Section 2: Intraoperative care

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Availability and accuracy of operating lists
Dr A F Naylor, Dr L Anderson

Why do this audit?

Proper and safe patient care may be compromised if operating lists are published very late.1 If the patient is in hospital on the previous day, the anaesthetist should have access to the list, including its proposed order, in good time so that the patient may be visited and arrangements made for preoperative care. This may include requesting food/fluids be given to patients scheduled for surgery later on the list, organising diabetic care, organising additional preoperative tests or arranging availability of specific equipment.

Anaesthetic time may be wasted trying to find the list and its order, and patients may not receive appropriate care.

The operating list must be accurate. The patient’s full name, hospital number and date of birth should be included, as should the proposed procedure (including the side to be operated on where appropriate) – abbreviations should be avoided. Date and start time should also be noted as should the names of the operating surgeon and anaesthetist.

Errors on the list may lead to delays in theatre, e.g. theatre may require a different set of sterilised equipment for a procedure which differs from that stated on the list. More importantly, there are significant implications both for the patient and medico-legally where a procedure is performed inappropriately or on the wrong limb or organ.

Best practice: research evidence or authoritative opinion

A number of reports suggest that early communication is the key to optimal preparation of the patient and provision of appropriately skilled and experienced anaesthetists for the list.1–7

The medical defence societies, in conjunction with the nursing profession, have produced recommendations to reduce the risk of errors in operating theatres;8 incorrect details on operating lists increase the risk of such errors.

Suggested indicators

- % lists where the list was published by 1600 h on the previous day or 0800 h the same day for afternoon lists. Different deadlines may be chosen.
- % lists where changes were made to the published list. Genuine emergencies are excluded – although irritating, this may be unavoidable.
- % difficult cases notified to the anaesthetist at least 7 days prior to surgery. This includes planned ITU admissions or cases requiring special skills (such as fibreoptic intubation or where a history of anaesthetic complications exists, e.g. malignant hyperpyrexia). However, this is only possible if the surgical team are aware of likely difficulties
- % lists where errors have been made in patient details or proposed procedure.
- % patients cancelled due to immediate preoperative reassessment by surgeon different from the one that listed them.
## Proposed standard or target for best practice

100% of elective operating lists should be available as above.

0% lists should be changed after the time chosen as the deadline.

100% of problem cases should be notified to the anaesthetic department at least 7 days prior to surgery.

100% of lists should be accurate with complete patient and procedure details.

0% patients should be cancelled due to immediate preoperative reassessment by different surgeon.

## Suggested data to be collected

All lists or those from a suspected problem specialty should be audited over a period of 1–3 months.

The theatre administrator may be asked to record the time the list was received and any changes that were made after receiving it.

The anaesthetist may be asked what time he/she looked for and found the list and whether they made changes to it and why, and whether problem cases were previously discussed and when.

Theatre staff may be asked to verify the accuracy of the published list with regard to complete and accurate details on patient identification, proposed procedure, correct side stated, correct date and time.

The anaesthetist, the Operating Department Assistant (ODA) and theatre staff may be asked what problems arose from late changes.

## Common reasons for failure to reach standards

- Junior medical staff disorganised or too busy.
- Non-availability of beds or urgent cases requiring last-minute changes.

## References

Pre-anaesthesia equipment checks
Dr J Mackay

Why do this audit?
A correctly functioning anaesthetic machine is vital for safe anaesthesia. New anaesthetic machines are becoming more sophisticated and many have ‘self-testing’ programmes. It is the duty of the anaesthetist to ensure that anaesthetic equipment in the anaesthetic room and the operating theatre is working properly before starting an operating list. Failure to do so may result in a critical incident. Equipment failure may be responsible for up to 10% of critical incidents. Evidence exists that faults on machines are not always detected even if checks are performed.

Best practice: research evidence or authoritative opinion
The Association of Anaesthetists has published guidelines for checking anaesthetic machines. This document includes a new procedure for checking patency of single use filters, angle pieces and catheter mounts which may be specifically included in this audit.

Suggested indicators
Existence of a locally agreed list of recommended checks which reflects national published standards and is situated adjacent to all anaesthetic machines
% anaesthetists who know how to perform an adequate check of equipment.
% lists at which a check of the anaesthetic equipment by the anaesthetist is made prior to the first case.
% lists at which an adequate check is made in the opinion of the auditor.
Evidence of documentation of checks.

Proposed standard or target for best practice
100% of anaesthetic machines should have check-list immediately available.
100% anaesthetists should be able to perform adequate checks.
100% of lists a check of anaesthetic equipment should be made and documented appropriately.
At 100% of lists an adequate check should be made in the opinion of the auditor.

Suggested data to be collected
As above
Grade of anaesthetist.
The auditor would need to observe checks being made.
Common reasons for failure to reach standards

- Lack of communication between anaesthetists when more than one anaesthetist is covering a list.
- Checks not regarded as important.
- Inadequate resources for supervision of checking process in trainees.
- Inappropriate delegation of equipment checking.

References

Adequacy and location of advanced airway management equipment

Dr B E McGuire

Why do this audit?

Difficulty or failure in airway management is a significant factor in much anaesthesia-related morbidity and mortality. Rapid access to advanced airway equipment is essential for the provision of safe anaesthesia.

Knowledge among UK anaesthetists of the location and contents of the ‘advanced airway set’ is poor.

Excluding routine airway equipment, the advanced airway set should include equipment for the management of both the anticipated and the unanticipated difficult airway (the latter equipment must be immediately available).

Stipulation of the ideal contents of the Advanced Airway (AA) equipment set is very difficult as evidence is limited, but certain principles of advanced airway management are generally held in the UK and elsewhere in the world. There has been no attempt to recommend specific advanced airway equipment in this document, but there may be need to do so in the future if there is more consensus on best practice.

Best practice: research evidence or authoritative opinion

The Difficult Airway Society has published guidelines for the management of the unanticipated difficult intubation and has a list of recommended airway equipment available on its website.

Suggested indicators

Existence of a named consultant responsible for the AA set.
Immediate availability of an AA set in all areas where anaesthesia is administered.
Each AA set includes a list of contents and an algorithm flow chart of advanced airway management.
There is documentation of regular maintenance and stocking of each AA set.
Existence of training in the use of the equipment in the AA set.
% anaesthetists familiar with the location and contents of the AA set.
% anaesthetists with formal training in use of AA set.

Proposed standard or target for best practice

A named consultant should be responsible for the AA set.
100% of areas where anaesthesia is administered should have AA set immediately available.
100% AA sets should include a list of contents and an algorithm flow chart of advanced airway management.
100% AA sets should include evidence of regular maintenance.
100% of anaesthetists should be familiar with the location and contents of the AA set.
100% anaesthetists should have had training in the use of the equipment in the AA set.
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Suggested data to be collected

As above.

Common reasons for failure to reach standards

Inadequate awareness of advanced airway management issues or a lack of agreement as to which equipment and techniques represent best practice.

Inadequate documentation accompanying AA sets.

Lack of a leader to take responsibility for the provision, maintenance and education of advanced airway equipment/techniques.

Resource limitation or lack of prioritisation with regards to the purchase of advanced airway equipment.

Lack of facilities for training in advanced airways management.

Some locations may be forgotten, especially isolated ones. Consider A&E, X-ray, and obstetrics.

References

Anaesthetic records

Dr I Quasim

Why do this audit?

The anaesthetic record provides several important functions: a record of preoperative information about clinical and laboratory findings; discussion of techniques/risks of anaesthesia; record of completion of equipment checking; documentation of drug/fluid therapy given during the anaesthetic; and record of relevant physiological variables. The anaesthetic record should also provide information about the postoperative management of the patient. It is also important that any untoward event, which may have a bearing on future anaesthetics, is clearly documented.

An accurate anaesthetic record enables the patient to receive effective continuing care, enables the healthcare team to communicate effectively, allows another doctor or professional member of staff to assume care of the patient at any time, and enables the patient to be identified without risk or error.

The record is also useful retrospectively for a future anaesthetist to establish events or for use in medico-legal defence.

Best practice: research evidence or authoritative opinion

A recommended data set was published by the Royal College of Anaesthetists (RCoA) in 2002.2 NHS Quality Improvement Scotland assessed hospital performance using clinical standards for anaesthesia including complying with the RCoA minimum data set.3 At present very few anaesthetic records comply with all the RCoA recommendations.

Suggested indicators

% Anaesthetic records:

- containing RCoA recommended data set
- containing locally agreed minimum data set
- signed by the anaesthetist
- for trainee anaesthetists and non-consultant career grade anaesthetists name of supervising consultant
- assessed as complete
- legible.

Proposed standard or target for best practice

There are two areas to consider: structure and content of the anaesthetic record and adequacy of data entry on the anaesthetic record.

100% anaesthetic records used within the hospital/trust/health board or strategic health authority area provide space to record the data listed in the minimum data set.

The standard for completion will depend on the form being used and on the complexity of the case. A minimum acceptable data set should be prepared locally in consultation with colleagues in relation to case type. A suggested minimum data set is given below.
Suggested data to be collected

Ten cases per anaesthetist should be reviewed, chosen to cover all areas of practice. A suggested minimum data set is:

- Patient identification, date, operation, names of surgeon(s) and anaesthetist(s), including a named consultant, documentation of preoperative visit and relevant findings, pre-medication, cannulation, equipment and monitoring used including completion of AAGBI equipment check, drugs and fluids administered, record of relevant physiological variables, postoperative instructions including analgesia, anti-emetics, fluid and oxygen therapy. There should also be space available for documenting adverse events/critical incidents and consent to anaesthetic procedures.

The record should be assessed as adequate, inadequate or cause for concern according to the standards above.

Common reasons for failure to reach standards

Record has not been updated to take account of recent standards. Recommended RCoA data set contains a large amount of information to be recorded which can be difficult during short routine cases or when there is a lack of assistance with paperwork during theatre.

References

Monitoring
Dr J Fielden, Dr J Rechner

Why do this audit?
Many international bodies now recommend minimum standards of monitoring for anaesthesia aiming to reduce critical incidents and patient harm.1–3 This is backed by studies showing the high contribution of human error to these events,2 and the inability to detect some problems clinically without significant delay.1,4 As a risk management issue, it is important to meet these standards and show that the cost and effort of monitoring is justified by reduced frequency of critical incidents and patient morbidity.5 There is also some evidence that inappropriate monitoring may cause harm and thus it needs to be applied appropriately.5

Best practice: research evidence or authoritative opinion
Minimum standards of monitoring for anaesthesia have been described in the UK by the Association of Anaesthetists of Great Britain and Ireland (AAGBI).2 They state that the following are essential to the safe conduct of anaesthesia: pulse oximeter, non-invasive blood pressure monitor, electrocardiograph and capnograph. There is evidence to suggest that use of non-invasive blood pressure, ECG, pulse oximetry and clinical observation will detect 90% of all critical incidents.4 Capnography must be available in all locations where anaesthesia is administered and used in all instances of tracheal intubation.2,6

Guidelines for sedation suggest a lower standard of monitoring may be appropriate for cases solely receiving sedation and/or local anaesthesia.7,8

Suggested indicators
Using the AAGBI minimum monitoring standards:2
- % patients adequately monitored prior to and during induction
- % patients adequately monitored during anaesthesia
- % patients adequately monitored in recovery.

In the absence of absolute standards of frequency for intermittent monitoring, for example of non-invasive blood pressure, consideration should be given to defining targets for specific clinical situations in advance of data collection.

Proposed standard or target for best practice
100% of patients should receive minimum standards of monitoring prior to and during induction of anaesthesia, through the anaesthetic and in the recovery area. This may include locally set targets for frequency of intermittent measurements.

Suggested data to be collected
Anaesthetist, theatre, list, time of day, anaesthetic technique (e.g. regional or general anaesthetic, ventilated or spontaneously breathing), monitoring used.
Monitors immediately available, monitors available elsewhere.
Reason for not monitoring. Details of any critical incident that occurred.
Where a new type of monitor is being introduced there is an opportunity to monitor critical incidents before and after the introduction of the monitor.
Common reasons for failure to reach standards

- Lack of perceived benefit.
- Monitors not immediately available or not working.
- Monitors not available.

References

Management of diabetes mellitus
Dr D Lomax

Why do this audit?
Diabetes mellitus is the most common endocrine disorder encountered in anaesthesia and can have many adverse effects especially on the cardiovascular and renal systems. Several factors complicate the metabolic management of the surgical, diabetic patient. These include starvation, the endocrine and consequent metabolic response to surgery and immobilisation. Poor control can lead to significant morbidity and increased hospital stay.

Best practice: research evidence or authoritative opinion
There is no consensus as to the best way of managing diabetic patients but evidence is accumulating that intensive glycaemic control is associated with improvement of perioperative morbidity and mortality. Variables that will affect the method of management include whether the patient is insulin dependent or not, the level of control preoperatively and the extent of the surgery. For those patients who require insulin peroperatively, methods have been described:
1 separate, variable rate, IV glucose and insulin infusions
2 combined IV infusion of glucose and insulin
3 IV bolus insulin – although not recommended by some
4 S/C bolus insulin.

Regular measurement and correct interpretation of blood sugar levels may be more important than the regimen used. Bedside blood ketone monitoring may be useful for unstable diabetics. The National Institute for Health and Clinical Excellence (NICE) recommend that perioperative patients with type I diabetes are managed using a local protocol.

Suggested indicators
An up to date local protocol is routinely used to guide perioperative diabetic management. % diabetic patients in whom efforts have been made to keep starvation time to a minimum. This would usually be by placing them first on the morning operating list. % patients in whom the blood sugar is measured hourly for 4 h postoperatively, then 2 hourly for 4 h, then 4 hourly thereafter. This should be until oral food and fluid intake is resumed and the usual diabetic treatment regimen recommenced. % patients in whom regular urinalysis for ketones is performed during this period. % patients in whom > 90% of their blood sugar measurements fall between 5.5 mmol/l and 11.1 mmol/l during this period.

Proposed standard or target for best practice
100% of relevant clinical staff should be aware of and should use the local protocol. 100% patients should have:
- efforts made to keep starvation time to a minimum
- hourly blood sugar measurements as above
- regular urinalysis as above
- blood sugar control as above.
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## 2.6 Suggested data to be collected

<table>
<thead>
<tr>
<th>Suggested data to be collected</th>
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</thead>
<tbody>
<tr>
<td>Usual diabetic treatment regimen.</td>
</tr>
<tr>
<td>Level of preoperative control.</td>
</tr>
<tr>
<td>Extent of surgery.</td>
</tr>
<tr>
<td>Position on operating list and starvation time.</td>
</tr>
<tr>
<td>Perioperative regimen used.</td>
</tr>
<tr>
<td>Frequency of blood sugar checks and urine testing.</td>
</tr>
<tr>
<td>Results of blood sugar and urine tests.</td>
</tr>
<tr>
<td>Evidence that blood-testing equipment is being properly calibrated and used correctly.</td>
</tr>
<tr>
<td>Adverse cardiovascular or renal sequelae.</td>
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</tbody>
</table>

## Common reasons for failure to reach standards

<table>
<thead>
<tr>
<th>Common reasons for failure to reach standards</th>
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</thead>
<tbody>
<tr>
<td>List order changes and/or long starvation time.</td>
</tr>
<tr>
<td>IV not sited preoperatively when required.</td>
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<tr>
<td>Blood sugars not measured or incorrect interpretation of results.</td>
</tr>
<tr>
<td>Inaccurate measurements of blood sugars because of failure to calibrate measuring devices.</td>
</tr>
<tr>
<td>Inadequate preoperative control of diabetes.</td>
</tr>
<tr>
<td>Local regimens and guidelines not able to deal with all diabetic states encountered.</td>
</tr>
</tbody>
</table>

## References

Perioperative temperature management

Dr M Harper

**Why do this audit?**

Temperature monitoring is essential during induction and maintenance of anaesthesia and should be available during recovery from surgery. Both hypothermia and hyperthermia (including malignant hyperthermia) can complicate anaesthesia.

There are a number of reviews of the adverse effects of inadvertent peri-operative hypothermia (IPH) in the literature. Research has shown that IPH can lead to morbidity including prolonged recovery and hospital stay, increased blood loss and transfusion and an increased incidence of pressure sores, wound infections and morbid cardiac events. Reducing the incidence of IPH through appropriate peri-operative care can reduce the incidence of these complications.

In hyperthermia the margin between temperatures for normal cellular processes and cell damage from high temperature is very small compared with hypothermia. Hyperthermia can be corrected by cooling.

This audit reflects the recommendations of the NICE guideline ‘Perioperative hypothermia (inadvertent): The management of inadvertent perioperative hypothermia in adults’.

**Best practice: research evidence or authoritative opinion**

Best practice is to prevent IPH rather than have to treat it. The NICE postoperative treatment review found that the rate of rewarming is very slow (0.2–1°C per hour) in hypothermic patients.

Patients are at higher risk of hypothermia and its consequences if any two of the following apply:
- ASA grade 2–5 (the risk at 5 is greater than the risk at 2)
- pre-operative temperature below 36.0°C
- combined regional and general anaesthesia
- intermediate or major surgery
- at risk of cardiac complications
- extremes of age.

Care should be taken to ensure that patients are adequately covered on the ward and during transfer to the operating theatres. Unless surgery is life or limb saving, patients should be actively warmed to a temperature 36.0°C or above before being anaesthetised. Otherwise, active warming should be initiated in the anaesthetic room for all procedures where the total operative time (from first anaesthetic intervention to arrival in recovery) is greater than 30 minutes. For total operative times less than 30 minutes, only higher risk patients should be actively warmed. All intravenous infusions of greater than 500 ml (and all blood products and irrigation fluids) should be warmed.

Care should also be taken to keep the patient warm between the end of surgery and their arrival in the PACU as there is evidence that their temperature can fall significantly during this time.

Body temperature is as vital a clinical sign as the pulse or blood pressure and should be recorded in the hour prior to the patient coming to theatre. It should be measured throughout the operation and in recovery until such time as it reaches 36.0°C. It should be recorded at the same frequency as other vital sign measurements for the first 24 postoperative hours.

NICE have recently published a guideline on the management of IPH which details appropriate peri-operative thermal management. Although it recommends the use of forced-air warming, there is some preliminary evidence that other forms of active warming may be equally effective and that combining two methods can improve outcome.

The ultimate aim is for all patients to be kept comfortably warm at all times and that their temperature should be measured regularly to ensure that it remains in the range of 36–37.5°C.
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### 2.7 Frequency of temperature measurement

<table>
<thead>
<tr>
<th>Proposed standard or target for best practice</th>
<th>Suggested Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key outcome 1:</strong> All patients admitted to recovery should have core body temperature of 36.0°C or above.</td>
<td>Frequency of temperature measurement</td>
</tr>
<tr>
<td><strong>Key outcome 2:</strong> 100% patients should not be discharged from recovery until their temperature is above 36.0°C.</td>
<td>Temperature &lt; 36.0°C at any time</td>
</tr>
<tr>
<td></td>
<td>Use of body and fluid warming techniques</td>
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</tbody>
</table>

### Common reasons for failure to reach standards

- Failure to follow NICE guidelines in terms of warming patients. This stems in particular from patients not receiving warming from the first anaesthetic intervention to the start of surgery and failure to monitor patients’ temperatures in the pre-operative period.

### References

# Awareness and general anaesthesia

**Dr B Walton, Dr M Kinsella**

**Why do this audit?**

Patient recall of awareness during surgery is rare. However, particularly if associated with sensation of pain during surgery, it is unpleasant and potentially psychologically damaging. In the USA awareness under anaesthesia accounted for 2% of all claims from the American Society of Anesthesiologists Closed Claims Project.

**Best practice: research evidence or authoritative opinion**

Using the isolated forearm technique, response to command during surgery was found in 0% of patients anaesthetised with a volatile anaesthetic agent, 16% of patients having propofol-alfentanil total intravenous anaesthesia (TIVA) and 72% having midazolam-alfentanil TIVA.

This responsiveness is usually not remembered. As the isolated forearm technique is not used routinely, we depend on the patient remembering a period of intraoperative consciousness in order to gauge the incidence.

Intraoperative awareness with recall (hereafter ‘awareness’) is usually associated with one of three situations:

- light anaesthesia (either intentionally or due to drug administration error)
- increased anaesthetic requirement (e.g. drug interaction, alcoholism)
- machine malfunction or misuse resulting in inadequate delivery of anaesthetic.

The incidence of awareness depends on the structure and timing of the postoperative interview making accurate incidence even more difficult to quantify. Two recent large studies suggested an incidence of 0.13% and 0.16% both in a general patient population. Higher rates of recall have been reported in major trauma (11–43%), cardiac (1–1.5%) and obstetric anaesthesia (0.4%). Risk of awareness increases with increasing ASA status and in the presence of neuromuscular blockade. While some authors have advocated that the use of an objective central nervous system depth of anaesthesia monitor reduces this risk, evidence for this is weak and it is by no means standard practice.

**Suggested indicators**

% of patients having a general anaesthetic who, on postoperative questioning, complain of definite intraoperative awareness or symptoms suggestive of a high probability of intraoperative awareness.

**Proposed standard or target for best practice**

The ideal standard is that 0% of patients undergoing general anaesthesia should have awareness. However in line with published data:

For general surgical cases:

- < 0.2% should have intraoperative awareness.

For obstetric anaesthesia:

- < 0.4% of women should have intraoperative awareness.

For cardiac anaesthesia:

- < 1% should have intraoperative awareness.
Suggested data to be collected

Incidence of definite or probable awareness.

For cases where it occurred the following should be documented.

- ASA of patient and specific pre-existing patient conditions that may have influenced depth of anaesthesia, type of surgery, induction agent and dose, grade and difficulty of intubation, use of hypnotic agents, type of anaesthetic agent (inhalational or intravenous) and expired percentage/dose, use of N₂O, use of muscle relaxant, breathing system and fresh gas flow used, use of syringe labelling.
- Use of an objective central nervous system depth of anaesthesia monitor (e.g. Bispectral Index (BIS)® monitor).

Recommended audit frequency: continuous data collection.

Common reasons for failure to reach standards

Type of surgery and anaesthetic; use of neuromuscular blockade.
Perception of the need for a ‘light’ anaesthetic.
Drug labelling error.
TIVA equipment or administration problem.
Lack of appropriate and accurate end tidal anaesthetic agent monitoring.
Inexperience of the anaesthetist.

Related audits

13.14 – Audit of critical incident reporting
13.15 – Audit of complications of anaesthesia

References

Safe red cell transfusion

Dr C Brydon

**Why do this audit?**

The decision to transfuse red cells is a complex one and depends upon multiple factors. The risks of transfusion need to be balanced against the perceived benefits for each individual patient.\(^1\)

It is now generally accepted that we should avoid unnecessary transfusion of blood where possible by adopting appropriate transfusion triggers to reduce the risk to patients, conserve scarce resources and avoid unnecessary expense.

In addition to the well-established risks of red cell transfusion there is now the theoretical risk of transmission of variant Creutzfeld-Jakob disease by transfusion.

The introduction of more stringent safety requirements including leucocyte depletion has increased the cost of producing each unit of blood.

It is recognised that the most common adverse event relating to blood transfusion is incorrect administration of cross-matched blood.\(^2,3\)

**Best practice: research evidence or authoritative opinion**

It is accepted that most people, including the critically ill will tolerate a much lower haemoglobin than previously thought. National guidelines based on various levels of published evidence suggest that a haemoglobin of 7 g/dl may be adopted as an acceptable transfusion trigger in most patients. In some patients in whom anaemia is poorly tolerated, e.g. the elderly or those with cardiovascular disease, a haemoglobin of 8 g/dl may be more appropriate. It is also accepted patients with a haemoglobin level > 10 g/dl should generally not receive red cell transfusion.\(^1,4,5\) On-going active bleeding may modify application of these thresholds in individual patients.

Red cell use should be audited regularly and departmental guidelines should be drawn up jointly with the hospital transfusion committee.\(^2,4\)

**Suggested indicators**

Existence and use of local guidelines based on national standards including transfusion thresholds and safe procedure for administration of blood.\(^2,4\)

% patients receiving a blood transfusion in whom the reason for transfusion is documented and the pre-transfusion haemoglobin threshold is recorded.

% transfusions where guidelines on safe administration of blood are followed.

Any adverse events as a result of receiving red cells should be documented and reported via the transfusion nurse specialist to the Serious Hazards of Transfusion group.\(^3\)

**Proposed standard or target for best practice**

100% patients given blood transfusion have transfusion threshold documented.

100% patients with Hb > 7 g/dl given red cells have reason documented.

0% patients with Hb >10 g/dl receive red cell transfusion unless reasons documented.

100% transfusions should demonstrate evidence to support safe administration of blood.
Suggested data to be collected

This audit should be carried out jointly with the Haematology department and transfusion nurse specialist. They should be able to provide the information regarding which patients received red cells during their hospital stay.

For each patient who received red cells:
- type of operation
- elective or emergency procedure
- preop Hb and its timing
- postop and discharge Hb
- time to discharge
- evidence of safe procedure in administration
- documentation of transfusion including the indication and pretransfusion Hb in the patient’s notes
- any adverse events.

Common reasons for failure to reach standards

Variations between clinicians may be due to differences in surgical and anaesthetic techniques or case mix or differences in awareness and use of national standards.

Staff may be unaware of the national guidelines.

Lack of education or training in transfusion.

Related audits

1.10 – Preoperative cross-matching of blood
2.10 – Blood conservation strategies

References

# Blood conservation strategies

**Dr C Brydon**

## Why do this audit?

There are well-documented risks and hazards of transfusion which should be minimised by reducing where possible the use of allogeneic blood.\(^1\)

In addition, recent thinking has emphasised the safety of lower haemoglobin levels and the value of identifying individual patient thresholds thus shifting considerably the risk benefit balance of intraoperative red cell transfusion.\(^1,2\) (See also audit 2.9).

Blood is a scarce and expensive resource, likely to become even more so due to the restrictions on the donor population and increasing demand. A high proportion, approximately 50%, of all red cell transfusions are given to surgical patients.

The use of a protocol based system such as a maximum surgical blood ordering schedule (MSBOS) for ordering blood prior to elective surgery increases efficiency.

## Best practice: research evidence or authoritative opinion

Options to conserve blood stocks and reduce allogeneic red cell transfusions include:\(^1-4\)

- use of a maximum surgical blood ordering schedule (MSBOS)
- preoperative assessment and optimisation of haemoglobin with iron therapy or EPO if required 4–6 weeks prior to surgery
- accepting lower transfusion trigger
- preoperative autologous donation
- isovolaemic haemodilution
- intraoperative cell salvage
- postoperative cell salvage
- staff training and education.

## Suggested indicators

Existence and use of up to date MSBOS.

- % units of crossmatched blood which are transfused. This is the cross-match to transfusion ratio.
- % of patients who receive > 2 units of blood in whom cell salvage or other forms of autologous transfusion are not considered and reasons for this.

Evidence of anaesthetic staff training in transfusion and its alternatives.

## Proposed standard or target for best practice

MSBOS is used in 100% of relevant procedures.

A cross-match to transfusion ratio at least 2:1 or better for all procedures. This means that at least 50% of units crossmatched for elective surgery are actually transfused or reasons for variance explored and documented. The hospital MSBOS is thus subject to continuing scrutiny and adaptation.

Use of cell salvage or other forms of autologous transfusion should be considered in 100% of patients where blood loss is anticipated to be at least 1000 ml.\(^4\)

100% anaesthetists are trained in transfusion and blood conservation.
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Suggested data to be collected
This audit may be carried out jointly with the Haematology Department and the hospital transfusion nurse specialist in order to identify those surgical procedures which use two or more units of red blood cells.

Use of cell salvage or not and reasons for this.

Evidence of any other blood conservation methods employed.

Evidence for use and appropriateness of MSBOS. This aspect should be audited frequently or may be continuously evaluated.

Common reasons for failure to reach standards
Lack of equipment.

Lack of staff training.

Lack of preoperative facilities/co-ordination to allow advance haemoglobin optimisation or pre-donation.

Inability to guarantee date for surgery.

Related audits
1.10 – Preoperative cross-matching of blood

2.9 – Safe red cell transfusion

References
3 Royal College of Anaesthetists. The CCST in anaesthesia II: Competency based Senior House Officer training and assessment. RCoA, London April 2003 (see: www.rcoa.ac.uk/docs/ccstptied2.pdf).
Breathing system failures

Dr J Mackay

Why do this audit?

Failure of the breathing system including disconnection must be regarded as a critical incident as hypoxia or awareness may result. Modern monitoring usually allows failures to be detected before any harm comes to a patient. However, such failures remain an important potential hazard to the patient and should be avoided. Reporting of recurrent faults is vital as it may reveal a fault in equipment or lead to a change in anaesthetic practice. Measures may be introduced to reduce the risk of accidental disconnections.

Best practice: research evidence or authoritative opinion

All breathing system failures including disconnections are critical incidents. A means for critical incident reporting should be up and running in all anaesthetic departments. The Royal College of Anaesthetists has piloted a critical incident study. The use of a mandatory system for reporting adverse events, mishaps and errors was recommended by the Department of Health in An organisation with a memory and Building a safer NHS for patients.

Suggested indicators

It is suggested that an audit is performed for one month during which the anaesthetist is required to confirm that there was not a disconnection or other breathing system failure during each case.

% cases at which a disconnection or other breathing system failure occurs.

% cases of breathing system failure with critical incident severity. The Salisbury Severity Score can be used, as follows.

1. Transient abnormality unnoticed by patient.
2. Transient abnormality with full recovery.
3. Potentially permanent but not disabling damage.
4. Potentially permanent disabling damage.
5. Death.

% recurrent failures on repeat audit where measures aimed at prevention have been put in place. This may include education of clinicians, change in practice or change in equipment.

Proposed standard or target for best practice

A disconnection or other failure should occur in 0% cases.

Where a failure occurs, 0% should lead to a critical incident with severity 3–5.

100% of recurrent failures should be assessed for potential for prevention.
### Intraoperative care

#### 2.11 Suggested data to be collected

It is known that there is widespread under-reporting, it is therefore suggested that an audit is performed over one month during which the anaesthetist is required to confirm that there is not a disconnection or other breathing system failure during a case.

Where a failure did occur the exact circumstances and outcome should be noted. Action taken to prevent recurrent failures should be noted.

#### 2.11 Common reasons for failure to reach standards

- Lack of care in making connections in the breathing system.
- Unnecessary connections, poor equipment.
- Failure to use or interpret monitors correctly.
- Lack of clinical observation.

#### 2.11 References

4. Royal College of Anaesthetists Critical Incident Pilot Study. Further details can be obtained from the Royal College of Anaesthetists website (see: www.rcoa.ac.uk).