

Cardiac monitoring of adult cardiac patients in NSW public hospitals

Clinical Practice Guide

ACI Cardiac Network

July 2021

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Introduction

Cardiac monitoring is a routine clinical activity carried out in hospitals throughout NSW. Continuous cardiac monitoring^b 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 guideline 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^b are considered Level of Evidence C (based on standards of care or a consensus of expert opinion).¹ This guideline has been produced in consultation with cardiac nurses and cardiologists in rural and metropolitan areas, consumer representatives, 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 guideline provides further clarification on the role for, limitations of, and institutional resources to support ST segment monitoring, 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; observation of QT interval prolongation for patients at risk of torsades de pointes; the capacity for senior nurses with advanced cardiac skills to act as delegate decision makers about cardiac monitoring and, the expectations for reviewing and documenting cardiac monitoring alarms. It also outlines 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 guideline 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. Adherence with the guideline 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; and guiding decisions about safe and timely discharge.¹

This document may be used by Local Health Districts to inform the development of their own policies incorporating the minimum standards described in this guideline and additional information from other sources.

A thoughtful 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 monitoring are required locally.¹

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

Methodology

A rapid evidence-check on ST-Segment and QTc interval monitoring was completed to inform the clinical guideline. PubMed and Google were used to search peer reviewed and grey literature sources using a combination of Medical Subject Headings and text words for “ST or QT segment” AND “monitoring or ECG” AND “outcomes”. Studies published in English from 2016 to the present were included. 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 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 – Minimum Standard

1. Cardiac monitoring (arrhythmia +/- ST segment monitoring) is a useful diagnostic tool for patients with cardiac arrhythmias or acute ischaemic changes (actual or potential). It has no therapeutic value unless the clinicians supervising the patient are skilled in recognition and management of these abnormalities.
2. Cardiac monitoring in low-risk patients does not improve outcomes. There should be a clear indication for cardiac monitoring to optimise health resource utilisation, and to reduce established risks to patient independence and recovery.²
3. A senior nurse with advanced cardiac skills (Table 1, Group A) may allocate a patient to a monitoring category in the absence of medical direction, however, the final responsibility for risk assessment related to cardiac monitoring rests with the treating medical officer^a who should review the monitoring category within 24 hours.
4. Clinical areas designated for the management of patients requiring continuous cardiac monitoring^b should have central monitoring capability with all cardiac monitors (apart from those used for transfers) connected to the central monitor.
5. In the absence of a local policy, alarm parameters should be set as per ‘Between the Flags Yellow Zone’. Where patient parameters exceed an alarm zone, local contextually relevant protocols developed with multidisciplinary agreement should guide appropriately-skilled nurses to adjust alarm limits for individual patients to reduce non-actionable alarms and alarm fatigue.^{1,3}
6. All nurses are responsible for responding and reviewing cardiac monitoring alarms. If there is uncertainty about the cardiac rhythm triggering an alarm, this should be

escalated to the team leader.

7. Recording and documentation of a patient's rhythm strip (either hard copy, or extracted and entered into the eMR), along with interpretation and any actions taken is expected on admission at least every 8 hours, and following significant change in rhythm or haemodynamic status.¹
8. At the end of the minimum recommended monitoring period, daily re-assessment of the clinical indication for continued monitoring is necessary so that monitoring is ceased when no longer required.¹ This assessment should be performed by the treating medical team or a specific, locally delegated senior nurse with advanced cardiac skills to support complex decision making for Group A patients, or an appropriately skilled delegate (e.g. CNC, CNE, CNS, NUM) for Group B patients.
9. It is preferable that patients who require continuous cardiac monitoring^b 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^b by clinical staff with the appropriate skill set (see Table 1 p.6) during the entire period that cardiac monitoring is unavailable.
10. Clinical areas managing patients listed in this guideline should have at least one nurse on duty at all times who meets competency requirements for the relevant escort skill sets (see Table 1, p.6).
11. If facilities are unable to meet this standard, the patient should be transferred to a facility that is able to provide this level of care.
12. If a patient is being transferred, cardiac monitoring (or if unavailable, direct visual observation^c) must be maintained by a clinician with the appropriate skill set (see Table 1, p.6).
13. Each LHD should determine the required competency assessments for each facility to ensure availability of adequate staff skill mix.
14. Groups A and B in this document classify monitored patients in relation 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 2 (for Group A), and Table 3 (for Group B).

Table 1

Skill sets for staff escorts and required competencies

Group B (Basic) escort skill set	Competency requirements
Basic life support	Holds current, facility endorsed Basic Life Support (BLS) accreditation
Recognition and management of the deteriorating patient	Successful completion of training in the recognition and management of the deteriorating patient e.g., DETECT
Assessment/management of symptoms of myocardial ischaemia	In this context, the ability to administer supplemental oxygen (if SpO ₂ <92%), 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 vasoactive/chronotropic/anti-arrhythmic infusions)	Can demonstrate the ability to adjust flow rates if required and troubleshoot pump function

Group A (Advanced) escort skill set ^{4,5}	Competency requirements (Includes basic skill set)
Minimum skill set	
Administration of ALS drugs	Holds current, facility endorsed Advanced Life Support accreditation that includes administration of intravenous ALS drugs
Manual defibrillation	Holds current, facility endorsed ALS accreditation that includes the use of a manual defibrillator
Patient dependent skill set (elements of advanced escort skill set may be patient dependent and 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 <i>in situ</i>) including the ability to troubleshoot pacemaker function
Transcutaneous cardiac pacing	Holds current, facility endorsed accreditation for initiation and management of transcutaneous cardiac pacing, including troubleshooting pacemaker function
Management of IV medications requiring titration	Can demonstrate the requisite knowledge to manage a patient with an infusion of medication requiring titration e.g. inotropes, nitrates and other drugs

Table 2

Group A: conditions where monitoring is required

- Group A patients require continuous cardiac monitoring^b, OR in extenuating circumstances, continuous direct visual observation until cardiac monitoring is discontinued.
- All Group A patients require an escort with Group A (advanced) escort skills set for transfer.
- Group A patients must be escorted by trained staff as specified, with resuscitation equipment appropriate to the local facility and distance to be travelled, including a manual or automated defibrillator for all internal and inter-facility transfers.
- ST segment monitoring is recommended only where there are clear indications and no contraindications^d supported by comprehensive training/alarm management. It is of no benefit for patients after routine angiography or with non-urgent, uncomplicated PCI who are fully awake, alert and able to recognise/verbalise symptoms of angina.¹ Discontinue ST monitoring if continuous false alarms cannot be resolved to avoid alarm fatigue.¹
- A written medical order is required to discontinue cardiac monitoring.
- At the end of the recommended monitoring period, Group A patients require daily re-assessment of the clinical indications for continued monitoring (arrhythmia +/- ST segment) and documentation of these indications in the health care record.^{1,2}

Clinical indication for monitoring	Recommended monitoring duration
Confirmed acute coronary syndrome <ul style="list-style-type: none"> • Confirmed STEMI/NSTEMI < 24 hours • Confirmed STEMI/NSTEMI > 24 hours but considered clinically unstable^e 	<ul style="list-style-type: none"> • All STEMI and NSTEMI must be monitored for cardiac arrhythmias for a minimum of 24 hours.^{1,6} • It is reasonable to include ST segment monitoring if indicated.¹ • At the end of the recommended monitoring period, patients who are clinically stable^e should have cardiac monitoring discontinued.² This will require a written medical order. • 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 >24 hours.
Pre-operative cardiac surgery <ul style="list-style-type: none"> • 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.² • ST segment monitoring is reasonable immediately postoperatively 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 cause has been identified and treated.¹

Table 3

Group B: conditions where monitoring is required

- Patients require continuous cardiac monitoring^b OR direct visual observation^c until cardiac monitoring is discontinued.
- All Group B patients require Group B (basic) escort skill set for transfer, and for all inter-facility transfers, basic resuscitation equipment including an automated defibrillator should be carried. Group B patients may be transferred internally (intra-hospital) under direct visualisation by a nurse with Group B skill set if clinically stable^f, but should be connected to a monitor for the recommended period on arrival/return to the clinical department.
- Patients should have **cardiac monitoring discontinued by registered nursing staff** at the completion of the recommended monitoring period if they are assessed as clinically stable^f unless there is a written medical order to continue. NB: the decision to discontinue cardiac monitoring should be discussed with the RN in charge or another competent registered nurse (as described in Table 1).
- If cardiac monitoring continues after the end of the recommended monitoring period, the patient should be re-assessed daily by the medical team with the clinical indication for continued monitoring (arrhythmia +/- ST segment) documented in the patient's health care record.
- 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.² In the absence of a specified timeframe or listed clinical criteria, the order will be determined to apply for 24 hours only.

Clinical indication for monitoring	Recommended monitoring duration
Suspected acute coronary syndrome <ul style="list-style-type: none"> • NSTEMACS (intermediate risk) awaiting second troponin level 	Monitor until second troponin is available. If second troponin is negative and there are no acute ECG changes or recurrence of symptoms of suspected myocardial ischaemia, cardiac monitoring may be discontinued. ^{1,6}
Arrhythmias <ul style="list-style-type: none"> • Supraventricular arrhythmias (including AF with uncontrolled ventricular response) with haemodynamic stability requiring commencement of intravenous therapy with pro-arrhythmic potential (e.g., amiodarone, sotalol, flecainide) 	Monitor until reversion of rhythm or control of ventricular rate. ²
Patients requiring inotropes for symptom management at the end stage of their disease	The need and conditions for 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.
Acute moderate to severe^h electrolyte imbalance	Monitor until the acute electrolyte imbalance has been corrected and there are no related arrhythmias present. ¹
Post PCI, post EPS and post catheter ablation	<ul style="list-style-type: none"> • Monitor for a minimum of 4 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

Table 4

Other conditions when cardiac monitoring *MAY* be required

Condition	Monitoring duration
<ul style="list-style-type: none"> Pericardial effusion Suspected cardiac trauma Electrocution 	<ul style="list-style-type: none"> Monitor according to the direction of the treating medical team or local guidelines
<p>Inflammatory/infective cardiac conditions</p> <ul style="list-style-type: none"> For example, endocarditis, myocarditis or pericarditis 	<ul style="list-style-type: none"> Monitor according to the direction of the treating medical team or local guidelines

Table 5

When is cardiac monitoring *NOT* required?

Condition	Management
<ul style="list-style-type: none"> Patients with low risk NSTEMI/ACS^{2,6} Patients with persistent AF without haemodynamic compromise² Patients with persistent AF without haemodynamic compromise who are receiving intravenous digoxin temporarily in place of oral therapy (does not apply to IV loading doses for acute arrhythmia management) Patients with chronic ventricular premature beats, who are clinically stable^f Patients with a stable functioning ICD/PPM who have had a post implant check 	<ul style="list-style-type: none"> There is no evidence to support the need for cardiac monitoring for these conditions

Abbreviations

Abbreviation	Description
ACS	Acute coronary syndrome
ALS	Advanced life support
AF	Atrial fibrillation
AV	Atrio-ventricular
BLS	Basic life support
CNC	Clinical nurse consultant
CNE	Clinical nurse educator
CNS	Clinical nurse specialist
DETECT	Detecting Deterioration, Evaluation, Treatment, Escalation and Communication in Teams
EPS	Electrophysiology study
ICD	Implantable cardioverter defibrillator

Abbreviation	Description
NSTEMI	Non ST elevation myocardial infarction
NSTEACS	Non ST elevation acute coronary syndrome
NUM	Nurse unit manager
PCI	Percutaneous coronary intervention
PPM	Permanent pacemaker
QTc	QT segment/interval corrected for heart rate
STEMI	ST elevation myocardial infarction
SVT	Supraventricular tachycardia
TdP	Torsades de pointes
VF	Ventricular fibrillation
VT	Ventricular tachycardia

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Glossary

In the context of this document the following definitions apply:

- a Medical Officer** means the most senior doctor, or their delegate, responsible for the care of the patient.
- b Continuous cardiac monitoring** means that the patient is connected to a 3 or 5 lead cardiac monitor that is a component of a system with central monitoring functionality (including active alarms).
- c Direct visual observation** means that 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.
- d Contraindications** to ST segment monitoring include paced rhythm, myopericarditis, chronic 'scooped' ST segments from digitalis use, and BBB (unless advanced ECG interpretation skills present).¹
- e Clinically unstable** means that 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 (i.e., intravenous vasoactive medications or temporary cardiac pacing).
- f Clinically stable** means that 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 (i.e., intravenous vasoactive medications or temporary cardiac pacing).
- g Risk factors** for QT interval prolongation and TdP include increasing age, female sex, heart failure or liver disease affecting the hepatic metabolism of medications, hypokalaemia and hypomagnesaemia⁸
- h Moderate to severe electrolyte imbalance** Serum potassium ($\leq 3\text{mmol/L}$ or $\geq 6\text{mmol/L}$)⁹
Serum magnesium ($\leq 0.6\text{mmol/L}$ or $\geq 2\text{mmol/L}$)⁹
Serum calcium ($\leq 1.8\text{mmol/L}$ or $\geq 3\text{mmol/L}$)⁹

Additional resources

The Health Education and Training Institute (HETI) module on *Introduction to Cardiac Monitoring* focuses on the professional obligations of staff caring for patients during monitoring and is useful for junior staff new to working in cardiology. This course can be accessed at <https://www.heti.nsw.gov.au/education-and-training/courses-and-programs/introduction-to-cardiac-monitoring>

Module 1: Electrocardiogram (ECG) fundamentals:

Course Code:339664570

Module 2: Basic understanding of the electrocardiogram (ECG) and rhythm interpretation Course Code: 359181145 (Go to HETI's "My Health Learning site <https://www.heti.nsw.gov.au/education-and-training/my-health-learning>

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/> Interactive, electronic ECG resource have been developed by CIAP which is available by accessing the CIAP website, selecting 'Tools' and clicking on the link for 'Interactive ECG' or following the link <http://ecg.hcn.com.au>

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

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