Short title: Anaesthesia monitoring BP

1. Purpose

Monitoring is an integral part of observation and recording contributing to the management of anaesthesia and outcomes. In the perioperative period clinical changes can occur rapidly and at times unexpectedly, and consequently it is fundamental that such changes are detected early to facilitate management. In general, the term 'monitoring' is used to imply the use of electronic monitoring equipment; however other equipment such as a sphygmomanometer may meet the standard in some circumstances.

With advances in technology and monitoring equipment it is timely to review standards of monitoring.

PG18 was last reviewed in 2008 and was republished in 2013. In line with *CP24 Policy for development and review of professional documents*, the title of PG18 has been changed from "Recommendations" to "Guideline". "Guidelines" offer advice on clinical and non-clinical aspects of the practice of anaesthesia and perioperative medicine, reflecting expert consensus and supported by other evidence when available.

2. Scope

PG18 is intended to apply wherever anaesthesia is administered and includes general anaesthesia, sedation, and major regional analgesia. While general anaesthesia and major regional analgesia is performed by anaesthetists, conscious sedation is administered by a wide group of practitioners. The guideline is primarily intended for anaesthetists; however, any practitioner responsible for monitoring sedated patients should follow them.

The purpose of this guideline is to inform practitioners of the standards and to guide them in the use of monitoring aimed at achieving optimal clinical management and optimising patient safety and quality care.

3. Background

There have been significant changes over time in the ability to observe and record, either manually or by computerised methods, physiological parameters, and this ability has led to advances in anaesthesia techniques. With the advances in anaesthesia and the development of more potent and titratable agents comes the benefit of producing very rapid onset of effects, but also the disadvantage of rapid onset of other (unwanted) effects. Increasing patient comorbidities and sometimes complex procedural requirements adds to the complexity of care.

Historically, rapid changes in physiology necessitated the anaesthetist to be in close physical contact to the patient, with constant observation, palpation of peripheral pulses, continual auscultation with precordial stethoscopes, and visualisation of pupils, among other things. Increasing sophistication of equipment has allowed the anaesthetist to be removed from direct physical contact and has provided the opportunity for improved quantification of parameters, as well as enabling alarm parameters to be set, and recording of data. This in turn contributes to improved quality care and outcomes.

Vigilance and situational awareness cannot be replaced by monitoring equipment and the purpose of the equipment is to confirm changes in clinical status, but also to signal changes earlier. Consequently, monitoring is essential to management of anaesthesia with specific regard to optimising outcomes.

The accompanying guideline recommends that circulation, ventilation and oxygenation are monitored as a minimum and that other monitors should be added as required.

4. Issues

4.1 Pulse Oximetry

While monitoring of oxygen and use of pulse oximetry is regarded as mandatory for all cases the monitoring of other variables is strongly encouraged. Where, for any reason, other monitors are not used, they should be readily available should they become required.

4.2 Electrocardiography

It is recognised that ideally every patient should be monitored using an ECG and it is strongly encouraged; however, it is also acknowledged that there are situations where ECG monitoring may not be feasible. The omission of ECG monitoring in these circumstances should be clinically justifiable.

4.3 Capnography

Discussions as to whether capnography should be mandated for all cases indicated that there remains strong support for all cases in which general anaesthesia is administered. Capnography refers to the display of a continuous waveform on the monitor. Capnography is critical in the detection of oesophageal intubation, where presence of sustained exhaled carbon-dioxide waveform is a key component in excluding oesophageal intubation[1]. For sedation techniques that do not require airway instrumentation capnography is optional and should be determined by the patient's clinical requirement and depth of sedation, and not the availability (or lack thereof) of suitable equipment. The transition between general anaesthesia and sedation and their definitions can be found in *PG09(G) Guideline on procedural sedation*.

4.4 Blood pressure

Blood pressure monitoring is considered essential for the vast majority of cases. It is recognised however that in some situations this may be inappropriate for example prior to induction of an extremely agitated patient), or impractical (emergency management of a life-threatening airway condition, extremely brief paediatric procedure). In all such cases blood pressure monitoring should be initiated if and when circumstances permit.

4.5 Neuromuscular blockade monitoring

This is an emerging area of standardisation due to the awareness of the risk of residual curarisation. Guidelines such as the AAGBI (2015) provide excellent background and have moved towards mandating assessment of NMB; however the AAGBI Appendix does not consider suxamethonium and emergency cases if a NMB monitor is not available. A comprehensive review of non-depolarising neuromuscular blockade and reversal in 2017 concludes that "Objective measurement (a train-of-four ratio greater than 0.90) is the only method to determine appropriate timing of tracheal extubation and ensure normal muscle function and patient safety"[2]. Therefore, quantitative monitoring is recommended to assess depth of blockade prior to reversal and assessment of adequacy of reversal. Quantitative assessment is essential since tactile assessment is subjective and cannot detect fade at a TOF ratio of greater than 0.4. Only quantitative monitors can assess adequacy of reversal. Best available evidence suggests that a train-of four ratio of >0.9 should be achieved prior to extubation following the use of non-depolarising neuromuscular blockade.

Feedback received during the pilot phase revealed that interpretations of the available evidence varied with strong proponents advocating for mandatory use of quantitative neuromuscular function monitors while others were more moderate. Both benefits and cost implications were considered. The recommendations in the accompanying guideline acknowledge this debate and fall short of mandating their use. However, quantitative monitoring of neuromuscular functions is recommended with a view to improving the management of neuromuscular blockade.

4.6 Other monitors

The emergence of new monitoring modalities requires that their role and validity be carefully assessed prior to firm recommendations being made. Cerebral oximetry (using near infrared spectroscopy) is an example of such where although it is receiving widespread attention in a number of clinical applications, it is not yet clear that it will reliably alert to cerebral hypoperfusion in certain circumstances (for example beach chair or sitting positions). As further data emerges the role of these monitors will be clarified.

Temperature monitoring has historically been for the purpose of managing hypothermia. However, with the emergence of forced air warming and contact warming devices the potential for hyperthermia and its consequences has been recognised. As a result, whenever active warming devices are being used it is recommended that temperature be monitored to avoid hyperthermia. Specification of use for extended cases was avoided due to the many other factors that may be relevant other than purely time alone. Each case needs to be assessed on its merits and risks.

4.7 Presence of the anaesthetist

An anaesthetist must be constantly present while providing anaesthesia during the procedure. It is recognised however, that on occasions, exceptional circumstances may arise requiring the anaesthetist to leave theatre or procedure room for brief periods. Such absences should occur only if they are unavoidable, in which case a handover to another anaesthetist in accordance with *PS53(A) Position statement on the handover responsibilities of the anaesthetist* is required. If another anaesthetist is not available and the situation is within the scope of another suitably skilled practitioner, then delegation of observation, including recording of observations must be to a practitioner who is judged to be competent for the task and capable of responding to any significant perturbation either directly or by summonsing assistance. The term ‘practitioner’ is defined by the regulatory authorities in Australia and New Zealand and in the context of this document the term refers to an individual who is practising within their scope of practice as determined by the healthcare institution in which the case is being undertaken.

5. Summary

Monitoring is an integral part of observation and recording contributing to the management of anaesthesia and outcomes. PG18 was revised based on the above advice from the document development group. The goal of this revised document is to support uniform standards for the use of monitoring in conjunction with clinical observation.

Related ANZCA documents

CP24 Policy for development and review of professional 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 handbook for training

ANZCA handbook for accreditation

References

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
2. Brull SJ, Kopman AF. Current Status of Neuromuscular Reversal and Monitoring: Challenges and Opportunities. Anesthesiology. 2017;126(1):173-190.

Further reading

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 Accessed 4 Mar 2024.

Canadian Anesthesiologists' Society. Patient monitoring. In: Guidelines to the practice of anaesthesia. Toronto: Canadian Anesthesiologists' Society. 2022, revised edition 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, last affirmed 2020. 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.

Document development group 2015

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ANZCA regional and national committees

Faculty of Pain Medicine Board, national and regional committees

ANZCA Safety and Quality Committee

ANZCA Trainee Committee

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ANZCA professional documents are reviewed from time to time, and it is the responsibility of each practitioner to ensure that he or she has obtained the current version which is available from the college website (www.anzca.edu.au). The professional documents have been prepared having regard to the information available at the time of their preparation, and practitioners should therefore take into account any information that may have been published or has become available subsequently.

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