

Short title: Anaesthesia monitoring

1. Purpose

Clinical observation and assessment by a vigilant anaesthetist is essential for safe patient care during anaesthesia. The purpose of this guideline is to guide practitioners on monitoring standards that should be applied to clinical management in order to optimise patient safety and quality care.

2. Scope

The terms “anaesthetist”, “medical practitioner” and “practitioner” are used interchangeably in this document. Although this document is primarily aimed at anaesthetists, any practitioner responsible for patient monitoring during “anaesthesia” should follow this guideline. The following applies to the management of patients undergoing general anaesthesia, major regional anaesthesia/analgesia or sedation (to be collectively described by the term “anaesthesia”) for diagnostic or therapeutic procedures and should be interpreted in conjunction with other professional documents published by the Australian and New Zealand College of Anaesthetists.

3. Background

Monitoring can be defined as “observing and checking progress and quality over a period of time”. It includes clinical observation as well as measurement of applicable and relevant variables, and recording them over a period of time, which for the purposes of this guideline includes the duration of clinical responsibility. Recording may be either by automated computerised methods or manually.

In principle, monitoring of physiological variables provides information and feedback on the body’s response to therapeutic interventions or changing clinical conditions. This allows fine-tuning of management to achieve optimal outcomes and minimisation of complications.

4. Principles

- 4.1 Monitoring of fundamental physiological variables during anaesthesia is essential. Clinical judgment will determine how long this monitoring should be continued following completion of anaesthesia.
- 4.2 The healthcare facility in which the procedure is being performed is responsible for provision of equipment for anaesthesia and monitoring on the advice of one or more designated specialist anaesthetists, and for effective maintenance of this equipment (see [PS55 Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations](#)).
- 4.3 Some or all of the recommendations in this document may need to be exceeded depending on the results of the patient assessment at the pre-anaesthesia consultation (see [PG07 Guideline on pre-anaesthesia consultation and patient preparation](#)).

- 4.4 Monitoring equipment should always be used in conjunction with careful clinical observation by the anaesthetist as there are circumstances in which equipment may not detect unfavourable clinical developments.
- 4.5 Visual and audible alarms on anaesthesia equipment should be enabled at the commencement of anaesthesia. Alarms should only be disabled under exceptional circumstances (for example, cardiopulmonary bypass surgery where the patient is rendered apnoeic and pulseless) but those alarms should be made operational as soon as practicable.

5. Clinical observation and monitoring by an anaesthetist

- 5.1 Clinical observation and assessment by a vigilant anaesthetist is essential for safe patient care during anaesthesia. This person cannot be the practitioner performing the procedure (see [PG09\(G\) Guideline on procedural sedation](#)). Clinical monitoring should be supplemented with monitoring devices as necessary, to assist the practitioner responsible for the anaesthesia.
- 5.2 A medical practitioner whose sole responsibility is the provision of anaesthesia care for that patient must be constantly present from induction of anaesthesia until safe transfer to recovery room staff or intensive care unit has been accomplished (see [PS02\(A\) Position statement on credentialling and defining the scope of clinical practice in anaesthesia](#) and the relevant ANZCA training and accreditation handbook).
- 5.3 In exceptional circumstances brief absences of the anaesthetist primarily responsible for managing anaesthesia may be unavoidable. In such circumstances observation, including recording of observations of the patient and a plan for responding to significant perturbations in monitored physiological variables, must be temporarily delegated to a suitably trained and skilled practitioner who is judged to be competent for the task.
- 5.4 Permanent handover of responsibility, when required, must be to an anaesthetist who is able to accept continued responsibility for the care of the patient (see [PS53\(A\) Position statement on the handover responsibilities of the anaesthetist](#)).
- 5.5 The anaesthetist responsible for monitoring the patient should ensure that all monitoring equipment that may be required is available. Some procedures necessitate special monitoring (for example, magnetic resonance imaging) or remote monitoring to reduce the hazard to staff (for example, radiological procedures) (see [PS55 Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations](#)).
- 5.6 The monitoring of a patient undergoing any type of anaesthesia should include regular assessment and recording of the following:
 - 5.6.1 Circulation - by detection of the arterial pulse and supplemented by measurement of arterial blood pressure. Where blood pressure monitoring is omitted this decision should be clinically justifiable. The intervals between recordings of this data will depend on clinical circumstances and the stability of the patient but should be no less frequent than every 10 minutes.
 - 5.6.2 Ventilation - should be monitored continually.
 - 5.6.3 Oxygenation - in conjunction with clinical observation of the patient. Adequate lighting should be available to aid with assessment of patient colour.

6. Monitoring equipment

In general, monitoring equipment aids the clinical assessment of a patient and the following equipment should be available for use during anaesthesia. However, depending on the type of anaesthesia, some of these monitors are mandatory (please refer to those specific monitors). When the monitors are in use, the alarms (visual and audible) must be enabled (see item 4.5). The audible component of the alarm system should be able to be easily heard by the practitioner responsible for the anaesthesia. When any of the monitors of physiological function are in use during anaesthesia, regular recordings should be documented in the anaesthesia record either manually or using an automated electronic record keeping system (see also [PG06\(A\) Guideline on the anaesthesia record](#)).

6.1 Oxygen

- 6.1.1 Oxygen analyser – A device incorporating an audible signal to warn of low oxygen concentrations, correctly fitted in the breathing system, should be in continuous operation for every patient when an anaesthesia breathing system is in use.
- 6.1.2 Pulse oximeter – Pulse oximetry provides evidence of the level of oxygen saturation of the haemoglobin of arterial blood at the site of application and identifies arterial pulsation. A pulse oximeter should be in use for every patient undergoing general anaesthesia or sedation. When this particular monitor is in use, the variable pulse tone as well as the low threshold alarm shall be appropriately set and audible to the practitioner responsible for the anaesthesia.

6.2 Ventilation

- 6.2.1 Breathing system disconnection or ventilator failure alarm – When an automatic ventilator is in use, a monitor capable of warning promptly of a breathing system disconnection or ventilator failure should be in continuous operation. This should be automatically activated.
- 6.2.2 Carbon dioxide monitor – A quantitative monitor with a continuous display of the carbon dioxide level and waveform in inhaled and exhaled gases should be in use for every patient undergoing general anaesthesia. Such a monitor should be immediately available for any patient undergoing sedation. A sustained capnogram waveform of appropriate waveform morphology and amplitude is indicative of ventilation¹.

6.3 Cardiovascular

- 6.3.1 Electrocardiograph (ECG) – Equipment to monitor and continually display the electrocardiograph should be available for every anaesthetised patient. The ECG should be used for patients undergoing general and major regional anaesthesia as clinically indicated.
- 6.3.2 Intermittent non-invasive blood pressure monitor – Equipment to provide intermittent non-invasive blood pressure monitoring should be available for every patient undergoing anaesthesia; whenever such monitors are applied blood pressure should be measured and recorded during anaesthesia at intervals as indicated in 5.6.1 above. A variety of cuff sizes should be available.
- 6.3.3 Continuous invasive blood pressure monitor – Equipment to provide continuous invasive blood pressure monitoring should be available. This generally refers to a monitor connected via a transducer to an intra-arterial line.

- 6.4 Monitoring of anaesthetic effect on the brain – When clinically indicated, equipment to monitor the anaesthetic effect on the brain should be available for use on patients, especially those at high risk of awareness, during general anaesthesia.
- 6.5 Inhalational anaesthetic agent monitor – to identify and monitor the inspired and end-tidal concentration of inhalational anaesthetics should be in use for every patient undergoing general anaesthesia from an anaesthesia delivery system where inhalational anaesthetic agents are delivered.
- 6.6 Temperature monitor – to monitor “core” temperature continuously should be available for every patient undergoing general anaesthesia. Temperature monitoring should be used whenever warming devices are being used.
- 6.7 Neuromuscular function monitor – Quantitative neuromuscular function monitoring should be available for every patient in whom neuromuscular blockade has been induced and should be used whenever the anaesthetist is considering extubation following the use of non-depolarising neuromuscular blockade.
- 6.8 Other equipment – When clinically indicated, equipment to monitor other physiological variables (for example the electroencephalogram, central venous pressure, cerebral oximetry, transoesophageal echocardiogram, cardiac output or respiratory mechanics) should be available.

See further below for appendix 1. This document is accompanied by a background paper (PG18BP) which provides more detailed information regarding the rationale and interpretation of the Guideline.

Related ANZCA documents

PS02(A) Position statement on credentialling and defining the scope of clinical practice in anaesthesia

PG03(A) Guideline for the management of major regional analgesia

PG06(A) Guideline on the anaesthesia record

PG07 Guideline on pre-anaesthesia consultation and patient preparation

PG09(G) Guideline on procedural sedation

PS53(A) Position statement on the handover responsibilities of the anaesthetist

PS55 Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations

ANZCA Anaesthesia training program handbook

ANZCA Handbook for accreditation

Rural Generalist Anaesthesia Handbook for training

Reference

1. Chrimes N, Higgs A, Hagberg CA, Baker PA, Cooper RM, Greif R, et al. Preventing unrecognised oesophageal intubation: a consensus guideline from the Project for Universal Management of Airways and international airway societies. *Anaesthesia*. 2022;77(12):1395-415.

Further reading

Canadian Anesthesiologists' Society. Patient monitoring. In: Guidelines to the practice of anaesthesia. Toronto: Canadian Anesthesiologists' Society. Revised edition 2022, updated 2024. Available from: https://www.cas.ca/CASAssets/Documents/Practice-Resources/Guidelines/CAS_Final_Guidelines_2024.pdf Accessed 4 Mar 2024. Note: this updated reference has not yet been reviewed by ANZCA.

Committee on Standards and Practice Parameters, American Society of Anesthesiologists. Standards for basic anaesthetic monitoring. American Society of Anesthesiologists; amended 2010. Available from: <https://www.asahq.org/standards-and-practice-parameters/standards-for-basic-anesthetic-monitoring> Accessed 4 Mar 2024.

Short TG, O'Regan A, Lew J, Oh TE. Critical incident reporting in an anaesthetic department quality assurance programme. *Anaesthesia*. 1992;(47):3-7.

Klein AA, Meek T, Allcock E, Cook TM, Mincher N, Morris C, et al. Recommendations for standards of monitoring during anaesthesia and recovery 2021. Guideline from the Association of Anaesthetists. *Anaesthesia*. 2021 Sep;76(9):1212-1223. Available from: <https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/full/10.1111/anae.15501> doi: 10.1111/anae.15501 Accessed 4 Mar 2024.

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Appendix 1 – Intravenous access and blood pressure monitoring in patients with previous axillary nodal dissection

Purpose

To support anaesthetists in providing contemporary advice regarding the use of intravenous access and required anaesthesia monitoring in patients with a prior history of axillary nodal dissection.

Scope

This appendix applies to the management of adult patients with a prior history of axillary nodal dissection, requiring anaesthesia or sedation.

The information presented may also apply to these patients when requiring healthcare for other purposes.

Background

Upper limb lymphoedema is a significant complication that may arise following the removal of axillary lymph nodes. It refers to a generalised abnormal collection of protein-rich interstitial fluid that is associated with oedema and altered tissue structure.¹ The International Society of Lymphology describes four stages of lymphedema, ranging from sub-clinical (Stage 0) to overt (Stages I-III).² In Stage 0 there may be subjective symptoms with minimal visible tissue changes.

Patients with upper limb lymphoedema may suffer significant discomfort, wear compression bandages and are at risk of poor healing following trauma or infection of the affected limb. In an effort to reduce such complications secondary to lymphoedema, patients have traditionally been advised to avoid unnecessary trauma to the affected limb.³ This has included the avoidance of unnecessary intravenous access, venepuncture and blood pressure monitoring in the affected arm, despite limited supporting evidence.⁴ This advice has inadvertently extended to those with limited nodal resection (for example sentinel lymph node biopsy) and for those in whom an axillary dissection has occurred, but lymphoedema is not present.

Fellows of the college reported restrictions on anaesthesia care (intravenous access and blood pressure monitoring) arising when patients declined the use of the affected arm. Strategies to reinforce “avoiding the affected arm” have become embedded in many healthcare institutions.

PG18 provides ANZCA recommendations regarding monitoring during the administration of anaesthesia. Safe provision of anaesthesia requires secure intravenous access and cardiovascular monitoring including regular blood pressure monitoring.

This appendix summarises current recommendations related to intravenous access and anaesthesia monitoring in patients with previous axillary nodal dissection. It was developed to support fellows in providing optimal anaesthesia care to these patients. The aim is to facilitate approved anaesthesia management and monitoring and provide evidence-based education for patients and other healthcare staff.

Axillary nodal dissection may be necessary for cancer treatment, including melanoma and breast cancer and may be unilateral or bilateral. “Avoiding the affected arm” presents difficulties for patients and anaesthetists and may impact anaesthesia care in the following ways:

- Restricting peripheral intravenous access to one arm, in which the veins rapidly become “overused”, which adversely impacts the patient experience.
- Restricting the size of achievable peripheral intravenous access and intravenous fluid administration rates.
- Necessitating non-invasive blood pressure monitoring to be undertaken on the same side as the intravenous access. This may interfere with drug administration, particularly intravenous maintenance anaesthesia.
- In cases of bilateral axillary dissection, necessitating peripheral intravenous access and non-invasive blood pressure monitoring on the lower limbs, risking increased patient discomfort, infection and inaccurate measurements. Central venous access, with attendant risks, has also been used as alternative to upper limb peripheral cannulation.

Monitoring and intravenous access in patients with previous axillary nodal dissection:

1. Intravenous access:

- Consistent with ACSQHC Clinical Care Standard,⁵ peripheral cannulae should be inserted using aseptic technique and remain in-situ for the shortest required duration.
- There is limited and poor evidence to support the avoidance of peripheral cannulation in the impacted arm, particularly when lymphoedema is not present.³
- If significant lymphoedema is present and no veins visible on the affected arm, the benefits of using the contralateral arm or alternative locations/methods are greater.³
- In the absence of lymphoedema, the risks of central venous access are likely to outweigh the benefits, if avoidance of the affected arm(s) is the only indication for central venous access.

2. Blood pressure monitoring

- There is limited and poor evidence to support the avoidance of non-invasive blood pressure monitoring on the affected arm(s).³
- The risks of invasive arterial monitoring are likely to outweigh the benefits, if the only indication is avoiding non-invasive monitoring of the affected arm(s) or avoiding ipsilateral intravenous access and non-invasive blood pressure measurement.

Recommendations

1. Shared decision-making:

- Anaesthetists should communicate the importance of safety and optimisation of anaesthesia administration in this setting to allow patients to make informed decisions.

2. Institutional considerations.

- To facilitate shared decision-making, as well as staff and patient education, institutions should remove universal recommendations, such as wrist-band or standardised alerts, that relate to patients who have a history of axillary dissection.

3. For patients who have had axillary nodal dissection and do not have lymphoedema of the affected arm, there is no contraindication to:

- Non-invasive blood pressure monitoring using the affected arm.

- Peripheral intravenous cannulation in the affected arm.
- Arterial line insertion and monitoring in the affected arm if clinically indicated.

4. For patients WITH lymphoedema of the affected arm following axillary nodal dissection (Stages 0-III):

- An alternative site should be contemplated where practicable, considering the relative risk associated with more invasive procedures. There is no absolute contraindication to using the affected limb for monitoring and intravenous access.
- Ongoing monitoring of peripheral intravenous cannulae should be done in accordance with the ACSQHC Clinical Care Standard.⁵

References

1. McLaughlin SA, Staley AC, Vicini F, Thiruchelvam P, Hutchison NA, Mendez J, et al. Considerations for Clinicians in the Diagnosis, Prevention, and Treatment of Breast Cancer-Related Lymphedema: Recommendations from a Multidisciplinary Expert ASBrS Panel. *Ann Surg Oncol* 2017;24:2818-26.
2. Executive Committee of the International Society of Lymphology. The diagnosis and treatment of peripheral lymphedema: 2020 Consensus Document of the International Society of Lymphology. *Lymphology*. 2020;53:3–19. Refer to Table II ISL lymphedema staging. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7755442/table/tII-conc-27-336/?report=objectonly> Accessed 4 Mar 2024.
3. Jakes AD, Twelves C. Breast cancer-related lymphoedema and venepuncture: a review and evidence-based recommendations. *Breast Cancer Res Treat* 2015;154:455-61.
4. Dixon JM, Elder K, McLaughlin S. Evidence-based advice for patients following axillary surgery. *Breast Cancer Management* 2018;7:BMT15.
5. Australian Commission on Safety and Quality in Health Care (ACSQHC). Management of Peripheral Intravenous Catheters Clinical Care Standard. 2021. Available from: <https://www.safetyandquality.gov.au/standards/clinical-care-standards/management-peripheral-intravenous-catheters-clinical-care-standard>. Accessed 4 Mar 2024.

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