model of care. Prior to commencing a planning and design process, the future cardiology models of care across the full care continuum must be defined. This includes confirmation of the clinical pathway for managing Acute Coronary Syndrome to ensure that the future design supports a seamless patient journey with access to timely, high quality and coordinated patient care.

Key considerations relating to the models of care are noted below, acknowledging that not all components below will be provided in every facility but will be available via a networked service:

- implementation of early triage of myocardial infarction whereby ambulance services undertake a 12 lead ECG to determine if pain is cardiac in origin and if it requires urgent angioplasty within a specialist centre. The ambulance transfer may bypass the emergency department which has implications for the location of and access to the cardiac catheter laboratories;
- establishment of dedicated chest pain evaluation / assessment services with direct access to appropriate cardiac diagnostic equipment and staff skilled in cardiac care who can initiate treatment protocols. These are commonly being established either as a zone within a CIU or adjacent to the emergency unit;
- access to medical imaging modalities including CTCA and MRI. These modalities require the patient's heart to be slowed during acquisition of the image so expert cardiology staff must be in attendance;
- use of remote, home cardiac monitoring for chronic patients in the community;
- increasing use of telemedicine to support patient care;
- provision of specialist outpatient services, e.g. heart failure and rapid access clinics;
- increasing demand for interventional electrophysiology with complex arrhythmias such as atrial fibrillation, complex atrial tachycardia and ischaemic ventricular tachycardia now able to be treated with three-dimensional mapping; and
- converging of the disciplines of cardiology and cardiac surgery for procedures such as mitral valve repair, and repair of patent ductus arteriosus.

Cardiac catheter laboratories and cardiac diagnostic services are accessed by both inpatients and outpatients. Most inpatients will be transferred to the cardiac diagnostic services unit unless they are too unwell to travel, e.g. patients in CCU, ICU and ED resuscitation bays.

These units will have some diagnostic equipment on the unit, e.g. ECG, or alternatively a mobile machine will be taken to the patient, e.g. for TOEs. The use of mobile machines should be minimised given the sensitivity of the machines and staff work, health and safety considerations.

Access to holding and recovery bays is required for cardiac catheter laboratories and TOEs.

A brief description of a range of procedures that may be undertaken within a CIU is presented in the Appendix 5.3 Description of Cardiac Investigations Services.

02 PLANNING

2.1 OPERATIONAL MODELS

2.1.1 Operational Service Models

Cardiac Catheter Laboratories

Depending on the role and function of the service, cardiac catheter laboratories may be:

- a dedicated component of a cardiac precinct;
- a component of an interventional imaging suite in a medical imaging unit; or
- an extension of an 'interventional floor' incorporating operating theatres and cardiac catheter laboratories.

Advantages and disadvantages of these operational models are summarised below. The preferred model also needs to take into consideration the proposed location of ICU, CCU, ED and other cardiology services to ensure optimal patient flows.

Cath Lab Location	Advantages	Disadvantages
Cardiac Precinct	<ul style="list-style-type: none"> • rapid patient transfer to and from CCU • opportunity to share holding and recovery areas with TOE and other cardiac investigation services • direct access to additional staff skilled in cardiac care • greater opportunities for integration and collaboration across cardiology staff 	<ul style="list-style-type: none"> • less direct access to specialist anaesthetic support • less direct access to theatre in the event that open cardiac surgery is required • reduced opportunity for synergies with other interventional services relating to stock control
Interventional Imaging Suite	<ul style="list-style-type: none"> • opportunity to share holding and recovery areas with other interventional imaging services • synergies relating to stock control 	<ul style="list-style-type: none"> • greater travel distance between CCU and the cath labs • less direct access to theatre in the event that open cardiac surgery is required • less opportunity for collaboration with other specialist cardiac staff
Interventional Suite with Operating Theatres (only relevant in facilities where cardiac surgery is provided)	<ul style="list-style-type: none"> • direct access to anaesthetic support, recovery and other associated support areas 24/7 • rapid access in the event that open cardiac surgery is required 	<ul style="list-style-type: none"> • greater travel distance between CCU and the cath labs • recovery areas still require specialist cardiac staff who have less opportunity for collaboration with other cardiac team members

Cardiac Diagnostic Unit

Cardiac diagnostic services may be provided:

- as part of a fully integrated cardiac investigation unit or cardiac precinct;
- as part of a clinical measurement unit (that may also include facilities for diagnostic neurology and respiratory function testing, including spirometry); or
- as part of an outpatient / ambulatory care unit (depending on the range of tests to be provided).

Cardiac Specialist Outpatient Clinics

Cardiac clinics may be provided as:

- dedicated consulting rooms in a cardiac precinct;
- consulting rooms in a clinical measurement unit (usually shared with other disciplines); or
- a general outpatient / ambulatory care unit.

Provision of cardiac clinics should be based on throughput and endorsed clinical service planning.

2.1.2 Staffing

Staffing levels will vary for each unit, depending on the size of the unit; clinical case load; operational policies; required staff skill mix and level of supervision required.

The staff establishment may include (on a permanent and visiting basis) the following disciplines:

- cardiologists (specialists, registrars and residents);
- radiographers;
- cardiac physiologists;
- cardiac sonographers;
- nursing staff;
- unit or service manager;
- administrative staff;
- allied health professionals;
- education and research staff where applicable;
- support staff including patient transport; and
- students.

The staff establishment should be developed early in the planning process in order to inform the range of staff work areas and amenities that will be required.

2.1.3 Education, Training and Research

The approach to staff education, training and research for the unit and the overall hospital will inform the extent of associated facilities required, both within and external to the CIU.

This may include:

- some education, training and meeting spaces provided locally;
- videoconferencing facilities;
- simulation capability, e.g. for advanced life support and sonography;
- support for research protocols;
- specialist research laboratories may be provided in tertiary facilities;
- staff work areas for those engaged in education and research; and
- support for students.

2.2 OPERATIONAL POLICIES

2.2.1 General

Operational policies have a major impact upon the planning and design and capital and recurrent costs of health facilities.

Project teams should review their design proposals with these in mind and be able to demonstrate that the capital and recurrent cost implications of proposed operational policies have been fully considered. Operational policies may have hospital-wide application or be unit specific. A list of general operational policies that may apply can be found in Part B: Section 80 General Requirements.

2.2.2 Hours of Operation

The unit will generally operate during business hours with after-hours emergency access to catheter laboratories and echo (TTE and TOE) services, particularly in tertiary facilities, however after-hours services are increasingly being provided in selected regional areas also.

A range of other after-hours services may also be available, e.g. rapid chest pain clinics, access to CTCA and urgent pacemaker or defibrillator checks.

2.2.3 Cardiac Arrest and Resuscitation

Cardiac services and associated tests present a higher than usual likelihood of cardiac arrest, and resuscitation equipment should always be immediately accessible.

An electrophysiology or implantable electronic device laboratory should contain, or have access to, two external cardiac defibrillators, as multiple use during procedures increases the incidence of equipment failure. One cardiac defibrillator should be located within the laboratory and another close by.

In diagnostic rooms, such as those for echocardiography and stress testing, the room size should be sufficient to allow access to a patient in the event of cardiac arrest without requiring the major movement of equipment.

2.2.4 Electrocardiograms

In addition to ECGs routinely undertaken on its own patients (outpatients, inpatients, day patients), the cardiology service is frequently responsible for ECG requests for other inpatients throughout the healthcare facility, usually excluding emergency unit and intensive care units. Cardiology technicians may use machines stored in individual units or take an ECG machine to the patient from a central store. Facilities to store this equipment will be required.

Information technology should enable ECG recordings to be available anywhere, at any time, within the healthcare facility.

Consideration will therefore need to be given to:

- units that undertake their own ECG using their own equipment;
- the number of mobile ECG units for general hospital use and storage locations;
- after-hours arrangements;
- telemedicine capacity; and
- information technology systems that enable downloading of ECGs for centralised reporting.

2.2.5 Management of Bariatric Patients

Problems with the quality of the images may preclude heavier patients from treatment or investigations in the catheter laboratories. However, currently available tables are capable of supporting a total weight including patients and on table equipment, e.g. injectors, of up to 250-300 kilograms depending on the vendor.

In the catheter laboratories, space restricts effective use of hoists. Ceiling hoists will not be possible due to the C-Arm and other ceiling-mounted equipment. However, manual handling of bariatric patients can generally be achieved with the use of inflatable transfer mattresses or portable lifting equipment.

For other diagnostic rooms, consideration should be given to the weight capacity of plinths, examination couches and stress testing equipment.

2.2.6 Pathology

Point of care pathology testing is routinely required for cardiac catheter laboratories. The associated equipment may be provided within the unit or be easily accessible within adjoining units, such as the CCU or ICU.

Ready access to a pneumatic tube system (PTS) assists with the rapid or urgent assessment of pathology specimens.

2.2.7 Anaesthetic Services

The majority of patients accessing cardiac catheter laboratories are managed with local anaesthetic. Coronary angiography is provided under local anaesthetic and may require conscious sedation. PCI is performed under local anaesthetic with conscious sedation.

Some of the more complex procedures, such as insertion of permanent pacemakers and implantable cardiac defibrillators (ICD), are performed under general or local anaesthetic.

Patients requiring general anaesthetic are usually induced within the laboratory. Project teams should refer to local jurisdictional requirements regarding access to anaesthetic services.

2.2.8 Patient Recovery and Discharge Management

Patients require close observation for a minimum of three to four hours following angiography, and four to six hours following PCI. Inpatients will return to their own unit. Options for recovery of day patients include:

- recovery area in the cardiac catheter laboratory;
- CCU or cardiac inpatient unit; and/or
- extended day only (23 hour) unit, with cardiac monitoring capability.

Once stable, patients referred from other hospitals may be transported back to the referring institution, transferred to another healthcare facility with access to appropriate monitoring, or may be discharged home. However, overnight beds should be available for patients from geographically isolated areas who may not be able to return home immediately or following complications.

For the first 24 hours following angiography, day patients should remain within an accessible distance of a service that is able to manage relatively common complications. They also need to be accompanied by a responsible adult to and from the facility.

Access to recovery areas is also required following TOE procedures. Patient recovery time for this procedure is typically two hours.

Holding bays for patients awaiting their procedure should be flexibly used with recovery bays. The recommended number of recovery bays per cardiac catheter laboratory and TOE room is included in the schedule of accommodation at Appendix 5.1. The capacity requirements for pre-procedure patient holding bays will depend on local operational arrangements noting that access to pre-procedure holding bays for inpatients can increase the efficiency of the unit, however the staffing requirements to provide oversight of these patients requires consideration.

2.2.9 Reprocessing of Reusable Devices

TOE probes are commonly reprocessed within the unit, however facilities may access a centralised reprocessing service. A common arrangement is to provide a clean-up room directly accessible from the TOE room where probes are reprocessed using an automated and closed high level disinfection unit.

Ultrasound transducers used for TTEs will also require reprocessing. These are heat-sensitive items and need to be disinfected using low-temperature chemical sterilising or disinfecting agents, or other approved automated systems. This may be performed at the point of care or in a separate room with unidirectional dirty to clean workflows.

Reprocessing of reusable devices, under both centralised and decentralised models, must align with the following publications:

- AS/NZS 4187 Reprocessing of reusable medical devices in health services organisations (Standards Australia); and
- Australian College for Infection Prevention and Control (ACIPC) & Australasian Society for Ultrasound in Medicine (ASUM) 2017, Guidelines for Reprocessing Ultrasound Transducers.

2.2.10 Telemedicine

Telemedicine links between community centres, ambulance units, emergency departments, cardiac units and the cardiologists' homes may considerably enhance the early diagnosis and ongoing treatment of patients.

Information technology infrastructure needs to support the communication of high resolution images and videos for a range of services including Echo services, cardiac catheter labs and CTCA. This will include the provision of live two-way, uninterrupted video and audio transmissions between facilities to support telemedicine services and education and training.

2.3 PLANNING MODELS

2.3.1 Location

The most appropriate location for the CIU will depend on the range of services to be provided, the anticipated volume of inpatient and outpatient activity and the preferred operational model as previously described.

Consideration should be given to outpatient volumes with regard to ease of access for patients and vertical access to clinics if the cardiac precinct is not on a ground floor.

The CIU must not act as a thoroughfare to other parts of the healthcare facility.

Refer to Sections 2.1.1 and 2.5.1 for further information.

2.3.2 Service Profile

The range and quantum of services required will be determined by the Clinical Services Plan and will align with the level of service to be provided.

Although it may be possible for a cardiac catheter laboratory to function well in an institution without a cardiac surgery program, such laboratories will only offer limited services. A formal arrangement is required between the laboratory and a healthcare facility with cardiac surgery capacity. The Cardiac Society of Australia and New Zealand notes that coronary interventional procedures are preferably performed in hospitals with on-site surgical support. However, centres without on-site surgical backup can provide coronary interventional procedures in accordance with standards set out in the Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI) including Guidelines on Performance of Procedures in Rural Sites'.

2.3.3 Layout

The less complex and more frequently used diagnostic and clinic rooms should be located close to the unit entry, reception and waiting area. The cardiac catheter laboratories should be more discretely located.

The main public access to the unit should be separate to inpatient transfers in and out of the unit and access for 'back of house' support services.

2.4 FUNCTIONAL AREAS

2.4.1 Unit Functional Zones

The CIU will consist of the following functional zones that may or may not be collocated, depending on operational policies, service delineation and relationships to other services:

- entry, reception and waiting area;
- cardiac diagnostic services;
- cardiac catheter laboratories;
- patient holding and recovery; and
- staff work areas and amenities, including education, training and research.

2.4.2 Entry, Reception and Waiting

The reception and waiting area may be a shared area for all aspects of the CIU. It should provide easy access to both the diagnostic services and cardiac catheter laboratories and provide access to public and accessible amenities.

A separate reception / waiting area may be required for the catheter laboratories if it is not collocated with the cardiac diagnostic services, however opportunities to share with other collocated services should be considered.

2.4.3 Cardiac Diagnostic Services

The range and quantum of cardiac diagnostic services provided will be guided by clinical services planning and may include the following:

- consult rooms that can be flexibly equipped to provide outpatient ECGs, holter / ambulatory BP monitor applications and general cardiology clinics;
- clinic rooms to support the follow up and checking of pacemakers and implantable cardiac defibrillators (ICDs);
- stress testing rooms that may be flexibly used for ECG and echo exercise stress testing, and pharmacological stress testing;
- tilt table testing rooms;
- TTE rooms; and
- TOE rooms, that are commonly also flexibly used to provide TTE services.

Access to recovery bays with clinical staff oversight is essential to support TOE services. Patients are typically recovered for two hours following the procedure.

2.4.4 Cardiac Catheter Laboratories

The number and type of cardiac catheter laboratories will be informed by clinical services planning. Each laboratory will require a collocated control room. Shared control rooms are possible, however they are not recommended due to the operational impact of the number of staff to be accommodated and associated noise generated.

Access to consult rooms will be required for pre-admission interviews, consents, pre-procedure examinations and post angiogram reviews. Patients will need to change prior to and following the procedure and some patients will require access to a shower prior to the procedure.

A range of support areas are required including storage for lead aprons, sterile stock, medications, consumables and equipment, as well as viewing and reporting workstations.

2.4.5 Staff Work Areas and Amenities

Staff work areas and meeting rooms will generally be collocated in a zone that is accessible only by staff. These may be provided as part of an integrated cardiac precinct. The number and type of work areas to be provided will be dependent on the staff establishment and the relevant jurisdictional office accommodation policy. This will require consideration of work areas to support remote cardiac monitoring services.

Staff amenities will also be collocated with the cardiac investigations unit and accessible only by staff. Depending on the size of the unit, some staff toilets may be located near treatment areas so that travel is reduced. The staff room should be located in close proximity to the cardiac catheter laboratories for direct access by staff in the event of a clinical emergency and when preparing / waiting for cases, particularly after hours.

Provision for research may be justified depending on the defined role and function of the service.

2.5 FUNCTIONAL RELATIONSHIPS

2.5.1 External

Direct access from the emergency unit, ambulance access and helipad to the catheter laboratories is essential for the rapid transfer of emergency patients.

Direct access is also required between the catheter laboratories and Operating Theatres, ICU, CCU and day only recovery services (depending on the operational model for day only patients).

Ready access is required to and from cardiac diagnostic services and:

- chest pain assessment service (if provided and located elsewhere in the facility);
- medical imaging particularly chest x-rays and cardiac capable CT and MRI (where provided);
- nuclear medicine (particularly for stress testing);
- PET Unit (cardiac positron emission tomography) - tertiary facilities; and
- biomedical engineering services.

For some facilities satellite cardiac echo services may be required depending on the distance between the Cardiac Investigations Unit and clinical units.

Linkages to cardiac surgery occur at several operational levels including clinical decision-making regarding patients requiring cardiac surgery; joint research projects; and joint management of patients in the postoperative phase including rehabilitation.

2.5.2 Internal

The electrophysiology (EP) laboratory should not be located close to any high voltage electronic equipment such as a sub-station or lift plant room, as interruption by auxiliary radiofrequency will distort the assessment of the patient.

Pacemaker and implantable cardiac defibrillator (ICD) clinics should not be located in an area where high radiofrequency interference may affect new devices using wireless technology. Expert advice should be obtained.

03 DESIGN

3.1 ACCESS

3.1.1 Internal

Access is required for patients on beds, trolleys and wheelchairs in all diagnostic and treatment areas. The cardiac catheter laboratories will be designed to enable access by beds and trolleys, including for ICU and emergency department patients with associated equipment. The bed areas should facilitate unhindered access to the patient in the event of a cardiac arrest. An anaesthetic machine should be readily available, should emergency situations progress to interventional procedures.

3.1.2 External

There should be easy access to the unit from the main entry for outpatients and a defined point of access for non-urgent patients.

In the case of an emergency, after-hours access for authorised staff will be required for performance of a procedure or to gain access to equipment. Swipe card entry at access points should be considered as they provide more secure, cost effective access control.

3.2 PARKING

A sheltered vehicle drop-off area and disabled parking will be required for outpatients whose mobility may be severely compromised and for non-emergency patients arriving by ambulance, e.g. from nursing homes, etc.

Refer to AusHFG Part C for considerations relating to parking.

3.3 DISASTER PLANNING

The planning team will consider the role of the unit in any local, regional or state-wide disaster management plans.

Each unit will have operational plans and policies in place detailing the response to a range of internal and external emergency situations.

For further information refer to:

- Part C: Design for Access, Mobility, Safety and Security; and
- Part B: Section 80 General Requirements.

3.4 INFECTION CONTROL

The following aspects of planning and design contribute to the implementation of effective infection prevention and control measures and are relevant within the context of this HPU:

- hand hygiene facilities;
- isolation rooms (if applicable);
- linen handling;
- separation of 'clean' and 'dirty' work flows;
- storage (sterile and bulk);
- waste management; and
- surface finishes.

Refer to Part D: Infection Prevention and Control, AusHFG standard components and individual jurisdictional policies and guidelines.

3.5 ENVIRONMENTAL CONSIDERATIONS

3.5.1 Acoustics

Acoustic privacy will be required in consulting and testing rooms, and in any rooms where confidential information is discussed.

Minimisation of sound transfer between clinical spaces will reduce staff error from miscommunication and disruptions and increase patient safety particularly in control rooms.

Shared control rooms to cardiac laboratories are not optimal as acoustic difficulties may occur when more than one staff member occupies the same space, with the subsequent potential for instructions to be misinterpreted.

3.5.2 Natural Light

External windows are desirable in waiting areas, holding and recovery areas and in staff lounges, but they are not essential or desirable in diagnostic rooms.

3.5.3 Privacy

To ensure patient privacy, change rooms should be located adjacent to diagnostic rooms so that the patient does not cross public areas to access testing rooms, and are not open to view when doors are opened.

3.5.4 Interior Décor

Interior décor includes; furnishings, style, colour, textures, ambience, perception and taste. Pleasant interior décor can help to prevent an institutional atmosphere, however, cleaning, infection control, fire safety, patient care and patient perceptions of a professional environment should always be considered.

Some colours, particularly the bold primaries and green should be avoided in areas where clinical observation occurs. Such colours may prevent the accurate assessment of skin tones, e.g. yellow for jaundice, blue for cyanosis and red for flushing.

A calming non-threatening environment is desirable using colours that do not mask skin colours.

Consideration may be given to ceiling art and murals.

3.5.5 Signage and Wayfinding

Refer to:

- Part C: Design for Access, Mobility, Safety and Security; and
- Department of Health, NSW, 2009, Technical Series 2 - Wayfinding for Health Facilities.

3.6 SPACE STANDARDS AND COMPONENTS

3.6.1 Access and Mobility

The facility must comply with the Commonwealth Disability and Discrimination Act (DDA) and the following standards where applicable:

- Disability (Access to Premises – Buildings) Standard 2010
- National Construction Code
- AS1428 (SET)-2010 Design for access and mobility; and
- NZS 4121: Design for access and mobility: Buildings and Associated Facilities.

3.6.2 Building Elements

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in AusHFG Part C: Design for Access, Mobility, Safety and Security.

Ceilings in the catheter laboratories should be three metres high and capable of supporting the weight of ceiling-mounted imaging equipment. This may include; the gantry for catheter equipment, pendants, theatre light, room lighting and air-conditioning etc. Special attention is required in co-ordination of all ceiling fixed services. Floors should be capable of supporting floor mounted equipment.

Ensure that doorways are sufficiently wide and high enough to permit the manoeuvring of beds, wheelchairs, trolleys and equipment without risk of damage or manual handling risks.

Good visibility for the operators from the control room to the procedure room is essential to support a high level of communication between the clinicians and the equipment operators during all procedures, particularly in electrophysiology laboratories.

Audio communication facilities including microphone should be provided to support communications between the laboratory and the control room.

3.7 SAFETY AND SECURITY

3.7.1 Safety

The unit must provide a safe and secure environment for patient and staff.

A safety audit comprising of a risk analysis of potential hazards should be undertaken at every stage of the planning and design process of the unit.

Appropriate access to duress and emergency call systems is essential and the design of the unit must support efficient and safe staff work flows with no entrapment or concealment points.

Radiation safety guidelines require the use of 'X-ray in use' illuminated signs over the doors leading into the cardiac catheter laboratory.

3.7.2 Security

Access control systems will be needed to ensure that only those authorised will have access to restricted areas of the unit. Duress points may also be needed at staff stations and receptions.

Patient and visitor escorted access only will be provided beyond the waiting area.

The design will need to consider that staff may work out of hours and will access cardiac catheter laboratories and echo services including recovery areas and staff amenities after hours.

Refer to individual jurisdiction guidelines and to Part C: Section 6.0 Security.

3.8 FINISHES

3.8.1 General

Finishes in this context refer to walls, floors, windows and ceilings. Refer to the following references for further information:

- AusHFG Part C: Design for Access, Mobility, Safety and Security; and
- AusHFG Part D: Infection Prevention and Control.

3.8.2 Floor Finishes

The selection of floor finishes should be appropriate to the function of the space and take into account manual handling issues, including the impact of the flooring on push and pull forces for wheeled equipment.

Consider acoustic performance, slip resistance, consequences of patient falls, infection control, movement of beds and trolleys, maintenance and cleaning protocols. The flooring selected should be adequate to avoid the potential for slips, trips and falls to occur.

More detail is provided in Department of Health, NSW, 2009, Technical Series TS7 - Floor Coverings in Healthcare Buildings.

3.8.3 Wall Finishes

Adequate wall protection should be provided to areas that will be regularly subjected to damage. Particular attention should be given to areas where bed or trolley movement occurs such as corridors, bed head walls, treatment areas, equipment and linen trolley bays.

3.8.4 Ceiling Finishes

Ceiling finishes should be selected with regard to appearance, cleaning, infection control, acoustics and access to services.

3.9 FIXTURES, FITTINGS AND EQUIPMENT

3.9.1 Definition

The Room Data and Room Layout Sheets in the AusHFG define the required fixtures, fittings and equipment. Refer to:

- Part C: Design for Access, Mobility, Safety and Security; and,
- AusHFG Standard Components for CIU specific rooms.

3.10 BUILDING SERVICE REQUIREMENTS

3.10.1 General

In addition to topics addressed below, project teams should also refer to the following:

- AusHFG Part C: Design for Access, Mobility, Safety and Security;
- AusHFG Part E: Building Services and Environmental Design – refer to this for relevant jurisdictional references relating to engineering services guidelines; and
- AusHFG Standard Components for CIU specific rooms.

3.10.2 Air Handling Systems

Cardiac investigations and procedures are becoming increasingly complex and invasive in nature and, as a consequence, air handling systems in interventional catheter laboratories should be designed according to operating room standards including the installation of high efficiency particulate air (HEPA) filters.

Back-up systems should be considered, as laboratory air handling systems often shut down due to excessive heat generated by equipment. Air conditioning systems able to provide high air turnover rates are required to handle the heat produced by the fluctuating number of people accommodated in the space and the airflows required to prevent machinery from overheating.

Generator transformer boxes are decreasing in size, however; they still produce large amounts of heat and are best managed in a separate room with separate air conditioning controls.

Individual temperature controls should be provided in the laboratories.

3.10.3 Electrical Services

It is essential that services such as emergency lighting, telephones, duress alarm systems (including the central computer) and electronic locks are connected to the emergency power supply.

Cardiac catheter equipment will require a UPS and an emergency supply, as detailed in the AusHFG standard components relating to catheter laboratories.

Catheter laboratories should be cardiac protected in accordance with AS/NZS 3003:2018 Electrical Installations - Patient Areas. All other diagnostic rooms should be body protected.

3.10.4 Information Technology and Communications

Information, Communications and Technology (ICT) are key enablers to optimise patient care and to ensure efficient and effective patient information and image management. ICT systems necessary to support clinical and operational requirements should be assessed during the planning and design process to ensure an appropriate level of capability is provided that also supports future flexibility. Given cardiac services are high uses of ICT and rely on the seamless transmission of images and videos between facilities and service areas to support clinical care and education, it is essential that appropriate ICT infrastructure and resources are provided to support the service. Close collaboration with the local information technology department and clinicians is recommended.

Key considerations will include:

- video and teleconferencing capability with appropriate bandwidth to stream cases without interruption;
- picture archiving and communication system (PACS) and storage for digital archives (may be a local or facility-wide system);
- data capture (other than images);
- wireless technology;
- voice / data (telephones and computers);
- support for remote cardiac monitoring and reporting;
- audio visual, web network access to view angiograms;
- CCTV surveillance if indicated; and
- patient, staff and emergency call systems.

3.10.5 Lighting

Lighting that is capable of being dimmed to improve the reporting environment and screen visibility is required in the following areas:

- control room;
- reporting rooms;
- cardiac catheter laboratories;
- TTE / ECHO room; and
- Holter reading rooms.

Refer to the AusHFG standard components for cardiac diagnostic services and cardiac catheter laboratories for further detail regarding lighting requirements.

3.10.6 Medical Gases

Full anaesthetic capability including nitrous oxide and 'scavenge' is required within the catheter laboratories.

Refer to the AusHFG Standard Components for specific CIU rooms.

3.10.7 Radiation and Radiation Safety

Cardiac catheter laboratories require radiation shielding. For all issues related to radiation shielding and safety, refer to: Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology (RPS 14.1) (ARPANSA, 2008).

The radiation protection assessment will specify the type, location and amount of radiation protection required, according to final equipment selection and layout. Radiation protection requirements should be incorporated into the final specifications and the building plans.

04 COMPONENTS OF THE UNIT

4.1 STANDARD COMPONENTS

Rooms / spaces are defined as:

- *standard components* (SC) which refer to rooms / spaces for which room data sheets, room layout sheets (drawings) and textual description have been developed;
- *standard components – derived rooms* are rooms, based on a SC but they vary in size. In these instances, the standard component will form the broad room 'brief' and room size and contents will be scaled to meet the service requirement;
- *non-standard components* which are unique rooms that are usually service-specific and not common.

The standard component types are listed in the attached Schedule of Accommodation.

The current Standard Components can be found at:

www.healthfacilityguidelines.com.au/standardcomponents

4.2 NON-STANDARD COMPONENTS

Non-standard components are unit-specific and provided in accordance with specific operational policies and service demand.

Non-Standard components for this unit include:

- pacemaker / ICD follow-up clinic;
- tilt tabling testing room; and
- transthoracic echo service – TTE.

PACEMAKER / ICD FOLLOW-UP CLINIC

Description and Function

This room is for the follow up and checking of pacemakers and implantable cardiac defibrillators (ICD) for inpatients and outpatients. Note that devices are not inserted in this room.

The programmers used for checking devices weigh between fifteen and twenty kilograms and therefore require a sturdy bench top at a height for easy use.

Location and Relationships

The room may be part of a dedicated cardiac clinic.

Considerations

The following should be considered:

- bed and trolley access;
- cardiac protection;
- oxygen and suction;
- fail safe phones or external link to cardiac support;
- workstation with two computers (one for EMR and one for the reporting system) and three monitors. This includes twin monitors to test pacemakers with different device programmers;
- benches at an appropriate height to prevent staff neck and back injury if staff have to continually lift and move programming machines;
- trolley for moving programmers;

- storage cupboard for approximately six programmers from each vendor to be stored vertically; and
- Type B hand wash basin.

TILT TABLE TESTING ROOM

Description and Function

Tilt Table Testing is used for the investigation of syncope of suspected cardiothoracic origin. The procedure involves blood pressure and ECG monitoring while a patient is lying on a table that is then moved from a horizontal to a vertical position.

Location and Relationships

The room is usually part of a dedicated cardiac clinic.

Considerations

The following should be considered:

- bed and trolley access;
- tilt table to be accommodated within the room with sufficient space to transfer a patient from chair or bed to the tilt table;
- ECG machine;
- workstation;
- visitors chair;
- Type B hand basin;
- storage for supplies / leads;
- access to oxygen and suction; and
- body protection.

TRANSTHORACIC ECHO ROOM (TTE)

Description and Function

Transthoracic echocardiography (TTE) is a non-invasive procedure using an ultrasound transducer passed over the chest wall to gain two-dimensional and three-dimensional pictures of the heart and surrounds.

Location and Relationships

The room is usually part of a dedicated cardiac clinic. TTEs may be provided in the same room as Transoesophageal Echocardiograms (TOEs) depending on the projected activity, however a larger size room will be required as noted in the schedule of accommodation.

Considerations

The following should be considered:

- bed and trolley access;
- TTE examination couch or patient bed (note some services will use dedicated examination couches specifically designed for TTEs, other services will use a standard examination couch or hospital bed);
- ultrasound machine and chair for sonographer;
- workstation with two computers (one for EMR and one for the reporting system) and three screens;
- Visitor's chair;
- Type B hand basin;
- storage for consumables;
- access to oxygen and suction; and
- body protection.

05 APPENDICES

5.1 SCHEDULE OF ACCOMMODATION

A schedule of accommodation is shown below and lists generic spaces for this HPU. Quantities and sizes of spaces will need to be determined in response to the service needs of the specific unit

The 'Room / Space' column describes each room or space within the unit. Some rooms are identified as 'Standard Components' (SC) or as having a corresponding room which can be derived from a SC, i.e. 'Standard Components – Derived' (SC-D). The 'SD/SD-C' column identifies these rooms and relevant room codes and names are provided. All other rooms are non-standard and will need to be briefed using relevant functional and operational information provided in this HPU.

In some cases, Room / Spaces are described as 'Optional' or 'o'. Inclusion of this Room / Space will be dependent on a range of factors such as operational policies or clinical services planning.

The schedule of accommodation below assumes the provision of an integrated cardiac investigations unit, including both cardiac diagnostic services and cardiac catheter laboratories. For alternative operational models, e.g. where catheter laboratories are included as part of an interventional suite, collocated with operating theatres, opportunities to share support areas should also be explored.

ENTRY, RECEPTION and WAITING AREA

AusHFG Room	Room / Space	SC / SC-D	Qty	m2	Remarks
WAIT-20	Waiting	Yes	1	20	Area recommendation is indicative and will depend on the number of services sharing the waiting area and number of people to be accommodated. 1.2m2 recommended per seat, 1.5m2 per wheelchair space. Consider infrastructure requirements for patient self-registration and access to education / health promotion resources.
WCPU-3	Toilet - Public	Yes	2	3	May be shared with collocated services.
WCAC	Toilet - Accessible	Yes	1	6	May be shared with collocated services.
RECL-12	Reception / Clerical	Yes	1	12	Size will depend on number of services being supported.
STPS-8	Store - Photocopy / Stationery	Yes	1	8	
	Discounted Circulation %			25%	

CARDIAC DIAGNOSTIC AREAS

The number of cardiac diagnostic clinical spaces below is indicative only. The range and quantum of services will need to be determined on a project by project basis in line with the Clinical Services Plan and the defined role and function of the service.

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
CONS	Consult Room	Yes	3	12	To be flexibly used for ECG, holter / ambulatory BP application, general consultations. Number of rooms will depend on projected activity assuming optimal utilisation. May require ECG machine, Holter monitoring equipment (ECG leads and monitors) and blood pressure equipment.
	Holter Analysis Room		1	12	Desks / benching to support 2-3 computers.
	Pacemaker / ICD Follow-Up Clinical Room		1	15	Bed access; cardiac protection; dedicated write up area.
STRT	Stress Testing Room	Yes	1	20	To be flexibly used for ECG, echo exercise stress testing and pharmacological stress testing. Includes resuscitation trolley. Pharmacological stress testing may also be undertaken in a TOE room given a treadmill is not required.
CHPT	Change Cubicle - Patient	Yes	2	2	
BWD-1	Bay - Water Dispenser	Yes	1	1	Locate near to stress testing room. Should not be located in waiting room given some patients will be fasting.
	Tilt Table Testing Room		1	15	
	Echo Room - TTE		2	20	
ECHO-TOE	Echo-Transoesophageal	Yes	1	26	For TOES. May be flexibly used for TTEs also. Note recovery areas included with cath lab SOA below as an assumed integrated recovery zone.
CLUP-7	Echo Reprocessing Room	Yes	1	9	Collocated with TOE room. For reprocessing and storage of TOE probes and ultrasound transducers.
REPR	Echo Reporting Room	Yes	1	12	
SSTN-10	Staff Station	Yes	1	12	
CLUR-12	Clean Utility / Medication Room	Yes	1	10	Includes medication store.
DTUR-S	Dirty Utility-Sub	Yes	1	8	May be shared with adjacent service.
BRES	Bay - Resuscitation	Yes	1	1.5	
BLIN	Bay - Linen	Yes	1	2	
BMEQ-4	Bay - Mobile Equipment	Yes	1	4	
STEQ-20	Store - Equipment	Yes	1	16	Storage of mobile units, requires power and data. Area will depend on scope of service and no. of mobile units to be accommodated.
BWC	Trolley / Wheelchair Park		1	4	May be used to store outpatient trolleys when rooms are used for inpatients. Area requirement will depend on size of unit.
	Discounted Circulation %			32%	

CARDIAC CATHETER LABORATORY AREAS

It is assumed that the reception and waiting areas are shared with a collocated service, e.g. cardiac diagnostic services, interventional imaging suite or operating theatres.

The schedule of accommodation below assumes the provision of two interventional cardiac catheter laboratories and one EP laboratory. The number and type of laboratories will need to be determined on a project by project basis and will be informed by clinical services planning.

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
CONS	Consult Room	Yes	2	12	For examinations, post angiogram review, operator reviews, pre-admission interviews, consents etc. Also needs to accommodate a carer.
CLAB-I	Catheter Lab - Interventional	Yes	2	55	
CLAB-EP	Catheter Lab - Electrophysiology Studies		1	60	
CLCR-I	Cath Lab I Control / Reporting Room	Yes	2	14	1 control room per cath lab recommended.
CLCR-EP	Cath Lab EP Control / Reporting Room		1	17	Multiple staff will stand and sit in this area. Located ideally at head or foot of bed not at the side for maximum patient and procedure visibility.
	Equipment Room - Interventional Lab		2	10	For storage of vendor computer cabinets.
	Equipment Room - EP Lab		1	12	For storage of vendor computer cabinets, additional required for EP labs.
SCRB-4	Scrub Up / Gowning	Yes	3	4	Includes gowning requirements. May be shared between 2 labs.
	Bay - Lead Aprons		3	1	One per laboratory; may be shared between rooms. To be located for ease of donning prior to accessing the procedure room.
BBW	Bay - Blanket / Fluid Warmer	Yes	1	1	
BMEQ-4	Bay - Mobile Equipment	Yes	1	4	Minor equipment e.g. IV poles, commodes, wheelchairs.
STSS-20	Store - Sterile Stock		1	36	12m ² per lab.
STEQ-20	Store - Equipment	Yes	1	24	8m ² per lab. For large equipment when not required in cath labs.
STGN-8	Store - General	Yes	1	8	For storage of non-sterile bulk items/boxes
CLUP-7	Clean-up Room	Yes	1	10	
REPR	Reporting Room		1	18	1 workstation per lab assumed, however this will depend on the staffing profile. May be shared with cardiac diagnostic services if collocated.
DISP-10	Disposal Room	Yes	1	10	Large volume of packaging waste. May be shared with collocated service.
CLRM-5	Cleaner's Room	Yes	1	5	
	Discounted Circulation %			32%	

PATIENT HOLDING AND RECOVERY

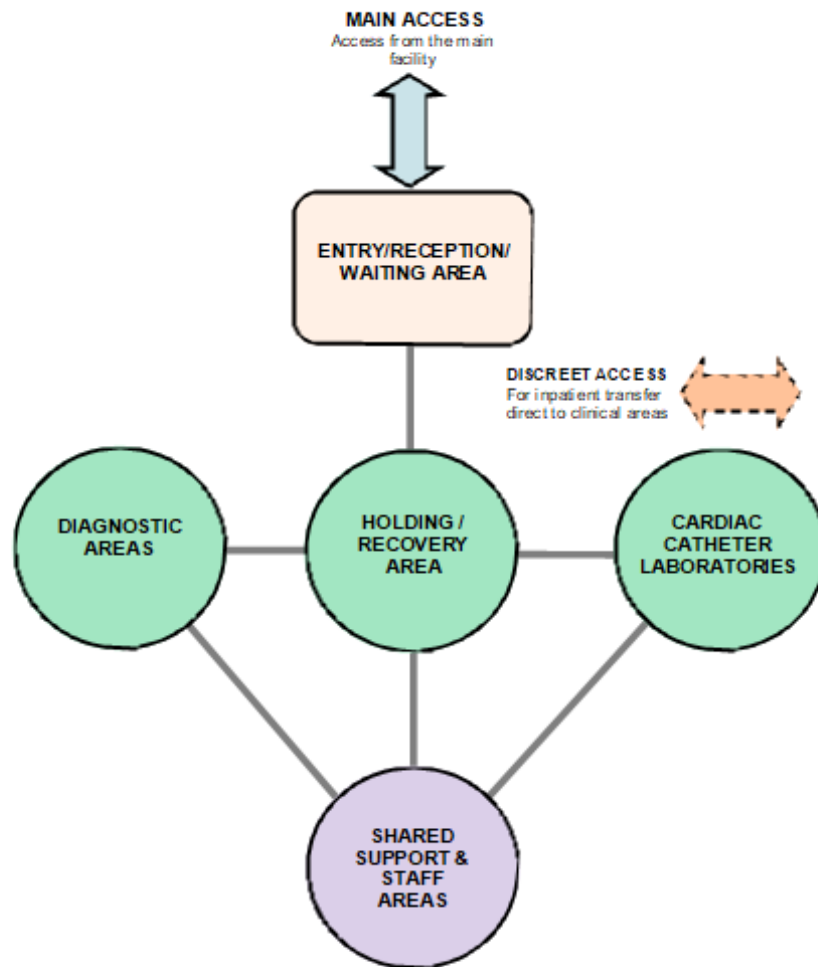
AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
CHPT	Change Cubicle - Patient	Yes	2	2	1 change space per lab
CHPT-D	Change Cubicle, Accessible		1	4	
	Property Bay - Patient		1	2	
PBTR-RS1	Patient Bay - Recovery, Stage 1	Yes	2	9	For pre and post procedure holding and recovery. 5 bays per laboratory and 1-2 per TOE room (including discharge lounge with recliners below). The number of Stage 1 recovery bays to support patients recovering from GA will require confirmation depending on anticipated activity. Locate to provide ease of access to lockers above.
PBTR-H-9	Patient Bay - Holding	Yes	10	9	
	Patient Bay - Discharge Lounge		5	4	
WCPT	Toilet - Patient	Yes	2	4	
WCAC	Toilet - Accessible	Yes	1	6	
	Shower / Toilet - Accessible		1	7	Close access from the stress testing room and cath labs.
SSTN-14	Staff Station	Yes	1	14	Includes central monitoring.
CLUR-12	Clean Utility / Medication Room	Yes	1	12	Shared with cath lab zone.
BHWS-B	Bay - Handwashing, Type B	Yes	4	1	1 between 4 bays
BPATH	Bay - Pathology	Yes	1	2	Accessible from cath lab and recovery zones
BPTS	Bay - Pneumatic Tube	Yes	1	1	
BBW	Bay - Blanket / Fluid Warmer	Yes	1	1	
BRES	Bay - Resuscitation	Yes	1	1.5	
BLIN	Bay - Linen	Yes	1	2	
BMEQ-4	Bay - Mobile Equipment	Yes	1	4	
BBEV-OP	Bay Beverage, Open Plan	Yes	1	4	
DTUR-S	Dirty Utility - Sub	Yes	1	8	
	Discounted Circulation %			32%	

STAFF WORK AREAS AND AMENITIES

The range and quantum of staff work areas and amenities, and associated area requirements, will depend on the staff establishment required for the unit.

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
OFF-S9	Office - Single Person	Yes		9	Number will depend on staff profile and local jurisdictional policies.
	Office - Workstation			5.5	To support home monitoring service. Number of workstations will depend on staff establishment.
MEET- L-15	Meeting Room	Yes	1	15	Number and size will depend on requirements of unit. May be shared with adjacent service. Will require audio-visual equipment.
SRM-18	Staff Room	Yes	1	18	Area requirement will depend on the staff establishment. Refer to standard components for capacity requirements. Shared staff room for small units. Depending on the size of service, additional beverage bays may be needed to support staff near to where they work.
WCST	Toilet - Staff	Yes	2	3	Number will suit FTE and be located in staff areas but also close to patient care rooms. Access to accessible toilet required.
CHST-10	Change Room - Staff (Male / Female)	Yes	2	15	Access to 1 male, 1 female. Comprises lockers, shower, toilet. Are requirement will depend on staff establishment.
	Discounted Circulation %			25%	

5.2 FUNCTIONAL RELATIONSHIPS



5.3 DESCRIPTION OF CARDIAC INVESTIGATION SERVICES

5.3.1 Cardiac Catheterisation / Coronary Angiography

Cardiac catheterisation or coronary angiography (the terms are used interchangeably) is a minimally invasive diagnostic procedure undertaken to detect the presence of disease in heart muscle, valves and blood vessels. It detects whether coronary arteries are narrowed or blocked.

The procedure is performed under local anaesthetic and may require conscious sedation. It involves the insertion of a catheter into an artery via a sheath threaded over a guide wire. Angiography and PCI (described below) are performed through the femoral artery and increasingly the radial or ulnar artery. A radio-opaque liquid contrast is injected through the catheter and digital images are taken. The procedure reveals if any of the coronary arteries are narrowed (stenosis) or blocked (plaque, clots).

The procedure routinely takes 20-30 minutes, however it may be longer depending on the nature of the study. A three to four-hour period of observation post procedure is required prior to discharge. The procedure may advance to an interventional procedure such as balloon angioplasty or stent insertion.

5.3.2 Percutaneous Coronary Intervention (PCI)

Also known as angioplasty; Percutaneous Transluminal Coronary Angiography (PTCA); or Balloon Angioplasty.

An interventional procedure whereby an occluded coronary artery (or arteries) is dilated by means of a balloon catheter, in order to restore blood supply to heart muscle. It is performed under conscious sedation and local anaesthesia. At the same time a stent may be inserted that supports the occluded artery and maintains patency. The procedure takes approximately 90 minutes. Catheter laboratories should have direct access to intra-aortic balloon pump therapy to support critically ill patients when required.

The Cardiac Society of Australia and New Zealand notes that coronary interventional procedures are preferably performed in hospitals with on-site surgical support. However, the Society believes that centres without on-site surgical backup can provide coronary interventional procedures in accordance with standards set out in Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI) including Guidelines on Performance of Procedures in Rural Sites.'

5.3.3 Electrophysiology (EP) Studies and Radiofrequency Ablation (RFA)

Electrophysiology (EP) studies are performed to assess and diagnose cardiac arrhythmias and conduction disorders and to evaluate the effect of drug therapy. Complex arrhythmias and atrial fibrillation are assessed using three-dimensional (3D) mapping technologies.

The procedure involves inserting a catheter attached to electric monitoring electrodes into a vein, usually in the groin or neck, and threading the catheter wire into the heart. Once the catheter reaches the heart, electrodes at its tip gather data and a variety of electrical measurements are taken. This data pinpoints the location of the abnormal electrical site and if amenable to treatment, radiofrequency ablation (RFA), (destruction of tissue) or medical therapy may be used to treat the arrhythmias.

Some patients may require an override pacemaker or automatic implantable cardiac defibrillator inserted as part of the treatment of an arrhythmia.

Provisions for echocardiography, pacing, defibrillation, and resuscitation should be immediately available.

5.3.4 Pacemakers and Implantable Cardiac Defibrillators

Pacemakers may be temporary or permanent and are used to treat cardiac rhythm irregularities. Temporary pacing systems are used for a short period of time (days or weeks) and the pacing wire is external. All cardiac units (secondary and tertiary) should have the capacity for temporary pacemaker insertion. Permanent pacemakers are inserted under the skin under general or local anaesthetic and under sterile conditions in an environment that meets operating theatre standards.

Implantable cardiac defibrillator (ICD) devices similarly control irregular heart rhythms but additionally deliver electrical currents and provide a safety net against ventricular fibrillation and cardiac arrest. ICDs are inserted under general or local anaesthetic with conscious sedation to ensure no discomfort to the patient at time of insertion.

5.3.5 Echocardiography

Also known as a cardiac ultrasound, echocardiography uses standard ultrasound techniques to produce two-dimensional (2D) images of the heart chambers, valves and surrounding blood vessels. The latest systems now employ three-dimensional (3D) real-time imaging.

Transthoracic echocardiography (TTE) is a non-invasive procedure using a transducer passed over the chest wall to gain two-dimensional pictures of the heart and surrounds.

Transoesophageal echocardiography (TOE) is an invasive procedure where the transducer is inserted into the oesophagus under conscious sedation (to reduce discomfort and the gag reflex) and provides more comprehensive images than can be achieved by simple TTE.

Stress echocardiography involves a TTE followed by exercise and then repeat TTE. This test may take up to two hours.

5.3.6 Clinical Stress Testing

Clinical stress testing is undertaken by a range of clinical specialties to assess functional capacity. In Cardiology, stress testing is performed on patients with known or suspected coronary artery disease to assess cardiac function under exercise conditions with the patient attached to ECG leads that record heart activity. It is usually undertaken on a motorised treadmill and less commonly on an exercise bicycle.

There is a small but definite risk of an adverse event during this procedure (arrhythmias, chest pain and cardiac arrest) and the room in which the tests are performed needs to be adequate to cope with complications. In the event of cardiac arrest, there needs to be space in the room to lay the patient on the ground and initiate CPR, and a resuscitation trolley and defibrillator needs to be immediately accessible.

The cardiac stress testing room may be used for ECG or Echo stress testing as well as pharmacological stress testing. This is a diagnostic procedure in which cardiovascular stress is induced by pharmacologic agents for patients with decreased functional capacity or who cannot exercise. Pharmacologic stress testing is also commonly provided in a TOE room given a treadmill is not required. It is essential that a defibrillator / resuscitation trolley is located in close proximity.

Refer to Safety and Performance Guidelines for Clinical Exercise Stress Testing (Freedman, Ben, 2010). This document represents the views of the Cardiac Society of Australia and New Zealand. The guidelines were ratified at the CSANZ Board meeting held on Friday 26 November 2010.

5.3.7 Ambulatory Monitoring

Holter (ECG) monitoring records cardiac activity usually over a 24-hour period while the patient is performing his usual daily activities. Monitoring can be used to:

- analyse the heart rhythm;
- detect problems missed in a regular ECG;
- evaluate chest pain;
- check activity after a heart attack;

- evaluate a new pacemaker; and
- check the effectiveness of medications.

Electrodes are attached to the chest and then wired to a small digital recorder on a belt or shoulder strap.

Refer to Guidelines for Ambulatory Electrocardiographic Monitoring (CSANZ, 2012). This document represents the views of the Cardiac Society of Australia and New Zealand (Cardiac Society of Australia and New Zealand 2009).

Ambulatory blood pressure monitoring can also be carried out. For this, the patient wears a cuff that inflates at regular intervals and a small monitor records the blood pressure. Checking of monitors may be carried out remotely in the patient's home over the telephone or via the internet (remote monitoring).

5.3.8 Tilt Table Testing

Tilt Table Testing is used for the investigation of syncope of suspected cardiothoracic origin. The procedure involves blood pressure and ECG monitoring while a patient is lying on a table that is then moved from a horizontal to a vertical position.

5.4 REFERENCES

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