31 Monitoring and transfer

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Key findings

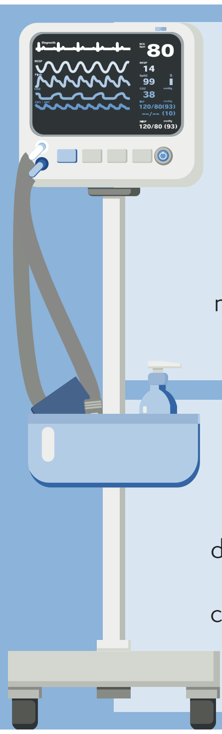
- Monitoring during general anaesthesia with non-invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2), ECG and capnography has high compliance.
- Despite the high use of essential monitoring, it is not continuous in all cases:
  - one-third of patients are not continuously monitored between the anaesthetic room and theatre, and
  - almost half (43%) of patients are not continuously monitored from theatre to the recovery area or critical care.
- Capnography is only used in 50% of cases where minimal sedation is the intended conscious level.
- Concerningly, capnography is only used in 27% of transfers from theatre to recovery or critical care where an airway device is in place.
- Where neuromuscular blockade is monitored, the recommended standard of quantitative assessment is used in only 24% of cases.
- The use of processed EEG (pEEG) has risen in recent years. This increase is driven mainly by a rise in the use of total intravenous anaesthesia (TIVA); however, pEEG use during volatile anaesthesia has also increased.
- We found examples of patients who had experienced a cardiac arrest where deterioration may have been detected earlier if continuous monitoring had been used during patient transfer.
- Overall, monitoring during anaesthesia and transfer falls below the Association of Anaesthetists' minimum standards. In some cases, this was associated with the occurrence of cardiac arrest.

Monitoring facts and figures from NAP7

Compliance with basic monitoring standards is high during general anaesthesia (close to 100%)

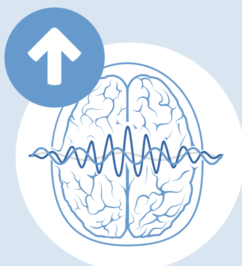
There is a gap in monitoring between the anaesthetic room and theatre and from theatre to recovery that could be prevented.

One-third of patients are not monitored between the anaesthetic room and theatre, and close to 50% are not monitored between theatre and recovery.



Universal use of capnography during sedation or during transfer with an airway in place does not happen. There should be resources available in every setting to make this possible.

The use of pEEG during general anaesthesia has increased notably, mostly driven by increased adoption of TIVA. Its use should be considered in patients having volatile anaesthesia who are high risk.



What we already know

Central to our work as anaesthetists is the safety of our patients, and a vital component of this is uninterrupted monitoring during all phases of anaesthesia and recovery. An early attempt to standardise monitoring in anaesthetic practice was undertaken at Harvard Medical School in 1986, which set minimum standards across its nine teaching hospitals in Boston (Eichhorn 1986). The motives were to improve patient safety and combat increasing litigation costs (Pandya 2021). Today, the minimum monitoring standards in the UK are agreed upon by consensus in the Association of Anaesthetists guidelines and are updated regularly (Checketts 2016; Klein 2021).

For the most part, monitoring our patients is a process that we do automatically. However, the impact can be high when best monitoring practices are not adequately adhered to, or when devices are not checked. In their study of litigation related to anaesthesia, Oglesby and colleagues found that although 'monitoring' as a classification of cause for a claim represented only 22 (2%) claims in 10 years, their impact was high: of the 22 cases, 17 patients were severely harmed or died, and the mean cost of these claims was £130,000, second only to cardiac arrest (Oglesby 2022).

Although the Activity Survey (Chapter 11 Activity Survey; Kane 2022) was not designed to be a national audit of compliance with the most recent guidelines, several of the questions were mapped directly to the document. We were therefore able to quantify monitoring practices on a national level (Klein 2021).

What we found

Standard monitoring during anaesthesia and sedation

Within the Activity Survey, of the 16,739 general anaesthesia cases, 16,734 (99.97%) reported monitoring oxygen saturations with pulse oximetry (SpO_2), 16,653 (99.5%) monitored NIBP, 16,667 (99.6%) monitored the ECG, and 16,713 (99.8%) monitored exhaled carbon dioxide by capnography (Figure 31.1). While the use of pulse oximetry remained high across conscious levels, the rates of compliance with recommended core monitoring were lower in sedated and awake patients than in patients in whom general anaesthesia was intended (Figure 31.1; Appendix 31.1). Notably, capnography was only used in 88%, 81% and 55% of patients undergoing deep, moderate and minimal sedation, respectively.

We did not capture the proportion of cases in which a neuromuscular blocking drug was used and its effect monitored. However, where neuromuscular blockade monitoring was used (4,698 cases, 28% of general anaesthetics), 3,595 (77%) cases reported using a visual or tactile train of four count. The recommended method of quantitative neuromuscular monitoring (eg accelerometer or electromyography) was used only in 1,150 (24%) cases where neuromuscular blockade monitoring was reported.

Processed EEG monitoring was used in 3,223 (19.3%) of 16,739 general anaesthesia cases (Table 31.1). This use was unequal between volatile anaesthetic cases (4%) compared with TIVA (63%). For volatile anaesthesia, rates of pEEG use increased with age, ASA and clinical frailty score but were still low compared with TIVA.

Monitoring during transfer

Of 12,842 patients where a separate anaesthetic room was used, 8,600 (67%) were monitored during transfer into theatre, and this was similar when just considering patients having a general anaesthetic (7,158, 67%; Table 31.2).

Of all 23,373 patients transferred to either recovery or critical care, SpO_2, NIBP and ECG monitoring were used in 11,790 (50%) cases (Table 31.2). For patients having a general anaesthetic, this was 9,588 of 16,739 (57%).

Figure 31.1 Proportion of patients being monitored with pulse oximetry, non-invasive blood pressure, electrocardiography and capnography (end-tidal CO_2) by the intended conscious level of the procedure. General anaesthesia ■, Deep sedation ■, Moderate sedation ■, Minimal sedation (anxiolysis) ■, Awake and unsedated ■.

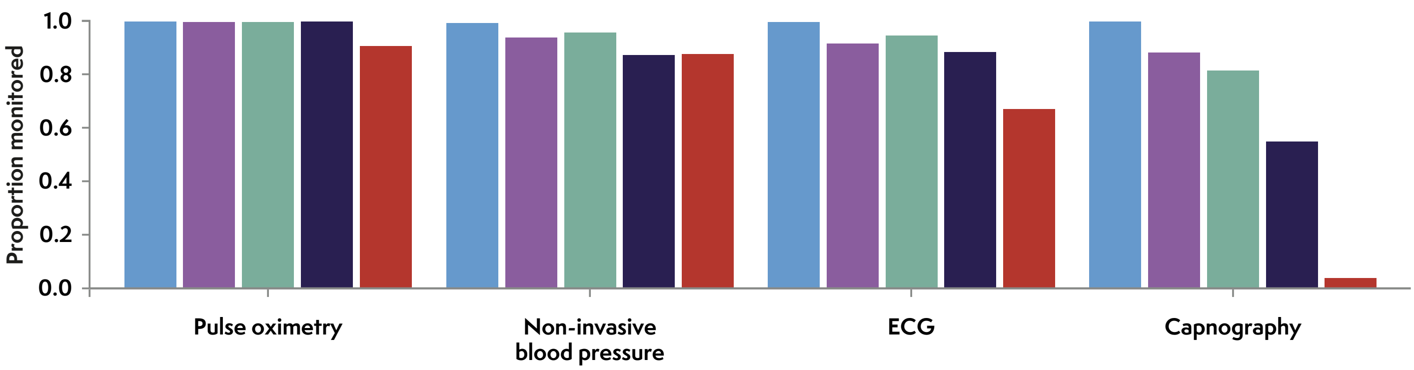


Table 31.1 Processed electroencephalogram (pEEG) monitoring during general anaesthesia. Values represent the proportion of patients within each category where pEEG monitoring was used. Blue bars represent relative proportion compared to other groups. CFS, Clinical Frailty Scale.

		GA type		
		Volatile	TIVA	All
Age	<28 d	0.03	0.00	0.03
	28 d to <1	0.01	0.39	0.04
	1 to 5	0.00	0.17	0.02
	6 to 15	0.01	0.40	0.07
	16 to 18	0.00	0.64	0.17
	19 to 25	0.01	0.63	0.15
	26 to 35	0.03	0.68	0.17
	36 to 45	0.03	0.69	0.20
	46 to 55	0.05	0.67	0.24
	56 to 65	0.05	0.64	0.23
	66 to 75	0.08	0.67	0.26
	76 to 85	0.07	0.70	0.26
	Over 85	0.08	0.76	0.23
	Total	0.04	0.63	0.19
ASA	1	0.01	0.57	0.12
	2	0.03	0.64	0.19
	3	0.08	0.69	0.26
	4	0.19	0.55	0.29
	5	0.09	0.29	0.19
	Total	0.04	0.63	0.19
CFS	1 to 3	0.05	0.66	0.24
	4 to 6	0.09	0.71	0.28
	7 to 9	0.10	0.58	0.22
	Unknown	0.15	0.30	0.18
	Total	0.07	0.67	0.25

Where it was reported that an airway device was in place at the end of the procedure, 2,266 (27%) of 8,732 cases reported that capnography monitoring (end-tidal carbon dioxide, $ETCO_2$) was used for the transfer to recovery.

Additional monitoring

Invasive arterial monitoring was reported in 2,167 (9%) Activity Survey cases. Of these cases, in 3.5%, the arterial line was inserted before induction of anaesthesia. Cardiac surgery had the highest proportion of patients with invasive arterial monitoring (85% of cases) and cases where this was established before induction (68%; Figure 31.2). The proportions of patients who had invasive arterial monitoring varied by age and ASA score (Table 31.3).

The use of near-infrared spectroscopy (NIRS) or cerebral oximetry was rare, with only 99 uses reported in the database (97 general anaesthesia cases). Most uses were during cardiac surgery (*n* = 57), representing 26.9% of cases in this group (Table 31.4).

Cardiac output monitoring was used during 238 cases in the survey; 236 during general anaesthesia (1.4% of all general anaesthetics). Cardiac output monitoring was used most frequently during hepatobiliary surgery (9.2% of cases), followed by cardiac surgery (7.5%) and transplant surgery (5.3%, Table 31.4).

Echocardiography use during anaesthetic care was highest during cardiac surgery (132 of 212, 62% of cases) and cardiology procedures (55 of 268 cases, 21%). Cardiac surgery and cardiology procedures accounted for 88% (187 of 212) of cases using echocardiography (Table 31.4).

Table 31.2 Reported rates of monitoring (non-invasive blood pressure, peripheral oxygen saturation and ECG) during transfers from anaesthetic rooms to theatre and from theatre to recovery or critical care. Data are presented as 'all cases' from the Activity Survey and those where general anaesthesia was the intended conscious level. For transfer from theatre to recovery or critical care, respondents reported if end-tidal CO_2 ($ETCO_2$) was used when an airway device was in place.

Monitoring	Anaesthetic room to theatre, n (%)		Theatre to recovery or critical care, *n* (%)		
	All cases	General anaesthetic	All cases	General anaesthetic	$ETCO_2$ with airway device
Monitored	8600 (67)	7158 (67)	11790 (51)	9588 (58)	2266 (26)
Not monitored	4242 (33)	3451 (33)	11299 (49)	6935 (42)	6466 (74)
Total	12842 (100)	10609 (100)	23089 (100)	16523 (100)	8732 (100)

Figure 31.2 Proportion of patients within each specialty who had invasive arterial monitoring. Arterial monitoring before induction of anaesthesia ■, arterial monitoring after induction of anaesthesia ■. Specialties where arterial monitoring proportion greater than 0.1 are included. GI, gastrointestinal.

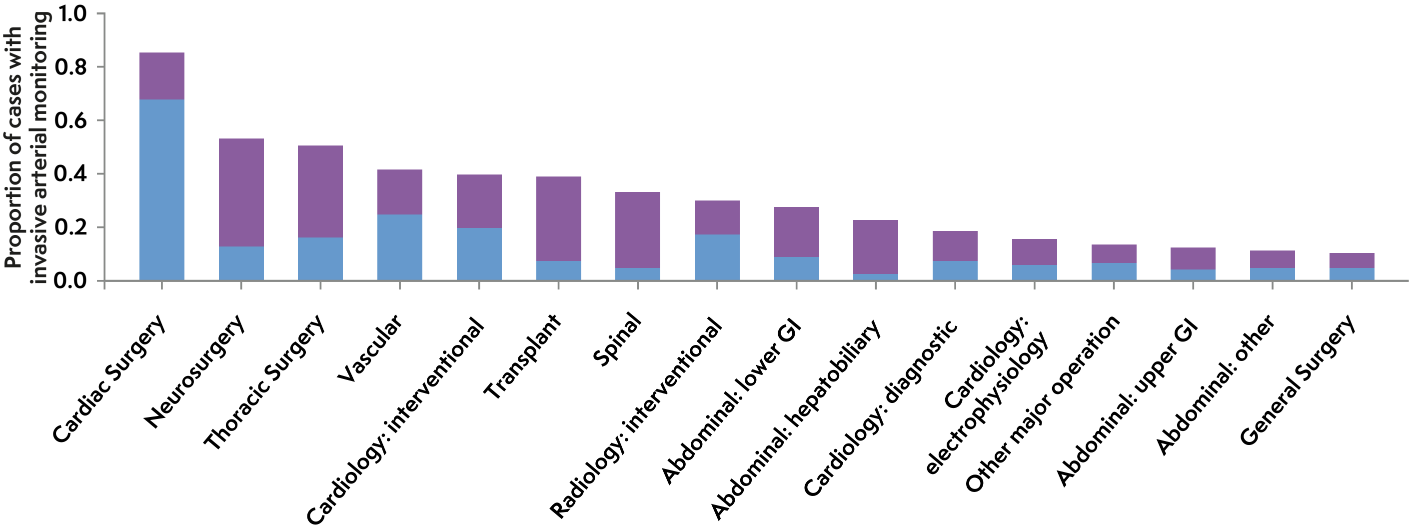


Table 31.3 Proportion of patients in each age and ASA group who had invasive arterial monitoring. Bars represent the relative proportion between different cells.

	ASA				
Age (years)	1	2	3	4	All patients
<28 d	0.00	0.00	0.30	0.44	0.25
28 d to <1	0.00	0.02	0.26	0.27	0.11
1 to 5	0.01	0.03	0.09	0.43	0.03
6 to 15	0.01	0.03	0.14	0.31	0.03
16 to 18	0.04	0.07	0.07	0.43	0.06
19 to 25	0.03	0.04	0.19	0.73	0.05
26 to 35	0.02	0.04	0.22	0.71	0.05
36 to 45	0.03	0.06	0.20	0.85	0.08
46 to 55	0.03	0.08	0.20	0.75	0.11
56 to 65	0.05	0.10	0.30	0.65	0.17
66 to 75	0.06	0.12	0.32	0.72	0.23
76 to 85	0.08	0.10	0.27	0.58	0.23
Over 85	0.00	0.13	0.17	0.39	0.21
All patients	0.02	0.04	0.25	0.61	0.12

Table 31.4 Proportion of cases within each specialty using additional monitoring techniques. ACT, activated clotting time; BIS, bispectral index; EEG, electroencephalogram; ENT, ear, nose and throat; GI, gastrointestinal; NIRS, near-infrared spectroscopy; TEG, thromboelastography; TOE, transoesophageal echocardiogram; TTE, transthoracic echocardiogram.

	Neuro-muscular blockade monitoring	Continuous temperature monitoring	Processed EEG (eg BIS)	Invasive arterial monitoring	Central venous pressure	PoC coagulation (eg TEG, ACT)	Cardiac output monitor	Echocardio-graphy (TTE or TOE)	NIRS / Cerebral saturation monitor	Total cases in specialty
Abdominal: hepatobiliary	0.57	0.40	0.30	0.23	0.15	0.04	0.09	0.00	0.00	1.00
Abdominal: lower GI	0.49	0.42	0.24	0.28	0.06	0.00	0.05	0.00	0.00	1.00
Abdominal: other	0.35	0.29	0.16	0.12	0.05	0.02	0.01	0.00	0.01	1.00
Abdominal: upper GI	0.49	0.29	0.26	0.12	0.06	0.00	0.01	0.00	0.00	1.00
Burns	0.05	0.41	0.15	0.08	0.03	0.00	0.00	0.00	0.00	1.00
Cardiac surgery	0.08	0.85	0.38	0.85	0.84	0.75	0.08	0.62	0.27	1.00
Cardiology: diagnostic	0.11	0.19	0.00	0.19	0.07	0.11	0.00	0.30	0.04	1.00
Cardiology: electrophysiology	0.09	0.21	0.15	0.16	0.01	0.07	0.01	0.13	0.01	1.00
Cardiology: interventional	0.02	0.32	0.12	0.41	0.08	0.22	0.00	0.27	0.00	1.00
Dental	0.08	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	1.00
ENT	0.29	0.13	0.24	0.04	0.01	0.00	0.00	0.00	0.00	1.00
Gastroenterology	0.15	0.06	0.07	0.07	0.02	0.01	0.00	0.00	0.00	1.00
General Surgery	0.33	0.23	0.17	0.10	0.04	0.00	0.02	0.00	0.00	1.00
Gynaecology	0.27	0.13	0.15	0.03	0.01	0.00	0.01	0.00	0.00	1.00
Maxillo-facial	0.30	0.18	0.15	0.05	0.01	0.00	0.01	0.00	0.00	1.00
Neurosurgery	0.32	0.71	0.38	0.53	0.07	0.04	0.02	0.00	0.01	1.00
None	0.05	0.10	0.00	0.15	0.00	0.00	0.00	0.00	0.00	1.00
Obstetrics: Caesarean section	0.03	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	1.00
Obstetrics: labour analgesia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Obstetrics: other	0.04	0.01	0.01	0.02	0.00	0.04	0.00	0.00	0.00	1.00
Ophthalmology	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Orthopaedics - cold/ elective	0.08	0.14	0.09	0.03	0.00	0.00	0.00	0.00	0.00	1.00
Orthopaedics - trauma	0.19	0.17	0.11	0.06	0.00	0.01	0.00	0.00	0.00	1.00
Other	0.09	0.09	0.10	0.04	0.01	0.00	0.00	0.01	0.00	1.00
Other major operation	0.34	0.24	0.23	0.14	0.05	0.03	0.00	0.00	0.00	1.00
Other minor operation	0.04	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Pain	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Plastics	0.13	0.25	0.20	0.05	0.01	0.00	0.01	0.00	0.01	1.00
Psychiatry	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Radiology: diagnostic	0.03	0.02	0.01	0.03	0.00	0.00	0.00	0.00	0.00	1.00
Radiology: interventional	0.18	0.31	0.14	0.31	0.04	0.07	0.00	0.00	0.00	1.00
Spinal	0.22	0.47	0.42	0.33	0.05	0.02	0.02	0.00	0.00	1.00
Thoracic Surgery	0.43	0.47	0.53	0.51	0.08	0.01	0.01	0.00	0.01	1.00
Transplant	0.46	0.67	0.27	0.39	0.39	0.16	0.05	0.03	0.01	1.00
Urology	0.18	0.17	0.12	0.06	0.01	0.00	0.01	0.00	0.00	1.00
Vascular	0.26	0.38	0.23	0.42	0.07	0.10	0.02	0.02	0.01	1.00
All cases	0.19	0.18	0.14	0.09	0.03	0.02	0.01	0.01	0.00	1.00

Perioperative cardiac arrest case reports and monitoring

Of the 881 reports of perioperative cardiac arrests, 186 (21%) had either arrested on transfer to theatre or recovery or had reference to 'monitoring', 'transfer', 'a-line', 'art line', or 'arterial line' in the keywords or free text of the panel review. While this represents a heterogenous group of cases, it suggests that issues regarding monitoring, transfer and their interaction feature strongly in the case mix.

Of those 881 patients, 10 (1.1%) arrested during the transfer from the anaesthetic room to theatre and 15 (1.7%) arrested from the theatre to recovery. These are identified as areas with a significant monitoring gap, as shown in the Activity Survey. In 3 of these 25 cases, monitoring was one of the key lessons identified as a contributory factor for cardiac arrest during the transfer.

One of the most commonly reported monitoring deficits was the failure to consider the use of an arterial line. In 31 (17%) of the 186 cases above, an arterial line was mentioned as a keyword during the case review process.

The panel assessment of care during the case review for those 186 patients was judged lower than for the remaining perioperative cardiac arrest cases, especially in the evaluation of care in the preoperative period.

The induction of a high-risk patient in the anaesthetic room was considered a risk because of the potential for a monitoring gap when a patient was moved to and positioned in the operating theatre. The role of anaesthetic rooms is discussed in detail in Chapter 32 Anaesthetic rooms.

During the case review process, there were many occasions where no monitoring data were recorded on the case report form or periods where monitoring data were missing. Notably, of the 842 'general' cases (ie not 'special inclusion' cases), 280 (33%) included no prearrest observations. It is not clear if these data were not measured, recorded or not reported to the NAP7 panel.

Discussion

Monitoring during anaesthesia is essential to provide early warning of abnormal physiology and drive interventions to reduce the likelihood of severe patient harm (Klein 2021). We have found high compliance with the recommended minimum monitoring standard of ECG, SpO_2, NIBP and capnography during general anaesthesia. However, we also found evidence of gaps in continuous monitoring during the patient journey, at times known to be relatively high risk for complications. The data provide evidence of a significant 'monitoring gap'.

The high compliance rates with monitoring standards during general anaesthesia are pleasing, particularly the universal use of capnography. Current UK and Ireland guidelines state that capnography should be used where 'there is loss or likelihood of loss of normal response to verbal contact', and also go on to say that 'there is a very fine line between sedation and anaesthesia, and the former can easily lead to the latter' (Klein 2021). At best, 12% of patients having deep sedation were not monitored to the recommended standard for capnography. Accepting that patients undergoing moderate or minimal sedation could obstruct their airway or become apnoeic, the capnography gap is higher than 12% of patients receiving sedation, and arguably up to 45%; capnography was only used in 88%, 81% and 55% of patients undergoing deep, moderate and minimal sedation, respectively.

Although usually short, the transfer of a patient from an anaesthetic room to the operating theatre was found to be frequently unmonitored. In NAP5, which examined accidental awareness during general anaesthesia, it was noted that numerous cases of accidental awareness occurred during this period, where intravenous induction agents may have reduced effect and volatile anaesthetic levels may not have climbed sufficiently (Pandit 2014). Similarly, this is a period of risk of hypotension, hypoxaemia or arrhythmia; 110 (12.5%) of the 881 NAP7 reports of cardiac arrest occurred in the period between induction and the start of surgery. Failure to monitor will lead to delayed recognition and intervention, risking progression to more severe consequences. In NAP7, only 67% of patients who started their care in an anaesthetic room were monitored on transfer to the operating theatre. The panel found several cases where this disconnection was associated with a cardiac arrest. The panel noted comments from reporters that, with the transfer of the patient and repositioning, there may have been several minutes before the reconnection of monitoring. The panel judged that monitoring should be continuous during these points of transfer (Chapter 32 Anaesthetic rooms).

> An older patient was extubated after an emergency abdominal operation. The patient appeared alert and was breathing well in theatre with good measured tidal volumes. During transfer to recovery, there was no monitoring attached to the patient and the patient had a respiratory arrest that led to cardiac arrest. The local reporting team and the review panel judged that lack of monitoring contributed to a delay in recognition of the event.

> A patient was taken from critical care for major surgery. At the end of the case, the patient was extubated and taken to the recovery area without any monitoring connected. On arrival in recovery, the patient's airway was obstructed and they were noted to be cyanotic with no palpable pulse. Resuscitation was started and adrenaline was administered. When the arterial line was reconnected the systolic blood pressure was over 300 mmHg. The patient was reintubated before returning to critical care.

The 2015 minimum monitoring standards guideline stated that quantitative neuromuscular monitoring is superior to non-quantitative methods (Checketts 2015). However, only in the updated 2021 guidelines is it recommended that these devices be used where neuromuscular blocking agents are used (Klein 2021). There is good evidence that qualitative methods are unable to distinguish adequate recovery of function (train of four ratio > 90%) from significantly greater blockade (Debaene 2003). Only 24% used quantitative methods in this survey, with the remaining using inferior visual or tactile train of four counts or similar.

Processed EEG monitoring can reduce the risk of accidental awareness during general anaesthesia (Pandit 2014), and an increasing evidence base shows that it can reduce the rates of postoperative cognitive dysfunction (Evered 2021). Where TIVA and neuromuscular blocking drugs are used together, pEEG is recommended as part of minimum standards (Klein 2021). It is likely that there is increasingly good compliance with this standard.

Use of pEEG is recommended in high-risk patients having inhalational anaesthesia (Klein 2021). Rates of pEEG use increased with age, ASA and clinical frailty scores, but not to high levels. In the BALANCED delirium study, targeting a bispectral index of 50 compared with 35 in higher-risk patients (60 years and over, ASA 3–4, having major surgery lasting two or more hours) almost halved the incidence of postoperative delirium (Evered 2021). Applying similar criteria to the Activity Survey (66 years and over, ASA 3–4, major/major complex surgery, ≥ 2 hours surgical time and undergoing general anaesthesia) found 765 patients (3.1% all patients in the survey), of whom 445 (58%) did not have pEEG monitoring. Extrapolating this to annual activity would indicate around 85,000 patients who might benefit from such monitoring. Applying the number needed to treat of 10 from the BALANCED delirium study to this subset of the Activity Survey population, around 4800–5000 instances of delirium might potentially be prevented if targeted depth of anaesthesia using pEEG were used for all such patients.

Invasive arterial monitoring was used in 9% of cases in the Activity Survey, with the highest rates of use in cardiac surgery. Cardiac surgery also had the highest rates of insertion of arterial lines before induction of anaesthesia. There is evidence to suggest that inserting arterial lines before induction may reduce periods and severity of post-induction hypotension; however, whether this leads to improved outcomes is unclear (Kouz 2022). The utility of an invasive arterial line was often discussed at length during the case review process, where the panel considered that it may have benefited. There were several cases where patients known to be high-risk developed severe hypotension leading to cardiac arrest, which may have been noted and acted on sooner with invasive monitoring in place. As stated in other parts of this report, there was a panel opinion that increased adoption of invasive arterial monitoring, and at the very least more frequent non-invasive blood pressure monitoring, would probably have prevented some cardiac arrests, but there was no consensus (Chapter 28 Older frailer patients).

An older patient went to theatre for an urgent operation. The patient was scored ASA 4, had atrial fibrillation with severe left ventricle impairment. Following regional and neuraxial blockade, the patient became hypotensive and this progressed to cardiac arrest. Resuscitation was attempted, but spontaneous circulation was not returned. The review panel noted that there was no invasive arterial monitoring.

A frail patient presented for major surgery. The anaesthetist established invasive arterial monitoring before administering neuraxial and general anaesthesia. Following induction of general anaesthesia, the patient had a systolic blood pressure less than 50 mmHg and chest compressions were started. The patient had a good outcome. The review panel judged that use of an arterial line in the case led to earlier detection of hypotension and early effective treatment, and this may have prevented more significant harm.

Cardiac surgery represents a group of highly monitored patients with the highest rates of monitoring for invasive arterial and central venous pressure, point of care coagulation, echocardiography and cerebral oximetry monitoring of any specialty. Echocardiography is almost exclusively used during cardiac surgery and cardiology procedures in the UK (187 of 212, 88%, uses in the survey) while these specialties account for only 450 (1.8%) of 24,172 of procedures. There is increasing appreciation that echocardiography may have a role in high-risk non-cardiac cases (Fayad 2018). For example, where a patient has severe valvular or ventricular dysfunction, or for volume and haemodynamic status assessment (eg major haemorrhage, trauma, transplantation; Fayad 2018) and its use should be considered. The cardiac arrest case reports show that echocardiography was used during resuscitation in 160 (18.2%) of the 881 NAP7 cases. Of these 160 cases, 38 (23%) were cardiac surgical cases and 27 (17%) occurred in the cardiac catheterisation laboratory. The role and use of echocardiography in cardiac arrest is discussed in Chapter 15 Controversies.

In summary, despite high compliance rates with basic monitoring during general anaesthesia, there are significant gaps during patient transfers. In particular, compliance with capnography guidelines during transfer is poor.

Recommendations

National

- Department compliance with national accepted monitoring standards should be measured.

Institutional

- Monitoring should be consistent with published guidelines and continuous throughout the peri-operative patient journey, including during transfers. Disconnections in patient monitoring should only occur exceptionally.
- The level of monitoring should match patient risk. The majority of NAP7 reviewers advocated a low threshold for continuous invasive arterial blood pressure monitoring in theatre and recovery. Research to inform national guidelines would be of value.
- Capnography should be considered in all cases of sedation where the loss of verbal contact is possible.
- Departments should ensure that all theatres have enough equipment to meet the recommended monitoring requirements. This includes monitoring end-tidal CO_2 on transfer from theatre to recovery and in recovery if an airway device is in place.
- Following a cardiac arrest in the perioperative pathway consideration should be given to downloading all monitoring data available in an electronic format.

Individual

- Monitoring of exhaled carbon dioxide should continue during transfers from theatre to recovery or critical care where an airway device is in place for the transfer.
- Where neuromuscular blocking drugs are used, quantitative train of four monitoring should be used.

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