

Cardiac monitoring of adult cardiac patients in NSW public hospitals

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The information is not a substitute for healthcare providers' professional judgement.

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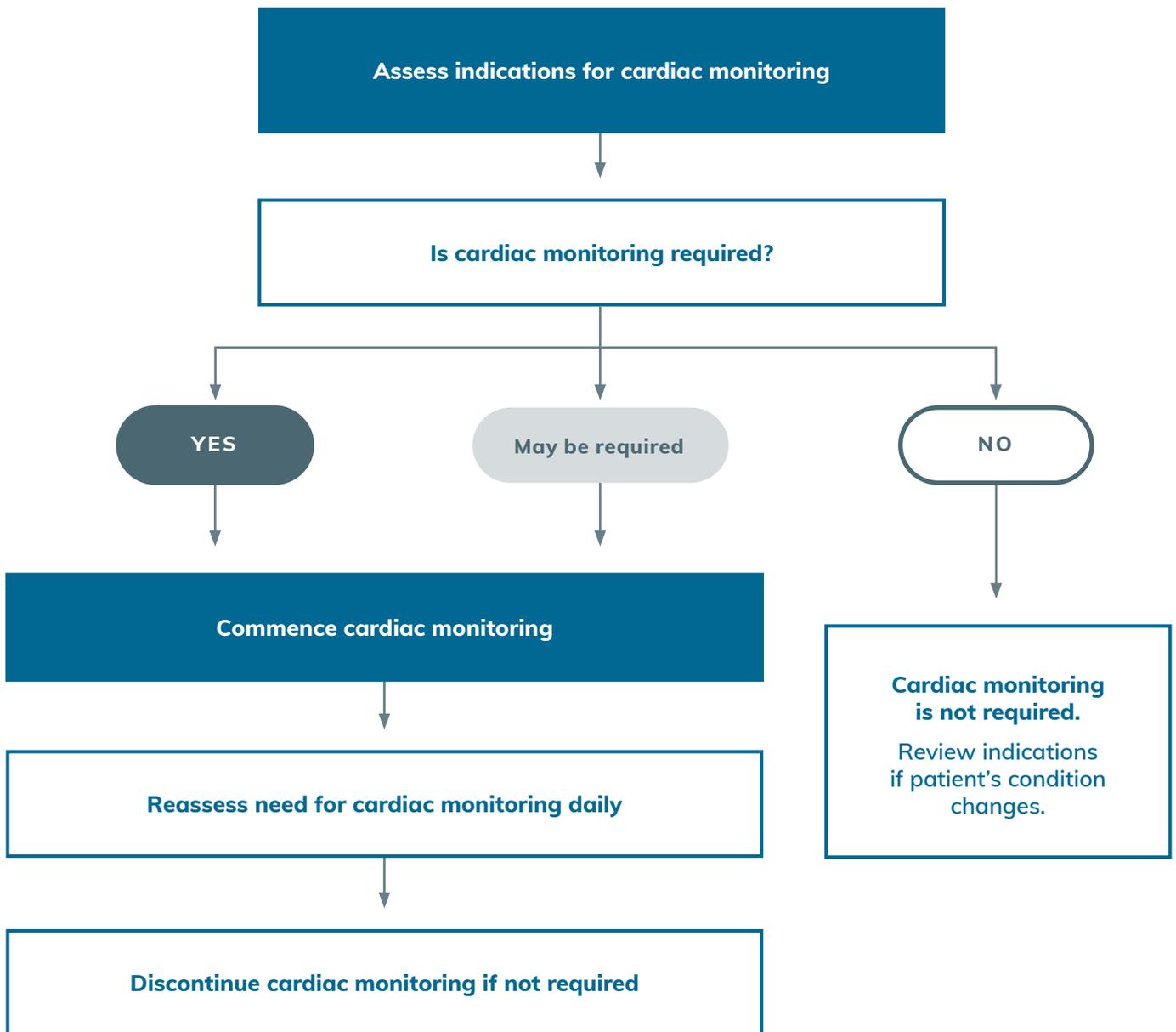
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Cardiac monitoring of adult cardiac patients in NSW public hospitals

Cardiac monitoring of adult cardiac patients in NSW public hospitals – at a glance

Continuous cardiac monitoring allows early identification and management of cardiac arrhythmias and, under some circumstances, myocardial ischaemia warranting further investigation. It also supports decisions about safe transfer or discharge following cardiac events or procedures.



Background

About this document

Cardiac monitoring is a routine clinical activity carried out in hospitals throughout NSW. Continuous cardiac monitoring allows early identification and management of cardiac arrhythmias and, under some circumstances, myocardial ischaemia warranting further investigation. It also supports decisions about safe transfer or discharge following cardiac events or procedures. This clinical practice guide replaces the NSW Health *Guideline on Cardiac Monitoring in Adult Cardiac Patients in Public Hospitals in NSW (GL2016_019)*.

Internationally, the limited available evidence supporting practice guidelines means that most recommendations for continuous cardiac monitoring are considered Level of Evidence C (based on standards of care or a consensus of expert opinion).¹ This guide has been produced in consultation with cardiac nurses and cardiologists in rural and metropolitan areas, consumer representatives, emergency consultants, anaesthetists, cardiothoracic surgeons, the Agency for Clinical Innovation Cardiac Network, the Heart Foundation, the Cardiac Society of Australia and New Zealand, the Australian Commission for Safety and Quality in Health Care and NSW Ambulance.

The revised guide provides further clarification on:

- the role for, limitations of, and institutional resources to support ST segment and QT interval monitoring
- lead selection according to indication
- advice on avoidance of inappropriate monitoring in low-risk patients
- safe adjustment of alarm parameters to reduce alarm fatigue
- the skills within the Group A advanced escort skill set that are patient-dependent
- the capacity for senior nurses with advanced cardiac skills to act as delegate decision makers about cardiac monitoring
- the expectations for reviewing and documenting cardiac monitoring alarms
- the revised monitoring requirements for clinically stable patients awaiting pacemakers or internal cardioverter defibrillator implantation, and for patients receiving inotropes as supportive care at the end of life.

The guide represents the recommended minimum standards for cardiac monitoring for adult patients with a primary cardiac diagnosis, regardless of the clinical area in which they are managed. Patients requiring such monitoring should be managed in a unit with appropriate equipment and trained staff. Adherence with the guide will optimise patient outcomes through the appropriate use of cardiac monitoring in public hospitals in NSW by facilitating:

- earlier recognition of arrhythmias that may result from or precipitate patient deterioration
- timely recognition of cardiac arrest to reduce time to defibrillation
- diagnosis of arrhythmias or understanding the cause of symptoms, such as palpitations and syncope
- monitoring responses to treatment
- guiding decisions about safe and timely discharge.¹

This document may be used by local health districts (LHDs) or speciality health networks (SHNs) to inform the development of their own policies, incorporating the minimum standards described in this guide and additional information from other sources.

A considered decision by nurses, physicians, and biomedical engineers at each hospital is critical to identifying an interprofessional protocol for ischaemia (ST-segment) monitoring, and QTc segment monitoring. It is important to identify which hospital units commonly admit the patient populations who may or may not benefit from such monitoring, and what equipment, training and quality measures are required locally.¹

The numbers in superscript in this document relate to references to research and national and international practice guidelines, while superscript letters relate to definitions in the glossary. Abbreviations are listed at the end of this document.

Method

This clinical practice guide draws on international literature and particularly the 2017 *Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings: A Scientific Statement* from the American Heart Association.¹ We have largely adopted and adapted these standards for the Australian context. The guide also draws on the Cardiac Society of Australia & New Zealand *Clinical Guidelines for the management of Acute Coronary Syndromes* and *NSW Pathway for Acute Coronary Syndrome Assessment (PACSA)*.^{2,3}

A rapid evidence-check methodology was used to search the peer reviewed and grey literature, via PubMed and Google Scholar, using a combination of Medical Subject Headings and keywords for 1) “Cardiac Monitoring OR Arrhythmia Monitoring” and 2) “ST segment OR QT segment” AND “monitoring OR ECG”. Studies published in English from 2016 to November 2021 were included to capture evidence since publication of the national and international guidelines.¹⁻³ The work was guided by a small

working group of subject matter experts with substantial experience in cardiac monitoring from facilities across rural and metropolitan NSW.

Scope

This guideline applies only to hospitalised adult patients with a primary cardiac diagnosis. Clinicians should consult local guidelines for cardiac monitoring in the context of non-cardiac medical or surgical conditions.

Principles and minimum standards

Purpose

Cardiac monitoring (for arrhythmia with or without ST segment monitoring) is a useful diagnostic tool for patients with, or at risk of, cardiac arrhythmias or acute ischaemic changes. It has no therapeutic value unless the clinicians supervising the patient are skilled in the recognition and management of these abnormalities.

Indications

There should be a clear indication documented for cardiac monitoring to optimise health resource use, and to reduce established risks to patient independence and recovery. Cardiac monitoring in low-risk patients does not improve outcomes.⁴

Central monitoring

Clinical areas designated for the management of patients requiring continuous cardiac monitoring^a should have central monitoring capability with all cardiac monitors (apart from those used for transfers) connected to the central monitor.

Responsibility

A senior nurse with advanced cardiac skills (Table 2, Group A) may allocate a patient to a monitoring category in the absence of medical direction and should document the clinical reasoning for their decision. However, the final responsibility for risk assessment related to cardiac monitoring rests with the treating medical officer^b or the medical officer responsible for the person's cardiac monitoring who should review the monitoring category within 24 hours.

Alarm parameters

In the absence of local policy, alarm parameters should be set as per Between the Flags Yellow Zone^c, except where altered calling criteria^d are documented. Where patient parameters exceed an alarm zone, local, contextually relevant protocols developed with multidisciplinary agreement should guide appropriately skilled nurses to adjust alarm limits to reduce non-actionable alarms and alarm fatigue.^{1,5}

Alarm response and review

All nurses are responsible for responding to and reviewing cardiac monitoring alarms. If there is uncertainty about the cardiac rhythm triggering an alarm, this should be escalated to the team leader. Proper skin preparation and quality electrode management may reduce non-actionable alarms and alarm fatigue.⁶

Rhythm strip documentation

Recording and documentation of a patient's rhythm strip (either hard copy, or extracted and entered into the electronic medical record), along with interpretation and any actions taken is expected:

- on admission
- at least every eight hours
- following a change in rhythm or haemodynamic status.

The documentation should be accessible to all treating clinicians.¹

Daily reassessment

At the end of the minimum recommended monitoring period, daily reassessment of the clinical indication for continued monitoring is necessary so that monitoring is ceased when no longer required¹ (see Tables 3, p.8-10 and 4, p.12). For Group A patients, this assessment should be performed by the treating medical team, the medical officer responsible for the patient's cardiac monitoring, or a specific, locally delegated senior nurse with advanced cardiac skills to support complex decision making. For Group B patients, the assessment may be performed by an appropriately skilled delegate, for example clinical nurse consultant (CNC), clinical nurse educator (CNE), clinical nurse specialist (CNS) or nurse unit manager (NUM).

Interruptions to monitoring

It is preferable that patients who require continuous cardiac monitoring^a remain monitored at all times. However, if cardiac monitoring must be interrupted (for example, for showering or investigations), patients must be under direct visual observation^e by clinical staff with the appropriate skill set (see Tables 1 and 2, p.6-7) during the entire period that cardiac monitoring is unavailable.

Staff skill mix

Clinical areas managing patients listed in this guide should have at least one nurse on duty at all times who meets competency requirements for the relevant escort skill sets (see Tables 1 and 2, p.6-7).

Appropriate facility

If a facility is unable to meet the required staff numbers and competency, the patient should be transferred to a facility that is able to provide this level of care.

Transfer

During transfer, cardiac monitoring (or if unavailable, direct visual observation^e) must be maintained by a clinician with appropriate escort skill sets (see Tables 1 and 2, p.6-7).

Competency assessment

Each local health district should determine the required competency assessments for each facility to ensure availability of adequate staff skill mix.

Patient risk classification

Groups A and B in this document classify monitored patients according to their risk for life-threatening arrhythmias and the subsequent skill set required for safe nursing care and transfer. Specific clinical contexts are detailed in Table 3 for Group A, and Table 4 for Group B.

Skill sets and required competencies for staff escorts

Table 1: Skill sets and required competencies for staff escorts, Group B

Group B (Basic) escort skill set	Competency requirements
Basic life support	Holds current, facility-endorsed basic life support accreditation including use of an automated defibrillator ⁷
Recognition and management of the deteriorating patient	Successful completion of training in the recognition and management of the deteriorating patient e.g. DETECT
Assessment and management of symptoms of myocardial ischaemia	In this context, the ability to administer supplemental oxygen (if SpO ₂ <93%), nitrates and analgesia (including Schedule 8 medications)
Basic cardiac rhythm interpretation	Can recognise a change in rhythm and escalate accordingly
Management of the infusion pump (if in use) Basic skill set does not apply to infusion of medication requiring titration, e.g. inotropes and nitrates. Also note Group A pharmacotherapy exclusions, see Table 3	Can demonstrate the ability to adjust flow rates if required and troubleshoot pump function

Table 2: Skill sets for staff escorts and required competencies, Group A

Group A (Advanced) escort skill set ^{8,9}	Competency requirements (includes basic skill set)
Minimum skill set	
Administration of advanced life support drugs	Holds current, facility-endorsed advanced life support accreditation, that includes administration of intravenous advanced life support drugs
Manual defibrillation	Holds current, facility-endorsed advanced life support accreditation, that includes the use of a manual defibrillator
Patient dependent skill set Elements of advanced escort skill set may be patient dependent. Escort nurse skills should be matched to meet individual patient transport needs.	
Management of a temporary cardiac pacemaker	Holds current, facility-endorsed accreditation for managing a patient with a temporary cardiac pacemaker (transvenous or epicardial electrodes in situ), including troubleshooting pacemaker function
Transcutaneous cardiac pacing	Holds current, facility-endorsed accreditation for initiation and management of transcutaneous cardiac pacing, including troubleshooting pacemaker function
Management of intravenous medications requiring titration	Can demonstrate the requisite knowledge to manage a patient with an infusion of medication requiring titration, e.g. inotropes and nitrates (also note Group A pharmacotherapy inclusions, see Table 3)

Group A: conditions where cardiac monitoring is required

Monitoring

Group A patients are at higher risk of life-threatening arrhythmias and/or increasing myocardial ischaemia and require continuous cardiac monitoring^a, or in extenuating circumstances, continuous direct visual observation^e until cardiac monitoring is discontinued.

Escort skills and equipment for transfer

All Group A patients require an escort with Group A (advanced) escort skills set for transfer. Resuscitation equipment appropriate to the local facility and distance to be travelled, including a manual or automated defibrillator for all internal and interfacility transfers is required.

ST segment or QTc interval monitoring

ST segment or QTc interval (QT interval corrected for heart rate) monitoring is recommended only where there are clear indications and no contraindications^f and must be supported by comprehensive training and alarm management.

Discontinue ST or QTc monitoring if continuous false alarms cannot be resolved to avoid alarm fatigue.¹ ST segment monitoring is of no benefit for patients after routine angiography or with non-urgent, uncomplicated percutaneous coronary intervention, who are fully awake, alert and able to recognise and/or verbalise symptoms of angina.¹

12-lead electrocardiograms (ECGs) may be used to monitor QTc intervals ranging in frequency from eight hourly to daily, depending on the patient characteristics and drug therapy.

Lead selection for monitoring^g should be guided by the priority indication for monitoring (arrhythmia and/or ST segment and/or QTc segment monitoring).

Daily reassessment

At the end of the recommended monitoring period, Group A patients require daily re-assessment of the clinical indications for continued monitoring and documentation of these indications in the health care record.^{1,4} A written medical order is required to continue cardiac monitoring beyond the recommended monitoring period.

Table 3: Group A conditions where cardiac monitoring is required

Clinical indication for monitoring	Recommended monitoring duration
<p>Confirmed acute coronary syndrome</p> <ul style="list-style-type: none"> Confirmed ST elevation myocardial infarction (STEMI) or Non-ST elevation myocardial infarction (NSTEMI) <24 hours Confirmed STEMI or NSTEMI >24 hours, but considered clinically unstable^h 	<ul style="list-style-type: none"> All confirmed STEMI and NSTEMI patients must be monitored for cardiac arrhythmias for a minimum of 24 hours.^{1,2} It is reasonable to include ST segment monitoring, if indicated.¹ At the end of the recommended monitoring period, patients who are clinically stableⁱ should have cardiac monitoring discontinued.⁴ Patients with acute coronary syndrome, who are being transferred to another facility using a patient transfer service, may be escorted with a Group A skilled nurse, provided they have been free of ischaemic pain for over 24 hours.

Clinical indication for monitoring	Recommended monitoring duration
High-risk suspected acute coronary syndrome (ACS)^j	<ul style="list-style-type: none"> All high-risk, suspected ACS^j patients must be monitored for cardiac arrhythmias for a minimum of 24 hours (or until this is ruled out, or a second troponin is negative).^{1,3} It is reasonable to include ST segment monitoring, if indicated, including for coronary artery spasm.¹ At the end of the recommended monitoring period, patients who are clinically stable¹ should have cardiac monitoring discontinued.⁴ This will require a written medical order. A change in risk category from high-risk should only occur after senior medical review.³
Pre-operative cardiac surgery Critical left main disease (or equivalent) awaiting urgent revascularisation	<ul style="list-style-type: none"> Continue cardiac monitoring until successful coronary revascularisation occurs.¹ It is reasonable to include ST segment monitoring, where available, until successful coronary revascularisation occurs.¹
Post-operative cardiac surgery	<ul style="list-style-type: none"> Monitor for a minimum of 48 hours.¹ ST segment monitoring is reasonable immediately post-operatively in intubated and sedated patients, until they are able to recognise and report new or ongoing ischaemia.¹
Post cardiac arrest	<ul style="list-style-type: none"> Monitor for a minimum of 24 hours and until the cause has been identified and treated.¹
Life-threatening arrhythmias and implantable devices <ul style="list-style-type: none"> Wide complex tachyarrhythmia including ventricular tachycardia, ventricular fibrillation or supraventricular tachycardia with aberrancy Narrow complex tachyarrhythmia with haemodynamic instability Syncope of unknown origin Second and third degree atrio-ventricular blocks Symptomatic bradyarrhythmia Awaiting insertion of implantable cardiac device (e.g. implantable cardioverter defibrillator or permanent pacemaker) with or without temporary cardiac pacing 	<ul style="list-style-type: none"> Monitor until a reversible cause is identified and treated, cardiac symptoms have been stabilised by medical therapy and/or a device is implanted and satisfactorily tested (minimum 24 hours).⁴ Patients awaiting permanent pacemaker who are clinically stable¹ may be regarded as Group B, but they must remain monitored until device implantation occurs. Cardiac monitoring is always required during temporary cardiac pacing even if a device implant is not planned.¹

Clinical indication for monitoring	Recommended monitoring duration
<p>Pharmacotherapy Intravenous inotropes, vaso-active drugs, anti-arrhythmics, fibrinolytics</p>	<ul style="list-style-type: none"> Continue cardiac monitoring during the course of therapy. Patients requiring inotropes for symptom management at the end stage of their disease are not included in Group A. Monitoring in these cases is at the discretion of the consultant medical officer, and this decision should be clearly documented by the consultant or their delegate in the medical record.
<p>Other Ingestion of pro-arrhythmic drugs including overdose of recreational drugs, class III anti-arrhythmics, sodium channel blockers, antidepressants and anti-psychotics causing actual or potential QTc prolongation or ventricular arrhythmias^{1,10}</p>	<ul style="list-style-type: none"> Duration of monitoring must be determined by a medical officer^b based on type of drug, dose and time since ingestion. In hospitalised patients on medications which increase the QTc interval, who may be at risk of developing torsades de pointes^k, QTc intervals should be monitored with a 12 lead ECG 8 - 24 hourly.^{1,11} In patients at risk of torsades de pointes^k it is reasonable, if available, to use fully automated QTc segment monitoring;¹ however, staff knowledge and skill, and alarm fatigue should be considered.
<p>Cardiogenic shock, haemodynamic or respiratory compromise requiring support with inotropes or intra-aortic balloon pump</p>	<ul style="list-style-type: none"> Continue cardiac monitoring during the course of therapy.

Group B: conditions where cardiac monitoring is required

Monitoring

Patients require continuous cardiac monitoring^a or direct visual observation^e until cardiac monitoring is discontinued.

Escort skills and equipment for transfer

All Group B patients require the Group B (basic) escort skill set for transfer, and for all interfacility transfers. Basic resuscitation equipment, including an automated defibrillator, should be carried. Group B patients may be transferred internally (intra-hospital) under direct visualisation^e by a nurse with the Group B skill set if they are clinically stableⁱ. These patients should be connected to a monitor for the recommended period on arrival or return to the clinical department.

Discontinuing monitoring

Patients should have cardiac monitoring discontinued by registered nursing staff at the completion of the recommended monitoring period if they are assessed as clinically stableⁱ, unless there is a written medical order to continue.

Note: the decision to discontinue cardiac monitoring should be discussed with the registered nurse in charge.

Daily reassessment

If cardiac monitoring continues after the end of the recommended monitoring period, the patient should be reassessed daily by the medical team. The clinical indication for continued monitoring must be documented in the patient's health care record.

Written order for additional monitoring

When writing an order for cardiac monitoring beyond the recommended monitoring period, medical staff should specify the indications and time period that additional monitoring will be required, or stipulate clinical criteria that would allow cessation of monitoring.⁴ In the absence of a specified time frame or listed clinical criteria, the order will be determined to apply for 24 hours only.

Table 4: Group B conditions where cardiac monitoring is required

Clinical indication for monitoring	Recommended monitoring duration
<p>Confirmed acute coronary syndrome Intermediate risk^l</p>	<ul style="list-style-type: none"> If all the following criteria are met, the patient can be observed in an emergency department observation unit or chest pain unit, and does not require continuous ECG monitoring:^{2,12,13,14} <ul style="list-style-type: none"> – symptoms have resolved – the initial ECG shows no ischaemic changes (including the absence of left bundle branch block) – and the initial troponin value is within the normal reference range If NSTEMI is confirmed by troponin rise, follow the Group A recommendations in Table 3.^{1,2}
<p>Arrhythmias Haemodynamically stable patients with supraventricular arrhythmias (including atrial fibrillation with uncontrolled ventricular response) receiving intravenous drugs with pro-arrhythmic potential (e.g. amiodarone, sotalol, flecainide)</p>	<ul style="list-style-type: none"> Monitor until reversion of rhythm or control of ventricular rate.¹
<p>Patients requiring inotropes for symptom management at the end stage of their disease</p>	<ul style="list-style-type: none"> The need and conditions for monitoring in these cases is at the discretion of the consultant medical officer. This decision should be clearly documented by the consultant or their delegate in the medical record.
<p>Acute moderate to severe electrolyte imbalance^m</p>	<ul style="list-style-type: none"> Monitor until the acute electrolyte imbalance^m has been corrected and there are no related arrhythmias present.¹
<p>Post percutaneous coronary intervention, post electrophysiology study (EPS) and post catheter ablation</p>	<ul style="list-style-type: none"> Monitor for a minimum of four hours post procedure, or as per local policy.¹ Monitor for up to 24 hours if there are procedural complications, arrhythmias, chest pain or haemodynamic compromise.¹

Conditions where monitoring *may* be required

Monitor according to the direction of the treating medical team or local guidelines. Monitoring may be required for the following conditions:

- Pericardial effusion
- Suspected cardiac trauma
- Electrocutation
- Inflammatory or infective cardiac conditions (for example endocarditis, myocarditis or pericarditis).

Conditions where monitoring is *not* required

There is no evidence to support the need for cardiac monitoring for these conditions:

- Low-risk non-ST elevation acute coronary syndrome (NSTEMI)^{1,2,12,13,14}
- Persistent atrial fibrillation without haemodynamic compromise¹
- Patients with persistent atrial fibrillation without haemodynamic compromise receiving intravenous digoxin temporarily in place of regular oral therapy
- Patients with acute onset tachyarrhythmia without haemodynamic compromise can be given a single dose of up to 250 mcg intravenous digoxin without cardiac monitoring. Any further loading doses require cardiac monitoring
- Patients with chronic ventricular premature beats, who are clinically stableⁱ
- Patients with a stable functioning implantable cardioverter defibrillator or permanent pacemaker who have had a post implant check
- Patients following routine diagnostic coronary angiography beyond the immediate post-procedure clinical area.¹

Appendix 1: Cardiac monitoring of adult cardiac patients in NSW public hospitals

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Cardiac monitoring of adult cardiac patients in NSW public hospitals

Patient risk classification	Indication	Recommended monitoring duration	Requirements
GROUP A patients Staff skill mix required: responsible MO, or delegated senior nurse with advanced cardiac skills to support complex decision making	Confirmed acute coronary syndrome	<ul style="list-style-type: none"> STEMI and NSTEMI: monitor for a minimum of 24 hours. ST segment monitoring is reasonable. Clinically stable patients: cease monitoring after recommended period with written medical order. ACS patients for inter-facility transfer: Group A skilled nurse if pain free >24 hours. 	<ul style="list-style-type: none"> Continuous cardiac monitoring OR direct visual observation until monitoring ceased (in extenuating circumstances). ST or QTc segment monitoring recommended only where there are clear indications and no contraindications, supported by comprehensive training and alarm management. Escort by staff with Group A skills. Resuscitation equipment appropriate to local facility and travel distance (including a manual or automated defibrillator) required for all internal and interfacility transfers. Written medical order required to continue monitoring beyond recommended period. End of recommended monitoring period: daily reassessment of clinical indications for continued monitoring (document in healthcare record).
	High-risk suspected ACS	<ul style="list-style-type: none"> Monitor for a minimum of 24 hours (or until 2nd troponin negative). ST segment monitoring is reasonable. Clinically stable patients: cease monitoring after recommended period with written medical order. 	
	Pre-op cardiac surgery	<ul style="list-style-type: none"> Critical left main disease: continue cardiac monitoring until successful coronary revascularisation occurs. 	
	Post-op cardiac surgery	<ul style="list-style-type: none"> Monitor for minimum of 48 hours. 	
	Post cardiac arrest	<ul style="list-style-type: none"> Monitor for min 24 hours (and until cause identified and treated). 	
	Life-threatening arrhythmias, syncope of unknown origin, or implantable devices	<ul style="list-style-type: none"> Monitor until reversible cause is identified and treated; cardiac symptoms are stabilised and/or device implanted and tested. Clinically stable patients awaiting IPPM are Group B but must be monitored until device implanted. Monitoring required during temporary cardiac pacing, even if device implant not planned. 	
	Pharmacotherapy	<ul style="list-style-type: none"> Monitor during therapy. Duration determined by MO, based on type of drug, dose and timing. Patients receiving inotropes to manage end-stage disease not included in Group A. Monitoring at discretion of MO (to be documented). 	
Cardiogenic shock, haemodynamic, or respiratory compromise	<ul style="list-style-type: none"> Monitor during therapy. 		
GROUP B patients Staff skill mix required: skilled delegate (e.g. CNC, CNS, CNE, NUM)	Suspected intermediate risk NSTEMI/ACS	<ul style="list-style-type: none"> Monitor until 1st troponin result. Discontinue if symptoms have resolved; initial ECG shows no ischaemic changes (including left bundle branch block); and initial troponin is negative. 	<ul style="list-style-type: none"> Continuous cardiac monitoring OR direct visual observation until monitoring ceased. Clinically stable patients: cease monitoring after recommended period in consultation with registered nurse (see Group A competency requirements), unless written medical order to continue. Medical staff to specify and document timeframe for additional monitoring, or stipulate clinical criteria for continued monitoring. If timeframe or criteria not documented, order will apply for 24 hours only.
	Arrhythmias	<ul style="list-style-type: none"> Monitor until rhythm reversed or ventricular rate controlled. 	
	Acute severe electrolyte imbalance	<ul style="list-style-type: none"> Monitor until acute electrolyte imbalance is corrected and no related arrhythmias are present (except in patients with a chronic condition, guided by local protocols). 	
	Post PCI, EPS and catheter ablation	<ul style="list-style-type: none"> Monitor for min 4 hours post-procedure, or as per local policy. Complications, arrhythmias, chest pain or haemodynamic compromise: monitor for up to 24 hours. 	

- Purpose:** cardiac monitoring has no therapeutic value unless the supervising clinicians can recognise and manage cardiac abnormalities.
- Indication:** must be clearly documented. Cardiac monitoring in low-risk patients does not improve outcomes.
- Responsibility:** senior cardiac nurse allocates monitoring category if medical officer (MO) unavailable. MO assesses risk and reviews within 24 hours.
- Central monitoring:** should be used in clinical areas designated for continuous cardiac monitoring. All cardiac monitors should connect to the central monitor.
- Alarm parameters:** set as 'Between the Flags Yellow Zone' (if no local policy), unless Altered Calling Criteria are documented. Local protocols guide adjustment to alarm limits.
- Alarm response and review:** all nurses must review and respond to monitor alarms. Escalate to team leader if uncertain about a rhythm or alarm triggers.
- Rhythm strip documentation:** record and document rhythm strips, (including interpretation and actions) on admission, eight-hourly and following rhythm or haemodynamic changes.
- Daily reassessment:** of indication for monitoring, as per Group A by a MO or senior nurse or Group B by a skilled clinician (e.g. CNC, CNE, CNS, NUM).
- Interruptions to monitoring:** patients should be continuously monitored. Direct visual observation by skilled staff is required if interruption occurs until monitoring recommences.
- Staff skill mix:** clinical areas using cardiac monitoring need at least one nurse on duty at all times who meets competency requirements for escort.
- Appropriate facility:** if sites are unable to meet the requirement in the guide, patients should be transferred to a facility that can provide the level of care.
- Transfer:** cardiac monitoring (or direct visual observation) must be maintained by a clinician with the appropriate skill set during transfer.
- Competency assessment:** LHDs should determine the competency assessments required for each facility to ensure adequate staff skill mix.
- Patient risk classification:** Groups A and B classify monitored patients relating to their risk for life-threatening arrhythmias and staff skills required for safe nursing care and transfer.



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References

1. K. Sandau, et al. "Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings. A Scientific Statement from the American Heart Association", *Circulation*. vol. 7. no. 136. pp. e273-e344, Nov, 2017. doi: 10.1161/CIR.0000000000000527
2. D. Chew, et al "National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes", *Heart Lung Circ*, vol. 205, no. 3, pp. 895-951, Aug, 2016. doi: <http://dx.doi.org/10.1016/j.hlc.2016.06.789>
3. "Pathway for Acute Coronary Syndrome Assessment (PACSA)", NSW Ministry of Health, St. Leonards, 2019. [Online] Available at: https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2019_014.pdf
4. R. Yeow, et al. "Eliminating inappropriate telemetry monitoring: an evidence based implementation guide". *JAMA Int Med*, vol. 178. No. 7, pp. 971-978, Jul, 2018. doi:10.1001/jamainternmed.2018.2409
5. Joint Commission. "Medical device alarm safety in hospitals". *Sentinel Event Alert*, vol. 8, no. 50, pp. 1-3, Apr, 2013, PMID: 23767076
6. N. Fålnun, et al. On behalf of the TELMON-NOR investigators. "Cardiovascular nurses' adherence to practice standards in in-hospital telemetry monitoring". *Nurs Crit Care*, vol. 25, no. 1, pp. 37-44. Apr, 2020. doi: 10.1111/nicc.12425
7. "ANZCOR guideline 7 – Automated external defibrillation in basic life support", Australia and New Zealand Council on Resuscitation, Apr, 2021, [Online] Available at: <https://resus.org.au/guidelines/>
8. A. Kulshrestha, J. Singh. "Inter-hospital and intra-hospital patient transfer: Recent concepts". *Indian J Anaesth*, vol. 60, no. 7, pp. 451-457, Jul, 2016. doi: 10.4103/0019-5049.186012
9. B. Ibanez, et al. "ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)". *Eur Heart J*, Vol. 39, no. 2, pp.119-77. Jan, 2018. doi: 10.1093/eurheartj/ehx393
10. S. Campleman, et al. Toxicology Investigators Consortium (ToXIC). "Drug-specific risk of severe QT prolongation following acute drug overdose". *Clin Toxicol*, vol. 58, no. 12, pp. 1326-1334, Dec, 2020. doi: 10.1080/15563650.2020.1746330
11. J. Tisdale, et al. "Drug-Induced Arrhythmias: A Scientific Statement from the American Heart Association." *Circulation*, vol. 142, no. 15, pp. e214-e33. Oct, 2020. doi: 10.1161/CIR.0000000000000905
12. M. Gatien, et al. "A Clinical Decision Rule to Identify Which Chest Pain Patients Can Safely Be Removed from Cardiac Monitoring in the Emergency Department". *Ann Emerg Med*, Vol. 50, no. 2, pp. E136-E143, Aug, 2007. doi: 10.1016/j.annemergmed.2007.02.00
13. S. Sayed, et al. "Prospective validation of a clinical decision rule to identify patients presenting to the emergency department with chest pain who can safely be removed from cardiac monitoring". *CMAJ* vol. 189, no. 4, pp. E139-145, Jan, 2017. doi: 10.1503/cmaj.160742

14. J. Oh, S. Asha. "The HEART score to identify emergency department patients suspected of an acute coronary syndrome who can be removed from cardiac monitoring: A retrospective chart review", *Emerg Med Australas*. Jun, 2021, Epub ahead of print. PMID: 34164917. doi: 10.1111/1742-6723.13818
15. M. Hafermann, et al. "Effect of intravenous ondansetron on QT interval prolongation in patients with cardiovascular disease and additional risk factors for torsades: a prospective, observational study". *Drug healthc patient saf*, vol. 3, pp. 53-58, Oct, 2011. doi: 10.2147/DHPS.S25623
16. "Prescribing guidelines for HYPO-electrolyte disturbances in Adults", Queensland Health Medicines Regulation and Quality Fluid and Electrolyte Guidelines Working Party (2020). Queensland Government. [Online]. Available at: https://www.health.qld.gov.au/_data/assets/pdf_file/0027/1006587/electrolyte-prescribe-gline-adult.pdf

Abbreviations

ACS	Acute coronary syndrome
CNC	Clinical nurse consultant
CNE	Clinical nurse educator
CNS	Clinical nurse specialist
DETECT	Detecting deterioration, evaluation, treatment, escalation and communication in teams
ECG	Electrocardiogram
EPS	Electrophysiology studies
IPPM	Implantable permanent pacemaker
NSTEMI	Non-ST elevation myocardial infarction
NSTEACS	Non-ST elevation acute coronary syndrome
NUM	Nurse unit manager
PCI	Percutaneous coronary intervention
QTc	QT segment/interval corrected for heart rate
STEMI	ST elevation myocardial infarction

Glossary

In the context of this document the following definitions apply.

- a. **Continuous cardiac monitoring** - the patient is connected to a three or five lead cardiac monitor, that is a component of a system with central monitoring functionality (including active alarms).
- b. **Medical officer** - the most senior doctor, or their delegate, responsible for the care of the patient.
- c. **Between the Flags Yellow Zone** - when an observation falls in the yellow-coloured zone, a medical review is triggered within 30 minutes.
- d. **Altered calling criteria** - a documented change to 'Between the Flags' parameters by a medical officer because the deranged physiological parameters reflect a known illness.
- e. **Direct visual observation** - the clinician can see and assess the patient at all times. It is not a routine substitute for monitoring, but a short-term option in extenuating circumstances, or to permit important care activities, such as showering.
- f. **Contraindications to ST segment monitoring** include paced rhythm, myopericarditis, chronic 'scooped' ST segments from digitalis use, and bundle branch block (unless a clinician with advanced ECG interpretation skills is present).¹
- g. **Lead selection** should be guided by the priority indications for monitoring:

- If arrhythmia monitoring is the primary indication, V1 is the most useful lead for distinguishing between ventricular tachycardia and aberrancy.¹
 - ST segment monitoring software frequently has capacity to monitor all 12 leads simultaneously. In practice, there remain some monitoring systems that are only able to monitor one precordial lead at a time. In such cases, if ST segment monitoring is the primary indication (for detection of ischaemia), select the monitor lead(s) based on the coronary artery or surface known or suspected to be affected by the ischaemic process, in addition to, or instead of, leads likely to be diagnostic of arrhythmias.¹
 - If QTc monitoring is the primary indication for monitoring, select the lead with the longest T wave and avoid a lead with U waves. If the lead selection or measurement source change (ECG versus automated monitoring), it should be clearly documented along with the QTc measurement.¹
- h. Clinically unstable** - the patient has exhibited one or more of the following during the previous 24 hours:
- recurrence of symptoms of myocardial ischaemia
 - cardiac arrhythmias requiring intervention
 - haemodynamic instability requiring supportive therapy such as intravenous vasoactive medications or temporary cardiac pacing.
- i. Clinically stable** - the patient has not exhibited any of the following during the previous 24 hours:
- recurrence of symptoms of myocardial ischaemia
 - cardiac arrhythmias requiring intervention
 - haemodynamic instability requiring supportive therapy, such as intravenous vasoactive medications or temporary cardiac pacing.
- j. High-risk suspected ACS** - any of the following criteria are present:
- ongoing symptoms despite treatment
 - syncope on presentation or systolic blood pressure less than 90 mmHg
 - acute onset of left ventricular failure
 - known left ventricular ejection fraction < 40%
 - significant arrhythmia
 - acute myocardial infarction, percutaneous coronary intervention or coronary artery bypass graft within six months
 - transient or dynamic ST segment changes (>0.5mm elevation or depression) or new T-wave inversion.^{2,3}
- k. Risk factors for QT interval prolongation and torsades de pointes** include increasing age, female sex, heart failure or liver disease affecting the hepatic metabolism of medications, hypokalaemia and hypomagnesaemia.¹⁵
- l. Intermediate risk NSTEMI/ACS** - if a patient is not high or low-risk, they are intermediate risk. This is a temporary categorisation while awaiting further evidence of clinical, ECG, troponin or summative risk determination.²
- m. Moderate to severe electrolyte imbalance**
- Serum potassium (<3mmol/L or >6mmol/L)¹⁶
 - Serum magnesium (<0.6mmol/L or >2mmol/L)¹⁶
 - Serum calcium (<1.8mmol/L or >3mmol/L)¹⁶
- NB: some patients, by the nature of their chronic condition, may frequently have electrolytes outside of these suggested ranges, for example, those with end-stage kidney failure having routine haemodialysis in hospital. In such cases, continuous cardiac monitoring may be guided by local protocols, and the attending medical officer should be consulted if staff require clarification in individual circumstances.
- n. Low-risk NSTEMI/ACS** - symptom free with non-ischaemic ECG and all of the following:
- age less than 45 years (unless in high-risk populations)
 - symptoms atypical for angina
 - no known coronary artery disease
 - or low risk by validated risk score (e.g. Emergency Department Assessment of Chest Pain Score (EDACS) or History, ECG, Age, Risk factors, and Troponin (HEART) score).²

Additional resources

Health Education and Training Institute (HETI) modules are accessible on the [My Health Learning platform](#) with a NSW Health login:

- [Introduction to cardiac monitoring](#) (course code: 66046650) focuses on the professional obligations of staff caring for patients during monitoring and is useful for junior staff new to cardiology.

Further staged modules are available on the HETI My Health Learning platform:

- Module 1 Electrocardiogram (ECG) fundamentals (course code: 339664570)
- Module 2 Basic understanding of the Electrocardiogram (ECG) and rhythm interpretation (course code: 359181145)
- Module 3 Commonly occurring complex rhythms and 12 lead ECG abnormalities (course code: 387120796)
- Module 4: Lesser known complex rhythms and ECG interpretation

The Australian and New Zealand Committee on Resuscitation has provided guidelines relating to the required skills and knowledge for advanced life support. These guidelines may be accessed at <https://resus.org.au/guidelines/anzcor-guidelines/>

An interactive, electronic ECG resource has been developed by the Clinical Information Access Portal (CIAP) team, and is available by accessing the CIAP website, selecting 'Tools' and clicking on the link for 'Interactive ECG' or following the link <https://ecg.hcn.com.au/?acc=36422>

Information on atrial fibrillation after coronary artery bypass surgery is available at <https://www.uptodate.com/contents/search?search=atrial-fibrillation-and-flutter-after-cardiac-surgery>

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