

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

01.01 Preamble

This Health Planning Unit (HPU) has been developed for use by project staff (architects, planners, engineers, project managers and other consultants) and for end users, to facilitate the process of planning and design.

It is intended to assist with the planning and design of a unit that will be fit for purpose in accordance with its designated service delineation / capability and defined catchment population.

It is a new HPU written for Australasian use, completed at the end of 2010. Its development has been informed by an extensive background research and consultation process during 2009/2010.

01.02 Introduction

GENERAL

This HPU outlines the specific requirements for the planning and design of a Cardiac Investigation Unit (CIU).

The entire range of cardiac services to be provided, including inpatient services, needs to be carefully defined on a project by project basis within the context of a pre-determined and endorsed clinical service plan, agreed level of service provision and defined models of care.

It should be read in conjunction with the Australasian Health Facility Guidelines (AusHFG) generic requirements and Standard Components described in:

- Part A: Introduction and Instructions for Use;
- Part B: Section 80: General Requirements;
- Part B: Section 90: Standard Components, Room Data and Room Layout Sheets;
- Part C: Design for Access, Mobility, OHS and Security;
- Part D: Infection Prevention and Control; and
- Part E: Building Services and Environmental Design.

This HPU should be read in conjunction with Part B: HPU 260 Coronary Care Unit. HPU 260 addresses the requirements for:

- coronary care units;
- colocated cardiac inpatient units caring for post acute phase cardiac medical patients;
- inpatient unit based cardiac rehabilitation;
- teaching and research; and
- staff offices and amenities.

CHEST PAIN ASSESSMENT UNITS

Chest pain assessment units are increasingly being established either as a zone within a CIU or adjacent to the emergency unit. These units are to be addressed in the revision of the Emergency HPU.

PAEDIATRIC STUDIES

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 catheterized only in centres with active paediatric cardiac surgical programs.

01.03 Policy Framework

GENERAL

Policies for the provision of healthcare services are formulated in accordance with the following principles:

- appropriate service models that ensure a comprehensive service network throughout state and regional health jurisdictions;
- safe and effective care that minimises both staff and patient risks;
- provision of a safe and efficient environment that minimises risk to all users of the facility;
- deployment of resources in a fair and cost effective manner to optimise health outcomes; and
- development and support for enhanced information systems to monitor, plan and evaluate healthcare services.

DIVERSITY AND SPECIAL GROUPS

Policy frameworks recognise the diversity of the community and that special groups within communities often require specific consideration to meet their needs and to enhance the effectiveness of any services provided. These groups include:

- Aboriginal and Torres Strait Islanders, and in New Zealand Maori and Pacific Islanders Aboriginal Mental Health and Well Being Policy 2006-2010 (NSW Health, 2007));
- people living in rural and remote areas;
- children and adolescents;
- obese (bariatric) people who may not necessarily be patients (Occupational Health & Safety Issues Associated with Management Bariatric (Severely Obese) Patients (Employee Relations, NSW Health, 2005);
- patients with co morbidities;
- people with sensory and cognitive disabilities;
- people from culturally and linguistically diverse backgrounds; and
- older people and the frail aged.

OVERARCHING POLICIES

Refer to the Disability Discrimination Act 1992, Act No. 135 of 1992 as amended (Australian Government, 2013).

Also refer to individual jurisdiction policies and to specific service planning guidelines under References and Further Reading.

01.04 Description

DESCRIPTION OF CARDIAC INVESTIGATION HEALTH PLANNING UNIT (HPU)

This HPU has been developed in three parts:

- cardiac catheter laboratory;
- cardiac diagnostic unit; and
- outpatient clinics.

Models of care for delivery of services and detailed facility needs are addressed in this guideline.

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) (diagnostic and interventional);
- electrophysiology laboratory;
- electrocardiogram (ECG);
- echocardiography;
- transthoracic echocardiography (TTE);
- trans-oesophageal (TOE);
- stress echocardiography;
- exercise stress testing;
- Holter monitoring;
- ambulatory blood pressure monitoring;
- pacemaker and defibrillator implantation, and follow-up; and
- outpatient clinics.

For the benefit of non-clinical project staff, a brief description of a range of procedures that may be undertaken within a CIU is presented in the appendices Cardiac Procedures - Further Information.

FUTURE TRENDS

The interventional cardiac program is likely to continue to expand as technological advances make procedures safer and more effective in a wider range of patients, especially very elderly patients. Infarct angioplasty is likely to become more widely practised, predominantly in those patients with large infarcts who have a high mortality rate in accordance with Cardiac Society of Australia & New Zealand (CSANZ) guidelines (Cardiac Society of Australia and New Zealand 2009).

The need for interventional electrophysiology is increasing with complex arrhythmias such as atrial fibrillation, complex atrial tachycardia and ischaemic ventricular tachycardia now able to be treated with three-dimensional mapping. New technologies include magnetic navigation techniques.

The disciplines of cardiology and cardiac surgery are increasingly converging with endovascular cardiac surgery for procedures such as mitral valve repair, and repair of patent ductus arteriosus being performed. Descriptions of these procedures can be found in appendices Cardiac Procedures -Further Information.

Insertion of devices such as ventricular assist devices, valve replacements, vascular procedures, and percutaneous valve replacement is increasing. Cardiac brachytherapy for restenosis (under certain conditions not amenable to drug therapy) may also be undertaken.

Increasingly complex machinery such as multiplanar systems give rise to spatial implications, as well as the need for enhanced engineering services.

02 PLANNING

02.01 Operational Models

HOURS OF OPERATION

The unit will generally operate during business hours with after hours emergency access to catheter laboratories particularly in tertiary facilities.

CARDIAC CATHETER LABORATORIES - MODELS OF CARE

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

- a component of an interventional imaging suite in a medical imaging unit;
- a dedicated component of a cardiac precinct; and
- an extension of an 'interventional floor' incorporating operating theatres and cardiac investigations with access to an extended day only (23 hour) or similar unit.

The number of laboratories will be determined by the clinical service plan, but laboratories should operate at near-optimum capacity to justify the expense of operation, maintain the skills and teamwork of the operators and staff, and provide maximum patient and operator safety.

CARDIAC DIAGNOSTIC UNIT - MODELS OF CARE

There are several options for service delivery. They may be provided:

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

CARDIAC OUTPATIENT CLINICS - MODELS OF CARE

Cardiac clinics may be conducted via:

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

Provision of dedicated cardiac clinics should be based on throughput and endorsed clinical service planning. In all instances as a minimum, access will be required to ECG testing.

02.02 Operational Policies

GENERAL

The development of operational policies is integral to defining how the unit will operate within a healthcare facility or health service, as well as in relation to adjoining health services from where patients may be referred. They impact on the capital and recurrent costs of a facility and will vary from unit to unit depending on a wide range of factors, such as the clinical characteristics of the patients and the defined role of the unit. The cost implications of proposed policies should be fully evaluated to ensure the most cost-effective and efficient design solutions are developed in providing therapeutic and high quality physical environments.

Operational policies should be developed for every unit as part of the project planning process. Refer to Part B: Section 80 General Requirements, Australasian Health Facility Guidelines (AHIA, 2010) for further information.

The operational policies detailed in this section are unit-specific.

ACCESS TO CARDIAC SURGERY

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 unit should exercise particular caution to not accept unstable, acutely ill, or other high-risk patients for studies. However the risks and benefits of early intervention should also be considered.

The Cardiac Society of Australia and New Zealand has developed guidelines for cardiac catheter laboratories including those in rural areas (Cardiac Society of Australia and New Zealand 2008b).

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 cardioverter defibrillator (ICD) implanting laboratory should contain, or have access to, two external cardiac defibrillators as multiple use during procedures increases the incidence of equipment failure.

Cardiopulmonary resuscitation (CPR) is best performed on a hard surface wherever possible. Therefore in diagnostic rooms such as those for echocardiography and ECG (particularly 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.

Cardiology staff may be part of a team attending medical emergencies within the healthcare facility, although individual units should have resuscitation trolleys available for access in each unit.

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 critical 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 emergency arrangements;
- telemedicine capacity;
- data outlet for downloading of ECG for centralised reporting; and
- remote viewing.

MANAGEMENT OF BARIATRIC (OBESE) PATIENTS

Problems with the quality of the images may preclude heavier patients from treatment or investigations in the catheter laboratories. However, tables are available that are capable of supporting patients weighing up to 220 kilograms.

In the catheter laboratories, space restricts effective use of hoists. Ceiling hoists may 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 transfer slides and portable lifting equipment.

In other examination rooms, plinths/examination couches should be able to accommodate bariatric patients' weight and girth.

PATHOLOGY

Pathology is extensively used in cardiology. Point of care equipment may be provided within the unit or be easily accessible within adjoining units, such as the emergency department, intensive care units and CCU.

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

PATIENT RECOVERY AND DISCHARGE MANAGEMENT

Patients are monitored for a minimum of four hours following cardiac catheterisation procedures. 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) or cardiac inpatient unit, with full cardiac monitoring capacity.

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 twenty four 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.

TELEMEDICINE

Telemedicine is the transmission of images, voice and data between two or more health units via telecommunication channels, in order to provide clinical advice and consultation, education and training services. It has particular relevance for rural and remote areas.

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.

The provision of information technology infrastructure such as LAN/WAN to support this transfer of information should be part of the information technology communication development, planning and design process.

STAFFING

A staff establishment should be developed early in the planning process in order to assess the office space, workstations and amenities that will be required.

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

The unit should provide sufficient functional area to support the number of staff in the safe and efficient delivery of care.

The environment should be secure and facilitate effective emergency responses to acute situations on each shift. Designing the unit on this basis will support efficient unit operation without imposing additional costs whilst enabling compliance with security and OHS requirements.

STAFF ESTABLISHMENT

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

- cardiologists (specialists, registrars and residents);
- radiographers;
- cardiac technicians, technologists, scientists (Cardiac Scientist health practitioners in Queensland);
- cardiac sonographers;
- nursing staff;
- unit or service manager;
- administrative staff; and
- allied health professionals.

02.03 Planning Models

LOCATION

The most appropriate location for the CIU will depend on the services to be provided and models of care as previously described. Consideration should be given to outpatient volumes with regard to vertical access to clinics if the cardiac precinct is not on a ground floor.

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

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 catheterisation suite should be more discreetly located.

Ideally there should be separate staff and patient paths, and separate access for inpatients.

02.04 Functional Areas

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:

- reception and waiting area;
- cardiac catheter laboratories;
- diagnostic facilities;
- cardiology outpatient clinics;
- staff offices and amenities; and
- teaching and research facilities.

RECEPTION / WAITING

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

A separate reception / waiting area may be required for the catheterisation suite if not a shared area.

CARDIAC CATHETER LABORATORIES

Patient Care Zone:

- reception (may be shared);
- patient / visitor waiting (may be shared);
- patient bed bays (holding and recovery, depending on operational guidelines);
- patient amenities/change rooms;
- staff station;
- clean and dirty utility rooms; and
- storage.

Treatment Zone:

- catheter laboratories (diagnostic, interventional, electrophysiology study (EPS));
- computer equipment rooms (generators etc);
- control room/s (note that shared control rooms are to be used with due consideration of acoustic and operational impacts);
- scrub bay(s) (located external to catheter laboratory);
- staff change rooms;
- sterile stock storage and set-up area; and
- equipment storage.

Support Zone:

- viewing and reporting room; and
- picture archiving and communication system (PACS) room for digital storage if local system.

Staff Zone:

- access to workstation;
- access to teaching and research facilities; and
- access to amenities.

CARDIAC DIAGNOSTIC FACILITIES

Cardiac diagnostic areas usually comprise of general, patient specific and staff areas, as follows:

General Area:

- reception/waiting area (may be shared).

Patient Specific Areas:

- change cubicles;
- toilets;
- access to shower facilities (for hygiene post-exercise testing);
- testing rooms for the various procedures (ECG, ambulatory monitoring, pacemaker clinic, echocardiography);
- patient holding bay/s for TOE patient recovery; and
- access to emergency resuscitation equipment is required.

Staff /Support Areas:

- technicians'/scientists' workrooms; and
- clinical support areas – staff station, utilities.

CARDIOLOGY OUTPATIENT CLINICS

Facilities for cardiology outpatient clinics will be provided as standard consultation rooms sufficient for throughput as outlined in the service plan.

If consulting rooms are part of a general outpatient area, ready access to ECG facilities is desirable and rooms may be scheduled for use by other disciplines.

If a pacemaker clinic is located in the general clinic area, access to a room should be provided for testing equipment and an external defibrillator.

STAFF OFFICES AND AMENITIES

Offices / workstations will be required for senior staff permanently attached to the various zones of the unit.

Offices / workstations for medical staff and some nursing staff (CNC / educators) may be located as part of an integrated cardiac precinct or as part of a general office complex.

The offices/workstations may be required for administrative as well as clinical functions to facilitate educational/research activities.

Guidance on the specific allocation of office/workstation space will align with each jurisdiction's office accommodation policies:

Staff will need access to the following:

- staff toilets;
- staff shower(s) (unless provided as part of hospital facilities);
- staff lockers;
- staff room with beverage facilities; and
- access to meeting rooms.

SHARED AREAS

Depending on the model of care, every opportunity should be taken to share facilities with other HPUs such as:

- public waiting areas and amenities;

- reception;
- support areas; and
- staff amenities.

EDUCATION AND STAFF DEVELOPMENT

The extent of teaching undertaken within the CIU will need to be assessed so that appropriate office/workstations and teaching facilities are provided. In all facilities there should be adequate access to facilities for staff education and meetings.

RESEARCH

Provision for research may be justified by service needs and role delineation. Relevant jurisdictional staff office accommodation policies should be referenced.

The following facilities may be required for clinical trials (or shared with other cardiac units including CCU):

- offices/workstations for senior coordinator/s and research fellow/s;
- shared offices / workstations for other clinical trial research staff;;
- shared offices / workstations for registrars and research assistants;
- patient consulting room/s (if the research unit is accessed by patients);
- drug monitoring room;
- drugs and research files storage; and
- research laboratories.

02.05 Functional Relationships

EXTERNAL

Direct access from the emergency unit to the catheter laboratory is essential for rapid transfer of emergency patients. It is desirable that the CIU has ready access to:

- chest pain assessment unit;
- medical imaging particularly chest x-rays and CT;
- nuclear medicine (particularly for stress testing);
- PET Unit (cardiac positron emission tomography) - tertiary facilities;
- operating unit;
- extended day only (23 hours) or similar unit;
- pathology services (via samples along pneumatic tube system);
- biomedical engineering; and
- community health services (Hospital in the Home, etc).

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 post-operative phase including rehabilitation. The units need to be well-linked and preferably collocated.

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.

If stress echocardiography is undertaken there should be ready access for patients and staff between the echocardiography room and stress testing room - assuming the echocardiography room does not have a dedicated treadmill.

03 DESIGN

03.01 Accessibility

INTERNAL

Access is required for patients on beds/trolleys and wheelchairs in all diagnostic and treatment areas particularly the cardiac catheter laboratories.

Access to an anaesthetic machine should be available, should emergency situations progress to interventional procedures.

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.

Keypad or swipe card entry at access points may be considered as they provide more secure, cost effective access control, particularly for staff.

03.02 Parking

All-weather vehicle drop off 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).

For staff parking, refer to AS/NZS 2890 (Set):2009, Parking Facilities Set (Standards Australia, 2009).

03.03 Disaster Planning

Each unit will have operational plans and policies detailing the response to a range of emergency situations both internal and external. Consider issues such as the placement of emergency alarms, the need for uninterrupted power supply (UPS) to essential clinical equipment and electronic sensor taps, services such as emergency lighting, telephones, duress alarm systems and computers and the emergency evacuation of patients, many of whom will require assistance.

A number of items (e.g. duress alarms, central computer, nurse call) require connection to a UPS and a generator to provide continuous power between the time of power failure and the time it takes for the generator to kick in. Otherwise systems have to be re-set and/or will not function during a power failure. The importance of a UPS may not be fully appreciated during procurement/construction.

Refer to Part B: Section 80 General Requirements, for general disaster planning/natural disaster information, local jurisdiction disaster management plans and Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions, for further information.

03.04 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, and to individual jurisdiction policies and guidelines.

Hand basins should be located in all clinical areas including treatment rooms; procedure rooms; clean and dirty utility rooms; medication rooms; and staff station if used for any medication preparation etc. See Part D: Infection Prevention and Control, for further information.

03.05 Environmental Considerations

ENVIRONMENTALLY SUSTAINABLE DESIGN

Sustainability applies to many areas such as:

- air handling and ventilation;
- thermal integrity (insulation, etc.);
- water management;
- choice of sustainable products e.g. low VOC floor finishes; and
- support of operational recycling policies.

Many of these issues will be addressed at overall facility level but may have greater or lesser implications for this HPU.

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.

Note: 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.

NATURAL LIGHT

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

PRIVACY

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

INTERIOR DÉCOR

Interior décor includes furnishings, style, colour, textures, ambience, perception and taste. This can help prevent an institutional atmosphere. However, cleaning, infection control, fire safety, patient care and the patients' 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 as bedrooms and treatment areas. Such colours may prevent the accurate assessment of skin tones e.g. yellow / jaundice, blue / cyanosis, red / flushing.

A calming non-threatening environment is desirable using colours that do not mask skin colours. Consideration could be given to ceiling art and murals.

SIGNAGE AND WAYFINDING

The orientation of people to and within healthcare facilities, and even safety and security issues are greatly assisted or hampered by the quality and location of signage which may be directional, used as a means of identification and/or statutory.

03.06 Space Standards and Components

HUMAN ENGINEERING

Human engineering covers those aspects of design that permit effective, appropriate, safe and dignified use by all people, including those with disabilities. For details refer to Part C: Section 730, Human Engineering.

As the requirements of occupational health and safety (OHS) and antidiscrimination legislation will apply, this section should be read in conjunction with Part C: Section 790, Safety and Security Precautions, in addition to relevant OHS legislation.

ERGONOMICS

The CIU should provide for easy access of beds, trolleys and ICU and emergency department patients with associated equipment.

Access in and around the bed areas should facilitate unhindered access to the patient in the event of a cardiac arrest.

Appropriate space for hanging and storage of PPE (e.g. lead aprons) should be external to procedure rooms etc.

Design and build the unit to ensure that patients, staff, visitors and maintenance personnel are not exposed to avoidable risks of injury.

Refer to the section on Access and Mobility in Part C: Section 730, Human Engineering.

ACCESS AND MOBILITY

Where necessary, design should comply with AS/NZS 1428:2010 Design for Access and Mobility (Set), AS/NZS 1428:2010 Design for Access and Mobility (Set) (Standards Australia, 2010).

Refer to Part C: Section 730, Human Engineering, for details.

BUILDING ELEMENTS

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in the section on Building Elements in Part C: Section 710, Space Standards and Dimensions.

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 considered to support between the laboratory and the control room.

03.07 Safety and Security

SAFETY

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.

SIGNAGE

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

SECURITY

Security of the various components/zones should be addressed at each stage of the planning, design, construction and commissioning process and not superimposed on a completed facility.

Security may include:

- fixed and personal duress alarms if indicated;
- access control; and
- video surveillance.

For further information refer to:

- TS11 - Engineering Services and Sustainable Development Guidelines, Technical Series TS11 - Engineering Services and Sustainable Development Guidelines (NSW Health, 2013): Section 5 – Security systems;
- individual jurisdiction security policies where available; and
- Part C: Section 790, Safety and Security Precautions.

RISK MANAGEMENT

Occupational Health and Safety (OHS) legislation requires designers to identify, assess and control risks in order to provide an optimal ergonomic design and to do this in consultation with stakeholders.

Safety considerations need to address the health and safety of end users, including staff, maintenance personnel, patients and visitors.

By adopting a risk management approach, many safety and security related hazards can be eliminated or minimized at the planning stage before work even begins, reducing the likelihood of adverse incidents occurring.

For further details refer to:

- Part C: Section 730, Human Engineering and Part C: Section 790, Safety and Security Precautions, for specific OHS requirements;
- AS/NZS 4360:2004 Risk Management (Standards Australia, 2004);
- TS11 - Engineering Services and Sustainable Development Guidelines, Technical Series TS11 - Engineering Services and Sustainable Development Guidelines (NSW Health, 2013); and
- TS7 - Floor Coverings in Healthcare Buildings, Issue V1.1 (NSW Health, 2009).

03.08 Finishes

GENERAL

Finishes in this context refers to walls, floors, windows and ceilings.

Refer to Part C: Section 710, Space Standards and Dimensions, for further details.

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. Refer to Part C: Section 710, Space Standards and Dimensions.

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 / 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, including as a result of joints between flooring.

Refer to:

- Part D: Infection Prevention and Control;
- TS7 - Floor Coverings in Healthcare Buildings, Issue V1.1 (NSW Health, 2009); and

- Part C: Section 710, Space Standards and Dimensions.

CEILING FINISHES

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

Refer to Part C: Section 710, Space Standards and Dimensions.

03.09 Fixtures, Fittings & Equipment

DEFINITION

The Room Data and Room Layout Sheets in the Australasian Health Facility Guidelines define fixtures and fittings as follows.

- Fixtures: Items that require service connection (e.g. electrical, hydraulic, mechanical) that include, but are not limited to hand basins, light fittings, medical service panels etc. but exclude fixed items of serviced equipment; and
- Fittings: Items attached to walls, floors or ceilings that do not require service connections such as curtain and IV tracks, hooks, mirrors, blinds, joinery, pin boards etc.

Refer to Part C: Section 710, Space Standards and Dimensions and to the Standard Components - Room Data Sheets (RDS) and Room Layout Sheets (RLS), for further detailed information.

Also refer to Part F: Section 680 Furniture Fittings and Equipment, regarding fixtures, fittings and equipment.

03.10 Building Service Requirements

GENERAL

In addition to topics addressed below, project staff may also refer to:

- Part E: Building Services and Environmental Design and
- TS11 - Engineering Services and Sustainable Development Guidelines (NSW Health, 2013).

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 HEPA (high-efficiency particulate air) 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.

Refer to Part D: Infection Prevention and Control and HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk (Standards Australia, 2003).

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.

Catheter laboratories should be cardiac protected in accordance AS/NZS 3003:2011 Electrical Installations - Patient Areas (Standards Australia, 2011).

All other diagnostic rooms should be body protected in accordance with AS/NZS 3003:2011 Electrical Installations - Patient Areas (Standards Australia, 2011) and Part E: Section 3, Electrical, Australasian Health Facility Guidelines (AHIA, 2015).

INFORMATION TECHNOLOGY AND COMMUNICATIONS

A wide range of systems will be required to ensure efficient and effective patient information and image management. These will include but are not limited to:

- increased provisions for wireless technology (stress testing is often wireless);
- voice / data cabling and outlets for phones, fax and computers;
- video and teleconferencing capability (LAN / WAN);
- PACS (picture archiving and communication system) and storage for digital archives (may be a local or facility-wide system);
- data cabling to support remote reporting;
- audio visual, web network access to view angiograms;
- CCTV surveillance if indicated; and
- patient, staff and emergency call systems to comply with AS 3811 - Hard wired Patient Alarm Systems (Standards Australia, 1998).

Close collaboration with the local information technology unit/ department and with clinical consultants is recommended. Refer also to Part B: Section 80 General Requirements.

HYDRAULIC SERVICES

Temperature-controlled water is required for hand basins.

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;
- ultrasound/ ECHO room; and
- Holter reading rooms.

MEDICAL GASES

All patient investigation rooms will require oxygen and suction facilities. The provision of medical air to patient recovery bays and interventional rooms should be considered.

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

Refer to Part E: Building Services and Environmental Design, Section 7 and to the Standard Components - Room Data Sheets (RDS) and Room Layout Sheets (RLS).

RADIATION SHIELDING AND RADIATION SAFETY

The 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

04.01 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/standard-components

04.02 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 are as below:

- ambulatory monitoring room;
- ECG room;
- electrophysiology (EP) laboratory; and
- pacemaker / ICD follow-up clinic.

AMBULATORY MONITORING ROOM

Description and Function

A room for attaching Holter monitors or blood pressure cuffs for ambulatory monitoring of patients.

Patients may change in the room or in an adjacent change cubicle.

Note that a standard consultation room may be suitable for this purpose.

Location and Relationships

Direct access is required to and from the waiting room or change cubicles.

Considerations

Body protection is required in accordance with AS/NZS 3003:2011 Electrical Installations - Patient Areas (Standards Australia, 2011).

The following FFE is included:

- examination couch;
- Holter monitoring equipment (ECG leads and monitors) and blood pressure (BP) equipment;
- desk and technicians' chair;
- patient chair(s);
- hand basin;
- clothes hook(s); and
- storage for supplies, leads etc.

ELECTROCARDIOGRAM ROOM

Description and Function

A room for undertaking resting electrocardiograms. Patients may change in the room or in an adjacent change cubicle.

This may be a single room/cubicle or may be designed as two curtained patient bays.

Location and Relationships

Direct access is required to and from change cubicles if provided.

Ready access from the waiting room and outpatient area is necessary as ECGs may be performed as a routine element of a cardiac clinic.

Considerations

This should be a body protected area in accordance with AS/NZS 3003:2011 Electrical Installations - Patient Areas (Standards Australia, 2011).

The following FFE may be included:

- examination couch/table;
- ECG machine;
- desk and technicians' chair ;
- patient chair(s);
- hand basin;
- clothes hook(s); and
- storage for leads etc.

If two bays, provide curtain tracks and screens. The hand basin may be shared.

ELECTROPHYSIOLOGY (EP) LABORATORY

Description and Function

A room for undertaking electrophysiology studies, and radiofrequency ablation if indicated.

Note that patients may become unstable during a procedure and therefore more support equipment is required.

Circulation space for four staff plus equipment is required.

The control room is to be ideally located at the head or foot of the bed, not to the side, for optimum patient visibility.

Location and Relationships

Direct access to and from the patient holding or recovery bays is required.

Considerations

Equipment required may include:

- two defibrillators;
- anaesthetic pendant at head of table;
- anaesthetic machine;
- resuscitation trolley;
- set-up and stock trolleys;
- three-dimensional mapping equipment; and
- TOE machine.

The room should be away from external electrical interference i.e. plant rooms or other equipment requiring high voltage, and properly shielded (Faraday cage) if necessary.

Ensure power points are collocated with the patient table to reduce trip hazard. Increasingly, equipment is becoming cordless e.g. foot pedals, echo machines.

Access to benching for preparation of emergency drugs is recommended. Space for mobile storage (which may contain hanging space and drawers) is to be utilised in the room.

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 Relationship

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/external link to cardiac support;
- communication/PC support for different device programmers with twin monitors to test pacemakers; and
- benches at an appropriate height to prevent staff neck and back injury if staff have to continually lift and move programming machines.

AX APPENDICES

AX.01 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 each Unit on a case by case basis.

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. These rooms are described as '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.

ENTRY / RECEPTION

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
RECLS-10	Reception / Clerical, 10m2	Yes	1	10	May be shared
WAIT-20	Waiting, 20m2	Yes	1	20	Adjust size to suit. May be shared.
WCPU-3	Toilet - Public, 3m2	Yes	2	3	1 male and 1 female
WCAC	Toilet - Accessible Room, 6m2	Yes	1	6	
OFF-S9	Office - Single, 9m2	Yes	1	9	Unit Manager
OFF-2P	Office - 2 Person Shared, 12m2	Yes	1	12	Workstations for general administration
STEPS-10	Store - Files, 10m2	Yes	1	8	If required
STPS-8	Store - Photocopy / Stationery, 8m2	Yes	1	8	Can be part of or included in central workstation area
PBTR-H-6	Patient Bay - Holding , 6m2	Yes	1	6	Bed or trolley for waiting patient. This space should be discrete with clinical staff overview if provided - e.g. need for patient privacy (optional)
BMEQ-4	Bay Mobile Equipment, 4m2	Yes	1	4	For mobile ECG machines (optional)
MEET-9	Meeting Room, 9m2	Yes		9	For interviews, consults. No. to be determined through service planning
CONS	Consult Room	Yes		12	Adjust number of rooms to service activity of optimum use.
	Discounted Circulation %			32%	

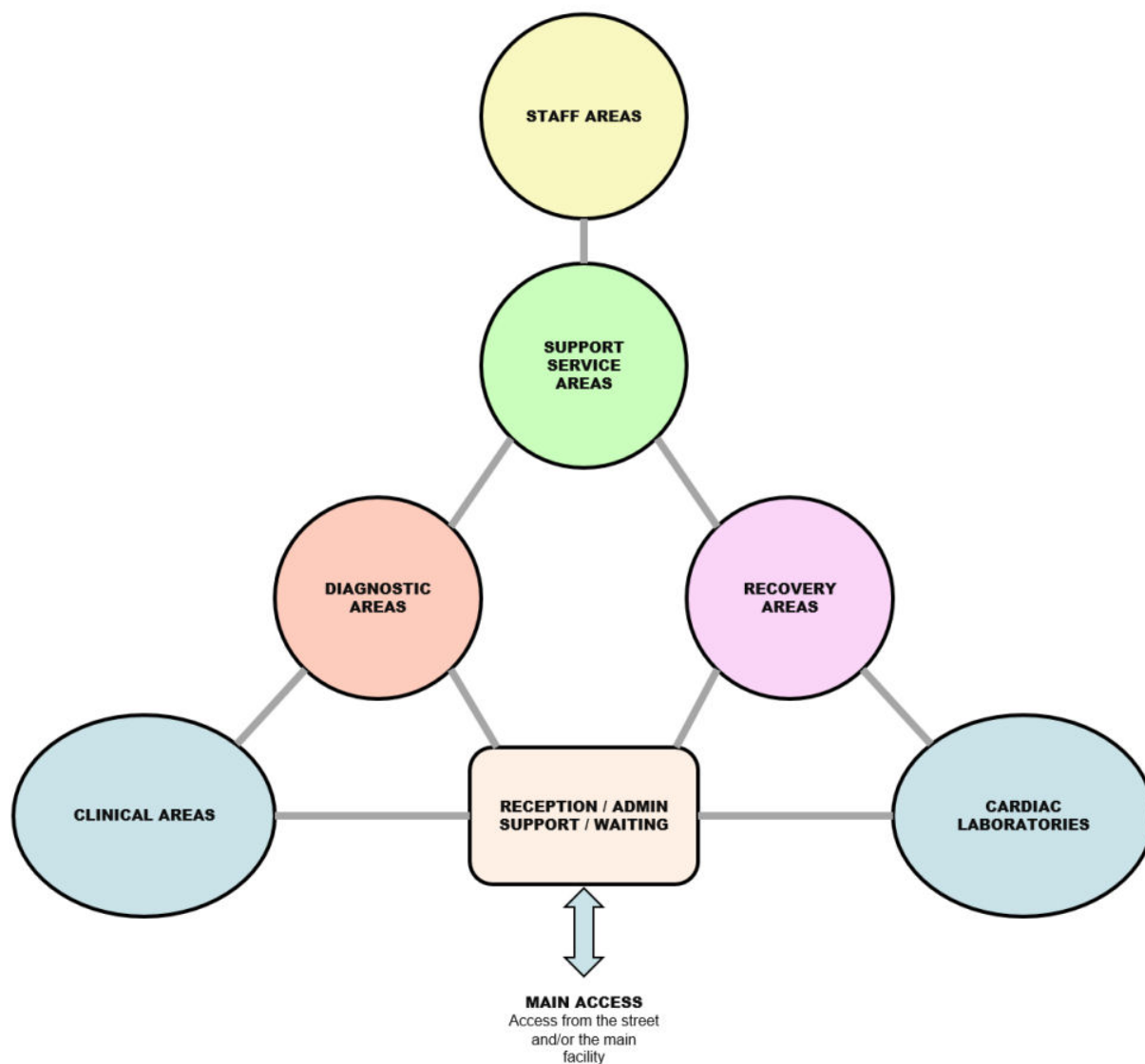
DIAGNOSTIC AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
	ECG Cubicle - 1 patient			9	Exam couch, chair, desk, ECG monitor, access to a hand basin. No. to be determined through service planning.
	ECG Room - 2 patients			18	Two curtained cubicles. Access to a shared hand basin. No. to be determined through service planning.
	Holter / Ambulatory BP Application			8	Number will depend on throughput unless standard consult rooms used
	Holter Analysis Room		1	12	Desks/benching to support 2-3 computers
	Pacemaker / ICD Follow-Up Clinical Room		1	14	Bed access; cardiac protection
	ECG Stress Testing Room		1	20	Includes resuscitation trolley
WCPT	Toilet - Patient, 4m2	Yes	1	4	Also for specimen collection if needed
	Shower / Toilet / Change - Access		1	8	Close access from the exercise labs
	Tilt Table Testing Rooms		1	16	Optional
BRES	Bay - Resuscitation	Yes	1	1.5	
	Echo Room - General		1	12	
	Echo Room - TTE		1	12	
	Echo Room - TOE		1	16	30m2 as per standard components in AusHFG
ECHO	Echo Reporting Room	Yes	1	12	May be part of shared reporting area
CLUP-7	Clean-Up Room, 7m2	Yes	1	7	For initial cleaning of ECHO probes etc - prior to cleaning as per Part D: Infection Prevention and Control, Australasian Health Facility Guidelines (AHIA, 2015)
SSTN-10	Staff Station, 10m2	Yes	1	12	
OFF-S9	Office - Single Person, 9m2	Yes	1	9	Unit manager is based in unit (optional)
	Office - Workstation, 5.5m2		1	5.5	Number of workstations will depend on staff establishment.
STEQ-20	Store - Equipment, 20m2	Yes	1	20	
BLIN	Bay - Linen	Yes	1	2	
BMEQ-4	Bay - Mobile Equipment, 4m2	Yes	1	4	Mobile ECG Units
WCST	Toilet - Staff, 3m2	Yes	2	3	Unless shared facilities
SRM-15	Staff Room, 15m2	Yes	1	15	Includes beverage bay
	Discounted Circulation %			32%	

CARDIAC CATHETER LABORATORY

AusHFG Room Code	Room / Space	SC / SC-D	Qty	m2	Remarks
RECLS-12	Reception / Clerical, 12m2	Yes	1	12	May be shared with adjoining unit. Spacing allowance for more than 1 staff member
OFF-2P	Office - 2 Person Shared, 12m2	Yes	1	12	Optional for administrative staff
STPS-8	Store - Photocopy / Stationery, 8m2	Yes	1	8	Space may be included as part of reception area
WAIT-10	Waiting, 10m2	Yes	1	12	8-10 places for chairs and wheel chair for relatives and for patient discharge
BBEV-OP	Bay Beverage, Open Plan, 4m2	Yes	1	4	Open beverage bay
INTF	Interview Room	Yes	1	10	1 or 2 rooms for post angiogram review, operator reviews, pre-admission interviews, consents etc.
CONS	Consult Room	Yes	1	12	1 or 2 rooms for examinations
CHPT	Change Cubicle - Patient, 2m2	Yes	2	2	As per standard components. May be included in area for pre-operative arrivals.
	Change Cubicle, Accessible, 4m2		1	8	Male and female, toilet and lockers
CLAB	Catheter Laboratory Procedure Room	Yes	1	55	Single Plane
CLAB	Catheter Laboratory Procedure Room	Yes	1	55	Bi - Plane
	EP Laboratory		1	55	Sized as per OT HPU
CLCRT	Catheter Lab Control / Reporting Room	Yes	1	14	Separate rooms are optimal. Shared rooms must take due consideration of audio and operational impacts.
	Control Room - EP Lab		1	15	Allow for 3 staff with up to 5m2 work spaces. Multiple staff will also stand and sit in this area. Located ideally at head or foot of bed not at the side for maximum patient and procedure visibility. Extensive rack space required for switches.
	Computer Equipment Room		2	10	For storage of large equipment not required in the lab e.g. 3D Mapping and RFA equipment, 'Radi' pressure wire monitors, Intra-vascular ultrasound (IVUS) machine.
SCRB-6	Scrub Up / Gowning, 6m2	Yes	1	6	May be combined to serve two rooms. Located external to the Catheter Laboratory.
	Bay - Lead Aprons		1	1	One per laboratory; may be shared between rooms. The storage method of lead aprons and other lead protection requirements should be reviewed in consideration of the volume required for these services and the safe access by staff to retrieve a lead gown and store them without folding the gowns.
	Store Sterile Stock / Set Up Room		1	20	
STEQ-14	Store - Equipment, 14m2	Yes	1	16	For storage of large equipment when not required in cardiac catheter procedure room
STGN-9	Store - General, 9m2	Yes	1	10	For storage of bulk items/boxes
CHST-10	Change - Staff (Male/Female), 10m2	Yes	2	10	Access to 1 male, 1 female. Comprises lockers, shower, toilet.
CLUP-7	Clean-Up Room, 7m2	Yes	1	7	Access for processing echo transducers. Refer Part D: Infection Prevention and Control, Australasian Health Facility Guidelines (AHIA, 2015)
	Viewing / Reporting Room		1	7	3 workstations
	Store - Films		1	4	Optional - use of digital storage systems / PACS
PBTR-H-9	Patient Bay Holding, 9m2	Yes	1	9	6 bays per laboratory plus 1 or 2 for TOE Rooms - to be reviewed if accessing shared recovery space.
BHWS-B	Bay - Handwashing, Type B	Yes	2	1	
	Staff Station / Clean Utility		1	10	
BPATH	Bay - Pathology	Yes	1	1	Benching for machine with an increase to 2m2 if including a pneumatic tube station
BBW	Bay - Blanket / Fluid Warmer	Yes	1	1	
BRES	Bay - Resuscitation	Yes	1	1.5	
BLIN	Bay - Linen	Yes	1	2	
DTUR-10	Dirty Utility Room, 10m2	Yes	1	10	
DISP-10	Disposal Room, 10m2	Yes	1	10	Large volume of packaging waste
OFF-S9	Office - Single Person, 9m2	Yes	1	9	Unit Manager
	Office - Workstation, 5.5m2		1	5.5	Optional: Cardiac technicians 5.5m2 per staff member
	Discounted Circulation %			35%	

AX.02 Functional Relationships / Diagrams



AX.03 Checklists

For planning checklists, refer to Parts A, B, C and D of the Australasian Health Facility Guidelines.

AX.04 References

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AX.06 Further Information

CARDIAC CATHETERISATION / CORONARY ANGIOGRAPHY

Cardiac catheterisation or coronary angiography (the terms are used interchangeably) is a diagnostic procedure undertaken to detect the presence of coronary artery 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 involves insertion of a catheter into an artery via a sheath threaded over a guide wire. 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 and requires up to a four hour period of observation post-procedure prior to discharge. The procedure may advance to an interventional procedure such as balloon angioplasty or stent insertion.

Refer to Coronary Computed Tomography Angiogram, Cleveland Clinic Website (Cleveland Clinic, 2015).

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 sedation and local anaesthesia. At the same time a simple or drug-eluting stent may be inserted that supports the occluded artery and maintains patency. The procedure takes approximately 90 minutes.

A joint 2005 American College of Cardiology/American Heart Association/ Society for Cardiovascular Angiography and Interventions report (Guideline Update for Percutaneous Coronary Intervention (Smith, C. et al, 2005)) 'strongly recommends that PCI should be performed in facilities that have an experienced cardiovascular surgical team available as emergency backup for all procedures.'

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 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 faulty electrical site. 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 over ride 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.

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 defibrillators (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.

ECHOCARDIOGRAPHY

Also known as a cardiac ultrasound, echocardiography uses standard ultrasound techniques to produce two-dimensional (2D) images of the heart 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 and echocardiography followed by exercise and then repeat echocardiography and TTE. This test may take up to two hours.

CLINICAL STRESS TESTING

Clinical stress testing is usually undertaken on a motorised treadmill and less commonly on an exercise bicycle. This not to be confused with non-clinical exercise such as may be carried out in a gymnasium prior to taking up a fitness programme.

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.

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.

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.

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 tape 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). The guidelines were approved by the Board of the CSANZ on 11 May 2012.

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).