

Section 10: Intensive Care Medicine

Edited by Dr Giles Morgan

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10.1

Estimation of demand for intensive care beds

Dr P Steed

Why do this audit?

The 2005 report 'Beyond Comprehensive Critical Care' by the Critical Care Stakeholder Forum recommended that 'the need for critical care capacity in both designated critical care areas and on general wards should be evaluated at a local level', using standardised data systems such as ICNARC's Case Mix Programme dataset and regular hospital and network wide point prevalence studies.¹ It reiterated previous recommendations² that the concept of intensive care and high dependency beds be replaced by four levels of patient dependency regardless of the patient's location.³

Best practice: research evidence or authoritative opinion

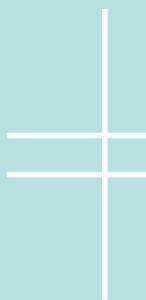
Within the developed world, the UK has one of the smallest proportion of acute hospital beds allocated to critical care.⁴ Many fear that changing patient demographics and increased patient expectations in a time of increasing financial strain and limited resources make bed crises a likely prospect for the near future.

Increases in critical care capacity have slowed (36% increase Jan 2000–July 2005 vs 16% increase July 2005–Jan 2011) and the majority of these new beds have been for patients with Level 2 needs.⁵ Failure to show further improvement in the number of non clinical transfers and rises in cancellation of urgent operations are of concern. Recent work modelling bed occupancy⁶ may help to predict future demand and shape future provision.

Occupancy is highly variable and increasing capacity does not necessarily result in an equivalent fall in occupancy.⁷ It is recommended that critical care occupancy should run at about 70%.⁸ Persistent occupancy of $\geq 70\%$ suggests a unit is too small. Over provision is wasteful but occupancy of $\geq 80\%$ is likely to result in non-clinical transfers and failure to admit in a timely manner with associated morbidity and mortality. Recent recommendations for high risk surgical patients⁹ will undoubtedly impact upon demand.

Outreach teams may be best placed to collect data on patients with Level 2 needs in non critical care locations and 'track and trigger' early warning systems based on physiological parameters should be utilised by ward staff to assist with prompt identification of such patients.¹⁰

Quality of care should be measured objectively. Four of the 20 quality indicators proposed by a recent survey¹¹ fall within the scope of this audit (readmissions, discharges at night, days at 100% occupancy and non-clinical transfers).

Suggested indicators**Level 3 care**

- D Number of patients requiring Level 3 care per day.
- D Occupancy of Level 3 beds.
- D % of appropriate admissions refused due to lack of beds.
- D % of patients discharged prematurely, for non-clinical reasons.
- D % of patients readmitted.
- D % of non-clinical transfers.
- D % of planned admissions whose elective surgery is deferred due to lack of beds.

Level 2 care

- D Number of patients in critical care beds and acute wards fulfilling criteria for Level 2 care.
- D % of appropriate referrals to ICU refused due to lack of beds.
- D Number of deferred elective operations.
- D % of premature discharges from and readmissions to ICU.

Proposed standard or target for best practice**Level 3 care**

- D 100% of patients requiring Level 3 care are in intensive care.
- D Less than 80% bed occupancy in intensive care.
- D 0% appropriate admissions refused.
- D 0% patients prematurely discharged.
- D 0% surgery deferred for non-clinical reasons.
- D Less than 5% readmission rate.
- D 0% non-clinical transfers.

Level 2 care

- D 100% of patients requiring Level 2 care in appropriate beds.
- D 0% of patients requiring Level 3 care in Level 2 beds.
- D 0% appropriate referrals refused.
- D 0% of patients prematurely discharged.
- D Less than 5% readmission rate.

Suggested data to be collected

Data should be collected over a time-frame that reflects seasonal and local variations in demand for critical care. Enquiries should be made to ascertain which data is already regularly collected to avoid duplication. Where possible, bed occupancy can be obtained from the ICNARC Case-mix Programme for participating units. Alternatively, occupancy may be calculated at a specific time on a daily basis (number of occupied beds as a percentage of total/operational bed spaces, taking into account that a lack of nursing staff may limit the number of operational beds).

In the ICU, number of:

- D Critical care bed spaces
- D Operational critical care beds
- D Occupied critical care beds
- D Appropriate patients denied intensive care
- D Planned surgical cases cancelled because of non-availability of critical care beds
- D Patients discharged prematurely
- D Patients discharged at night
- D Non-clinical inter-hospital transfers
- D Patients readmitted to intensive care.

Numbers of patients fulfilling the requirements for Level 2 and 3 critical care in:

- D Intensive care units
- D High dependency units
- D Acute wards.

Common reasons for failure to meet standard

- D Insufficient critical care beds.
- D Insufficient Level 1 beds.
- D Poor bed management.
- D Lack of outreach service.

CPD and Curriculum mapping

CPD matrix code: **2C07**

Training curriculum competence: **Domains and sections: I, I.4**

References

- 1 Quality Critical Care. Beyond Comprehensive Critical Care. A report by the Critical Care Stakeholder Forum. Sep 2005 (http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4121050.pdf).
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- 4 Adhikari NKJ et al. Critical care and the global burden of critical illness in adults. *Lancet* 2010;**376**(9749):1339–1346.
- 5 Critical Care Capacity. Monthly situation reports on cancelled operations and critical care bed capacity. *DH*, London (<http://www.dh.gov.uk/en/Publicationsandstatistics/Statistics/Perfomancedataandstatistics/EmergencyActivityandCriticalCareCapacity/index.htm>).
- 6 Griffiths JD et al. A simulation model of bed occupancy in a critical care unit. *J Simulation* 2010;**4**:52–59.
- 7 Parker A, Wyatt R, Ridley S. Intensive care services; a crisis of increasing expressed demand. *Anaesthesia* 1998;**53**:113–120.
- 8 Standards for intensive care units. *Intensive Care Society*, London 1997 (<http://www.ics.ac.uk/>).
- 9 The Higher Risk General Surgical Patient. *RCSEng and DH*, London 2011 (<http://www.rcseng.ac.uk/publications/docs/higher-risk-surgical-patient/>).
- 10 NICE Clinical Guideline 50. Acutely ill patients in hospital. Recognition of and response to acute illness in adults in hospital *NICE*, London 2007 (<http://www.nice.org.uk/CG50>).
- 11 Standards, Safety and Quality Committee. Quality Indicators (Draft version). *Intensive Care Society*, London (http://www.ics.ac.uk/intensive_care_professional/standards_safety_and_quality).

10.2

Discharges and follow up of patients from intensive care between 22:00 and 06:59 hrs

Dr L Morris, Dr P Sadler

Why do this audit?

Discharge from intensive care, out-of-hours places patients at increased risk of clinical deterioration and constitutes an adverse incident.

Best practice: research evidence or authoritative opinion

Between 2003 and 2007 the incidence of patients being discharged from intensive care units between 22:00 hrs and 06:59 hrs gradually but steadily increased from about 8% to about 10%.¹ This may contribute to poor clinical outcome and an increased risk of readmission to intensive care during the same hospital admission.² NICE guideline CG50, 'Acutely Ill Patients in Hospital'³ recommends that patients should not be discharged from intensive care to a general ward area between the hours of 22:00 and 06:59 hrs and that such events should be recorded as an adverse incident.

Suggested indicators

All patients discharged from intensive care.

Proposed standard or target for best practice

- D 100% of patients to be discharged between 07:00 – 21:59 hrs.
- D 100% of out-of-hours discharges to have completed adverse incident form.
- D 100% review of all discharges by intensive care outreach within six hours of arrival on ward.
- D 100% review of all discharges by ward medical team within six hours of arrival on ward.

Suggested data to be collected

- D Establish time period for completion of the audit.
- D Identify all discharges over the selected time period.
- D Exclude patient deaths on the unit.
- D Record time that patient clinically assessed as being ready for discharge.
- D Record times of patient discharge.
- D Determine whether or not an adverse incident form completed if required.
- D Record time of follow up visit by intensive care outreach.
- D Record time of follow up visit by ward team.

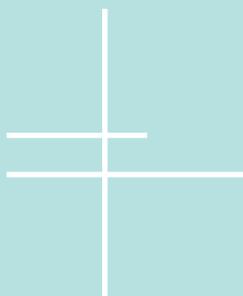
Common reasons for failure to meet standard

- D Poor communications between those involved in the discharge and follow up process.
- D No outreach service at night.
- D Poor understanding of risks.
- D Insufficient intensive care beds to meet demands.

CPD and Curriculum mapping

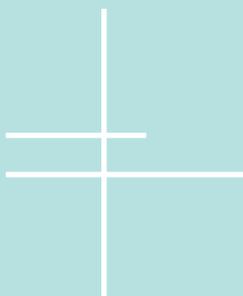
CPD matrix codes: **1101, 1105, 2C07**

Syllabus for the CCT in Intensive Care Medicine: **Domains 7 and 11, Section 6.1**



References

- 1 Welch CA, Harrison DA, Rowan KM. Trends in outcomes from adult general critical care units: potential outcome-based quality indicators other than case-mix adjusted mortality. *J Intens Care Soc* 2009;**3**:220–223.
- 2 Gopal S, Terry L, Corbett C. Association between out of hours discharge from the ICU and subsequent readmission. *Crit Care* 2010;**14**(Supp 1):476.
- 3 NICE Clinical Guideline 50. Acutely ill patients in hospital. Recognition of and response to acute illness in adults in hospital NICE, London 2007 (<http://www.nice.org.uk/CG50>).



10.3

Quality and safety of handover in intensive care

Dr J Rivers, Dr C Peden

Why do this audit?

Handover is an inevitable and essential aspect of caring for critically ill patients whilst working a shift system. Breakdowns in communication are one of the leading causes of patient harm and therefore handover is a key component of safe patient care in the critical care setting.¹ This Audit should be done to ensure that handovers are occurring efficiently and effectively, and that they are accurately transmitting the information required for safe patient care.

Best practice: research evidence or authoritative opinion

Clinical Handover between shifts is necessary to ensure information about patient care is correctly transmitted between incoming and outgoing medical teams. Deficiencies in the handover process can result in potentially dangerous errors in patient management. The information handed over should be accurate, succinct, and sufficient to allow the seamless continuation of care between teams. Inadequate handover carries risks for patients, individual clinicians and the organizations within which they work.^{1,2,3} Current handover practices are often not standardized and are highly variable.⁴

The handover should occur at a designated time in a designated area with clear leadership and without avoidable interruption. Information must be up to date, ideally a standardized proforma and format of presentation should be used to ensure key information is not omitted.⁴

Suggested indicators

- D % of key staff attending and reason for non-attendance
- D % of handovers starting within five minutes of the designated time and reasons for delay
- D % of handovers finishing on time and reasons for over running
- D % of handovers that are interrupted, and reasons for interruption
- D % of relevant information that is handed over: Key components essential for handover should be agreed by all teams and should include current test results, results pending, key medications and ongoing treatment plans as well as current diagnosis and management. Audit should measure the number of key components that are included for each patient at handover:

Proposed standard or target for best practice

- D 100% of key staff attending handover
- D 100% of handovers starting within five minutes of designated time
- D 100% of handovers finishing before a designated time
- D < 10% of handovers interrupted
- D 100% of relevant information handed over

Suggested data to be collected

Design an audit form that includes the domains of information that are required to be handed over. Clinical information could include:

- D name, age, diagnosis
- D reason for admission to ICU
- D history
- D significant recent events
- D current issues
- D daily goals
- D recent test results and tests pending
- D critical medication and any changes
- D ongoing plan for next shift.

Physical properties and human factors may also be recorded⁴ and include:

- D use of safety features such as 'teach back' or 'read-back' when the nurse or team repeats back essential pieces of information to confirm understanding.
- D location
- D start and finish times
- D time for each patient
- D interruptions by bleeps or phones

	<ul style="list-style-type: none"> D Interruptions by other members of staff not involved in handover; D Presence of background conversation D Distracting noise such as suction, fire alarm or TV.³ <p>The auditor, who is not taking part in handover, attends and records the handover on the Audit form. Key members of staff who are not present are noted.</p> <p>After handover the Auditor reviews the patient notes to identify relevant clinical information that was not given in handover. The proportion of relevant clinical information (judged against predefined standards) handed over is thus determined, and omissions that could impact negatively on patient care noted. Events that impair handover are recorded.</p>
<p>Common reasons for failure to meet standard</p>	<ul style="list-style-type: none"> D Failure to standardize and use a structured format, resulting in key information being omitted. D Inadequate time given to handover D Frequent delays D Frequent Interruptions
<p>CPD and Curriculum mapping</p>	<p>CPD matrix codes: 2C07, 1G01, 1I06, 3A13</p> <p>Syllabus for the CCT in Intensive Care Medicine: Domains and sections 11.1, 12.1–12.10</p>
<p>References</p>	<ol style="list-style-type: none"> 1 WHO Collaborating Centre for Patient Safety Solutions. Communication during patient safety handovers. Patient Safety Solutions, vol.1. <i>World Health Organization</i>, Geneva 2007 (http://www.ccforpatientsafety.org/common/pdfs/fpdf/presskit/PS-Solution3.pdf). 2 Safe Handover: Safe patients. Guidance on clinical handover for clinicians and managers. <i>BMA</i>, London 2004 (http://www.bma.org.uk/ap.nsf/content/handover). 3 M N Lyons, T D A Standley, A K Gupta. Quality improvement of doctors' shift-change handover in neuro-critical care. <i>Qual Saf Health Care</i> 2010;19:1–7. 4 How safe are clinical systems? Evidence in brief. <i>The Health Foundation</i> 2011 (http://www.health.org.uk http://www.health.org.uk/publications/evidence-in-brief-how-safe-are-clinical-systems).

10.4

Audit of end of life decisions in intensive care

Dr E McMaster, Dr C Ferguson.

Why do this audit?

We should do this audit to ensure that the complex issues surrounding end of life care for the critically ill are properly addressed.

Best practice: research evidence or authoritative opinion

The Intensive Care Society guideline of 2003¹ refers to several useful publications on the subject of withholding and withdrawing care.^{2,3} In essence, all highlight the following principles: ethically there is no difference between the terms withholding and withdrawing, all care should be delivered in the patient's best interests, treatment should not be continued if it does not benefit the patient, effective communication between patients, their families and those caring for them is of paramount importance, limits of treatment should be identified early in the patient's stay in intensive care, those dealing with these issues should be trained in communications skills, the process of withdrawal should be well documented and the method identified. Having taken all these into account, the final decision to withdraw rests with the consultant in charge of the intensive care unit.

The term, 'futility' may be used when all treatment intended to preserve a patient's life has become ineffective and does not benefit the patient. Under these circumstances death is usually inevitable.

The key role of communication and documentation were emphasised by Lautrette et al.⁴

The audit upon which this recipe is based retrospectively reviewed end of life care in patients in intensive care. The standard set was that there should be a documented discussion with the patient or family regarding withdrawal of treatment in 100% of cases where treatment was withdrawn.

An action plan following the audit made the following recommendations:

- D Decisions regarding treatment limitation and withdrawal should be a managed process beginning early in a patient's stay in intensive care.
- D The formal decision to withdraw must be documented in the casenotes.
- D The reason why this decision was made must be documented.
- D All discussions with the patient or their family must be documented.
- D The method of withdrawal must be documented.
- D Organ donation should be considered by the clinical team and the outcome documented.

Suggested indicators

All patients in intensive care for whom decisions are made to withhold or withdraw treatment directed towards the preservation of life.

Proposed standard or target for best practice

- D Treatment limitations (or absence of treatment limitations) documented in 100% of admissions to intensive care.
- D 100% of discussions with patient regarding end of life care to be documented.
- D 100% of discussions with family regarding end of life care to be documented.
- D Formal decision to withdraw treatment documented in 100% of cases in whom treatment withdrawn.
- D Timing of withdrawal of treatment documented in 100% of cases.
- D Method of withdrawal of treatment documented in 100% of cases.
- D Documented consideration of organ donation by clinical team in 100% of cases.

Suggested data to be collected

- D Documentation of treatment limitations.
- D Discussions with patient.
- D Discussions with family.
- D Formal decision to withdraw.
- D Timing of withdrawal.
- D Method of withdrawal.

Common reasons for failure to meet standard

- D Failure to communicate effectively with the patient and/or their family in the early stages of intensive care admission.
- D Poor documentation.

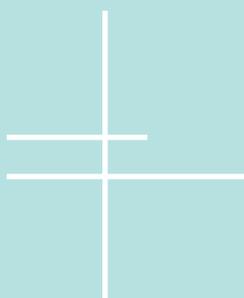
CPD and Curriculum mapping

CPD matrix codes: **IF02, 2C06, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains 8 and 12**

References

- 1 Cohen SL et al. Guidelines for limitation of treatment for adults requiring intensive care. *Intensive Care Society*, London 2003 (http://www.ics.ac.uk/intensive_care_professional/standards_and_guidelines/limitation_of_treatment_2003).
- 2 British Medical Association. Withholding and withdrawing life-prolonging treatments. 2nd edition. *BMJ Books*, London 2001.
- 3 Luce JM, Prendergast TJ. The changing nature of death in the ICU. In: Curtis JR, Rubenfield GD (Eds). *Managing death in the intensive care unit. Oxford University Press* 2001: pp 19–29.
- 4 Lautrette et al. A Communication Strategy and Brochure for Relatives of Patients Dying in the ICU. *New Engl J Med* 2007;**356**:469–478.



10.5

Perceived benefits of intensive care follow up clinic

Dr C Waldmann

Why do this audit?

We should do this audit as part of an assessment of the value of an intensive care follow up clinic to those who attend with a view to improving the lives of patients who survive to be discharged from hospital after critical illness.

Best practice: research evidence or authoritative opinion

About 70% of patients admitted to intensive care in the UK survive to leave hospital.¹ Recovery following intensive care is frequently prolonged, complicated and incomplete. The case for follow up and rehabilitation has been made in publications from the National Audit Commission² and the Department of Health³ and more recently in a NICE Guideline.⁴ Intensive care follow up clinics may have an important role in improving the lives of patients recovering from critical illness through recognition of associated problems and referral to appropriate specialists. The clinic can play a significant role in patients' re-integration into work and family life. On the other hand there is evidence that a supervised, self-help rehabilitation programme may be equally effective.⁵ (This article could be a useful source of ideas for audits relating to quality of life after intensive care).

This audit took the form of a postal survey completed by attendees at the well established intensive care follow up clinic at the Royal Berkshire Hospital.⁶ The clinic offers appointments at 3, 6 and 12 months post discharge from hospital. There was a 96.7% response rate to 204 questionnaires. 93.1% of responders found the clinic beneficial. Being able to discuss problems directly with a consultant, piecing together the story of their illness, sometimes by writing a diary, and being able to understand what had happened to them were important themes in the responses.

Suggested indicators

All patients discharged from hospital following a stay in intensive care.

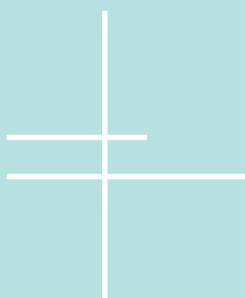
Proposed standard or target for best practice

- D 100% of patients discharged from hospital after critical illness should be offered the opportunity to attend an intensive care follow up clinic at 3, 6 and 12 months.
- D 100% of patients who attend the follow-up clinic should be asked to complete a questionnaire about their perceptions of the clinic.

Suggested data to be collected

This audit included four main questions regarding patients' perceptions of the follow up clinic:

- 1 Did you feel you benefited from attending the follow up clinic?
- 2 Which aspects of care at the clinic did you find beneficial?
 - ◆ Having questions answered
 - ◆ Revisiting the ICU
 - ◆ An opportunity to discuss problems
 - ◆ Helping the ICU staff
 - ◆ Compiling a diary of your ICU stay
 - ◆ Referral to other specialties
 - ◆ Counselling
- 3 If you did not find the clinic beneficial how would you make it more beneficial?
- 4 Would you recommend the follow up clinic to a friend or relative?



Common reasons for failure to meet standard

- ⓓ Intensive care unit does not have a follow up clinic.
- ⓓ Failure to track patient hospital discharge dates.

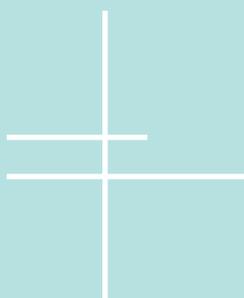
CPD and Curriculum mapping

CPD matrix codes: **1105, 2C07**

Syllabus for the CCT in Intensive Care Medicine: **Domains and section 7.1**

References

- 1 Casemix Programme, ICNARC (Intensive Care National Audit and Research Centre). <http://www.icnarc.org>.
- 2 Critical to Success. The place of efficient and effective critical care services within the acute hospital. *Audit Commission*, London 1999.
- 3 Comprehensive Critical Care. A review of adult critical care services. *DH*, London 2000 (<http://www.doh.gov.uk/nhsexec/compcritcare.htm>).
- 4 NICE Clinical Guideline 83. Rehabilitation after critical illness. *NICE*, London March 2009 (<http://guidance.nice.org.uk/CG83>).
- 5 Cuthbertson BH et al. The PRaCTICaL study of nurse led, intensive care follow-up programmes for improving long term outcomes from critical illness: a pragmatic randomised controlled trial. *Br Med J* 2009;**339**:bmj.b3723.
- 6 Waldmann C, Gager M. Quality rehabilitation and follow-up after critical care. Chapter 4, Critical Care Focus No 15, 'Quality in Critical Care'. Ridley S (Ed). *Intensive Care Society*.



10.6

Compliance with best practice guidelines for the insertion and care of central venous catheters

Ms C Rochester

Why do this audit?

Bloodstream infections associated with the insertion and subsequent care of central venous catheters (CVCs) are a significant cause of morbidity. Implementation of a guideline to support best practice for insertion and ongoing care can reduce the incidence of infective and other complications associated with CVCs.

Best practice: research evidence or authoritative opinion

Bloodstream infections associated with CVC insertion are a major cause of morbidity.¹ The adoption of guidelines for their insertion and ongoing care reduce the risk of infection in intensive care.² The Department of Health commissioned the EPIC group at Thames Valley University to produce a set of guidelines for the prevention of healthcare associated infections (HCAI), in particular catheter-related bloodstream infections.³ The DH initiative, 'Saving Lives: reducing infection' provides an audit tool for assessing the success with which the guideline is implemented.⁴

The main components of the action plan are:

- D implementation of hand hygiene training
- D feedback of audit data to all staff after each audit cycle
- D ongoing assessment of sepsis associated with central venous catheters in conjunction with the department of microbiology
- D plan for re-audit.

Matching Michigan is a quality improvement project based on a model developed in the United States which, over 18 months, saved around 1,500 patient lives. Linking technical interventions of changes in clinical practice and non-technical interventions such as leadership, teamwork and culture change has been shown to reduce central venous catheter bloodstream infections (CVC-BSIs). This quality improvement programme, introduced by the National Patient Safety Agency (NPSA) in 2009 has had high levels of participation across English Intensive Care Units.⁵

Suggested indicators

All patients who have a central venous catheter inserted after admission to intensive care.

Proposed standard or target for best practice

There are two parts to this audit: 1. insertion and 2. ongoing care.

- D 100% of patients who have a central venous catheter inserted while in intensive care should be enrolled to both parts of the audit.
- D Compliance with the guideline components for CVC insertion in 100% of lines.
- D Compliance with the guideline components for CVC ongoing care in 100% of lines.
- D No patient should be enrolled to the first part if their central venous catheter was inserted in a location outside intensive care where observation of the procedure and data collection may be unreliable. However, these patients could be enrolled for the second part as a separate cohort if data pertaining to infection rates is to be collected.

Suggested data to be collected

A comprehensive structured package of standardised data collection tools is available to download through the Matching Michigan project on the NPSA website.⁶

Part one: insertion

Compliance with the following audit components in 100% of lines:

- D Personal protective equipment (PPE)
- D Hand hygiene pre-patient contact
- D Facemask and goggles
- D 2% chlorhexidene skin prep
- D Aseptic technique
- D Hand hygiene post-patient contact
- D Documentation of the procedure.

	<p>Part two: ongoing care</p> <p>Compliance with the following audit components in 100% of lines:</p> <ul style="list-style-type: none"> D Hand hygiene prior to handling the CVC D Site inspected and condition documented D Dressing dry and intact D Aseptic technique when accessing lumens D Connections changed as per unit protocol.
<p>Common reasons for failure to meet standard</p>	<ul style="list-style-type: none"> D Limited awareness of the extent of the problem. D CVCs inserted in emergency situations. D Delay in training new staff. D Lack of supervision.
<p>CPD and Curriculum mapping</p>	<p>CPD matrix codes: 1E01, 2C01, 2C04, 3A13</p> <p>Syllabus for the CCT in Intensive Care Medicine: Domains and sections 5.9, 5.10, 11.2, 11.6</p>
<p>References</p>	<ol style="list-style-type: none"> 1 Smyth ETM. Third prevalence survey of healthcare associated infections in acute hospitals in England 2006. Summary of Preliminary results. <i>Hospital Infection Society</i> 2007 (http://www.his.org.uk). 2 Pronovost P et al. An intervention to decrease catheter related bloodstream infections in the ICU. <i>New Engl J Med</i> 2006;355:2725–2732. 3 Pratt RJ et al. Epic2: National evidence-based guidelines for preventing healthcare associated infections in NHS hospitals in England. <i>J Hosp Infection</i> 2007;65:S1–S64 (http://www.epic.tvu.ac.uk/PDF%20Files/epic2/epic2final.pdf). 4 National Resource for Infection Control (NRIC). Saving Lives – High Impact Interventions. Central venous catheter high impact intervention – insertion. Central venous catheter high impact intervention – ongoing care (http://hcai.dh.gov.uk/files/2011/03/CVC_Insertion_High_Impact_Intervention_090810.xls). 5 Matching Michigan. NPSA, London 2009 (http://www.nrls.npsa.nhs.uk/resources/collections/matching-michigan accessed 5 May 2012). 6 Matching Michigan Data collection tools. NPSA London 2009 (http://www.nrls.npsa.nhs.uk/resources/collections/matching-michigan/?entryid45=65615 accessed 5 May 2012).

10.7 Timeliness of antibiotic administration in septic shock

Dr S Baxter, Dr S Hutchings, Dr T Barnes

Why do this audit?

Duration of hypotension before initiation of effective antimicrobial therapy is a critical determinant of survival in human septic shock. Survival in septic shock is improved if antibiotics are administered early.¹

Best practice: research evidence or authoritative opinion

Kumar's paper showed that survival in septic shock was 79.9% if antibiotics were administered within 1 hour of the patient becoming hypotensive. Each subsequent hour without antibiotics decreases survival by 7.6%. Only 50% of septic shock patients received antibiotics within six hours and the median time to administration of antibiotics was six hours.¹ The surviving sepsis campaign stipulates the administration of antibiotics as soon as possible and preferably within the first hour of recognition of sepsis or septic shock.² This was endorsed by data published subsequently by the surviving sepsis campaign in 2010 which demonstrated a reduction in hospital mortality associated with a number of strategies including taking blood cultures before early administration of antibiotics.³

This audit retrospectively examined the management of patients with suspected septic shock admitted to intensive care over two three month periods before and after the introduction of a sepsis protocol which included a practice guideline and improved microbiology input. Definitions of sepsis, septic shock and hypotension were those of the surviving sepsis campaign.

Suggested indicators

All patients with a diagnosis of suspected septic shock from the following criteria:

- D SEPTIC SHOCK: Sepsis with hypotension despite adequate fluid resuscitation.
- D Sepsis: Presence or assumption of infection and a systemic inflammatory response.
- D Hypotension:
 - MAP < 65mmHg
 - Systolic BP < 90mmHg
 - Systolic BP 40mmHg lower than baseline
 - Persisting despite fluid resuscitation (2L)
 - Lasting more than 1 hour or recurrent

Proposed standard or target for best practice

- D 100% of patients with suspected septic shock should receive antibiotic therapy appropriate to their diagnosis within 1 hour of the onset of hypotension.
- D 100% of patients with suspected septic shock should have blood cultures drawn before administration of antibiotics.

If no culture sensitivities available, empirical antibiotics should be given in accordance with local microbiological guidelines.

Suggested data to be collected

- D Patient diagnosis, time of confirmation of sepsis/septic shock.
- D Time blood cultures taken.
- D Time antibiotics administered.
- D Duration of hypotension before antibiotics administered.
- D Patient location at time of diagnosis.
- D Patient outcome.

Common reasons for failure to meet standard

- D Limited awareness of the problem on general wards.
- D Infrequent measurement of blood pressure.
- D Non-measurement of mean arterial blood pressure.
- D Failure to review potentially septic patients.
- D Indecision regarding appropriate antibiotics.

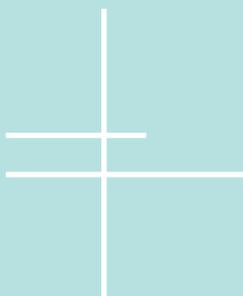
CPD and Curriculum mapping

CPD matrix codes: **1A02, 1E01, 2C03**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 1.1, 2.4, 3.9, 4.1, 4.2**

References

- 1 Kumar A et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med* 2006;**34(6)**:1589–1595.
- 2 Dellinger R et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock. *Crit Care Med* 2008;**36(1)**:296–327.
- 3 Levy MM et al. Surviving sepsis campaign: Results of an international guideline-based performance improvement program targeting severe sepsis. *Crit Care Med* 2010;**38**:367–374.



10.8

Ensuring best practice in patients with severe traumatic brain injury

Dr J Joss, Dr S Crofts

Why do this audit?

Severe Traumatic Brain Injury (TBI) is a major cause of morbidity and mortality and a common reason for admission to ICU.

Evidence for best practice in the management of severe TBI is reviewed and published by the Brain Trauma Foundation¹ and is found within many local policies and guidelines.

Despite the availability of guidelines, work has shown that we lack consistency in the application of best practice.²

Care bundles have been adopted as a means of improving patient outcomes.

Evidence exists that grouping evidence-based interventions together as a bundle results in a more consistent application of best practice.

An audit of the management of patients ventilated for severe TBI using the methodology of applying a 'bundle' would allow an assessment of whether best practice is being applied to those patients.

Best practice: research evidence or authoritative opinion

IHI methodology² should be applied in the creation and adoption of the bundle. The components of the bundle should be locally agreed.

Each patient ventilated for severe TBI should have:

- D A target for PaO₂ defined
- D A range of PaCO₂ defined
- D A temperature range defined
- D A threshold for ICP that would prompt active treatment
- D A defined range for Cerebral Perfusion pressure.

PaO₂: Analysis of research data by the BTF states that PaO₂ < 60mmHg (8kPa) is associated with increased mortality.³ However data does not exist that would define safe thresholds. Units must define what PaO₂ values they wish to target.

PaCO₂: There is evidence that prophylactic hyperventilation should be avoided.³ Evidence for the target range for CO₂ varies with expert opinion. A target of 4.5 kPa would be generally accepted and practised by leading neurocritical care centres.⁴

ICP thresholds: Current data supports 20mmHg to be the upper threshold at which treatment should be initiated to reduce ICP (level II evidence BTF).¹

CPP targets: 60mmHg. There will be no universally correct CPP target and individual targets may be set based on assessment of cerebral autoregulation and other markers of cerebral oxygenation. In the absence of other data it is likely that target CPP should be between 50–70 mmHg.¹

A temperature target should be defined: Temp < 37.5°C. Whilst the role of prophylactic hypothermia remains controversial, expert opinion would support the active maintenance of normothermia as a standard of care.^{1,5}

Suggested indicators

- D Percentage of patients who meet the inclusion criteria (all patients ventilated with a severe traumatic brain injury) in whom all elements of the bundle are applied or actively excluded.

Proposed standard or target for best practice

- D There should be at least 95% compliance in applying or actively excluding all components of the locally agreed care bundle.

Suggested data to be collected

Based on expert opinion and national guidelines individual components may be modified and agreed locally.

These may be easily applied to the patient's records in the form of a sticker and reviewed at the start of each day shift, e.g.:

- D PaO₂ > 11 kPa
- D PaCO₂ 4.5–5 kPa
- D Temperature <37°C
- D Documentation of agreed ICP limits ___20___mmHg
- D Documentation of agreed CPP target ___60___mmHg.
- D Data collection sheet recording compliance with bundle.
- D Run charts to allow real time feedback to clinicians (data collection sheet available on the College website)

Common reasons for failure to meet standard

- D Failure to agree local guidelines.
- D Failure to understand and use PDSA methodology to drive improvement in patient safety.

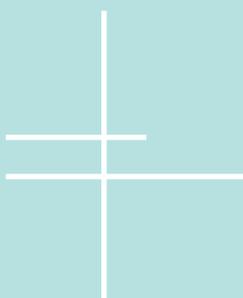
CPD and Curriculum mapping

CPD matrix codes: **Level 2, all domains**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections: 1, 1.5, 3, 3.6, 6, 6.3, 7, 7.3, 10, 10.1**

References

- 1 Guidelines for the Management of Severe Traumatic Brain injury, 3rd edition. *Brain Trauma Foundation* 2007 (<http://www.braintrauma.org/coma-guidelines/btf-guidelines/>).
- 2 Institute of Healthcare Improvement (<http://www.ihl.org/knowledge/Pages/HowtoImprove/default.aspx>).
- 3 Jones PA et al. Measuring the burden of secondary insults in brain injured patients during intensive care. *J Neurosurg Anesthesiol* 1994;**6**:4–14.
- 4 Hutchison PJ, Kirkpatrick PJ. Acute Head Injury for the Neurologist. *J Neurol Neurosurg Psychiatry* 2002;**73**(supp):i3–i7.
- 5 Helmy A, Vizcaychipi M, Gupta AK. Traumatic Brain Injury: Intensive care management. *Br J Anaesth* 2007;**99**(1):32–42.



10.9

Audit of inadvertent hypothermia in intensive care patients

Dr A Wong, Dr J Masters, Dr G Morgan

Why do this audit?

Inadvertent hypothermia is associated with physiological effects that can lead to adverse outcomes. These include cardiovascular instability, bleeding and wound infection.¹ Inadvertent hypothermia is common.²

Best practice: research evidence or authoritative opinion

A NICE guideline³ defines hypothermia as a core temperature below 36°C. NICE advocates that patients should not be discharged from the operating theatre recovery area to the ward if hypothermic and they should have their temperature monitored on the ward. If found to be hypothermic, forced air warming devices should be applied.

The quoted incidence of inadvertent hypothermia amongst ICU patients is high (>50%).^{1,4,5} Karapillai et al¹ carried out a large retrospective audit of over 5,000 patients and concluded that inadvertent hypothermia amongst ICU patients is not only common but is also associated with increased patient mortality and morbidity. There was an increased incidence of cardiac events, bleeding, wound infection and longer hospital stay.

We conducted a retrospective audit of all patients admitted to the intensive care unit between January and June 2010.² Temperature measurements are routinely recorded on admission to the ICU and throughout their stay. Patients who were being cooled for therapeutic reasons were excluded from the analysis.

Suggested indicators

D All patients admitted to intensive care are at risk of hypothermia.

Proposed standard or target for best practice

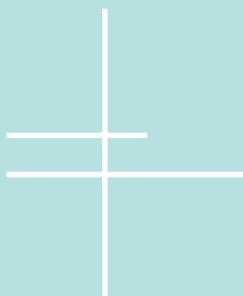
- D 100% of patients admitted to intensive care have their core temperature measured and recorded hourly.
- D 0% of patients are allowed to become inadvertently hypothermic.
- D 100% of patients admitted to intensive care have access to a suitable warming device, preferably a warm air blower.

Suggested data to be collected

- D Core temperature of the patient on admission to intensive care.
- D Core temperature of the patient hourly following admission to intensive care.
- D Temperature of the room in the bed space.
- D Documentation of use of air warming device.

Common reasons for failure to meet standard

- D Lack of awareness that inadvertent hypothermia is a problem.
- D Inability to provide patient warming devices.



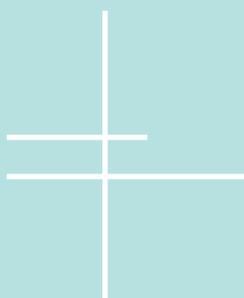
CPD and Curriculum mapping

CPD matrix codes: **IB04, 2C01, 2C03-04, 2F01, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 6, 7.1**

References

- 1 Karapillai D et al. Inadvertent hypothermia and mortality in postoperative intensive care patients: retrospective audit of 5050 patients. *Anaesthesia* 2009;**64**(9):968–972.
- 2 Wong A, Masters J, Morgan G. Inadvertent hypothermia on a general intensive care unit – an audit of NICE Guidelines in over 500 patients. Poster presentation. Intensive Care Society State of the Art Meeting 2010.
- 3 NICE Clinical Guideline 65. Perioperative hypothermia (inadvertent). *NICE*, London 2008. (<http://publications.nice.org.uk/inadvertent-perioperative-hypothermia-cg65> accessed 7 May 2012).
- 4 Kongsayreepong S J et al. Predictor of Core Hypothermia and the Surgical Intensive Care Unit. *Anesth Analg* 2003;**96**:826–833.
- 5 Adalha FJ et al. Hypothermia in a surgical intensive care unit. *BMC Anesthesiology* 2005;**5**:7–16.



10.10

Audit of tracheal tube length and tip position in ventilated patients

Dr P McQuillan, Dr G Morgan

Why do this audit?

To ensure consistency of practice in ensuring that tracheal tubes in ventilated patients are correctly sited.

Best practice: research evidence or authoritative opinion

In patients admitted to intensive care ventilated, tracheal tubes may have been inserted cut to an anticipated satisfactory length or uncut. They may have been inserted in a variety of locations in the hospital as planned procedures or as emergencies. Uncut, the tube may be placed in a bronchus. Cut tubes may be too short and risk inadvertent extubation. The method of securing tubes may not be reliable. The chest X-ray is considered the gold standard to assess the correct position of the tip of the tube in the trachea but this may change if the position of the patient is changed. Capnography may ensure that the tube is not in the oesophagus but provides little guidance on accurate placement in the trachea. There is inconsistent opinion as to whether the length of the tube inside the patient should be measured from the teeth or the lips. A literature search produced only one study in adult practice offering guidance on the correct length of tracheal tubes.¹ This study of patients in the operating theatre concluded that the length of tube inserted alone was a satisfactory guide, but was more reliable when combined with auscultation and observation of chest movement. In paediatric practice a number of studies have allowed the development of helpful formulae to estimate the appropriate length of a tracheal tube. Some of the dimensions from older children could be extrapolated to adults.²

In this intensive care unit the length of the tracheal tube inside the patient is measured and recorded. However, an audit of the position of the tip of tracheal tube in adults ventilated in intensive care showed considerable daily variation in the length of the tube from that recorded as correct. Following the audit an action plan was implemented. The main components are identified below as targets for best practice.

Suggested indicators

All adult intubated and ventilated patients in intensive care.

Proposed standard or target for best practice

- D In 100% of male patients, at intubation, the tube length inside the patient measured from the front upper incisors should be 23 cms.
- D In 100% of female patients, at intubation, the tube length inside the patient measured from the front upper incisors should be 21 cms.
- D In 100% of patients the intubating physician should confirm that there is air entry into both lungs using a stethoscope.
- D In 100% of patients the intubating physician should confirm equal movement of both sides of the chest by direct observation.
- D In 100% of patients capnography should be used to confirm that the tube is not in the oesophagus.
- D In 100% of patients a chest radiograph taken at 45° head up tilt should confirm the position of the tip of the tube mid way between the vocal cords and the carina.
- D In 100% of patients the tube length inside the patient measured from the teeth should be recorded during each nursing shift.

Suggested data to be collected

- D Length of tracheal tube inside patient measured from the upper incisors.
- D Confirmation of auscultation of chest.
- D Confirmation of movement of the chest.
- D Confirmation of use of capnography.
- D Confirmation of position of tube on X-ray.

Common reasons for failure to meet standard

- ⓓ Lack of awareness of potential problem.
- ⓓ Failure to complete documentation.

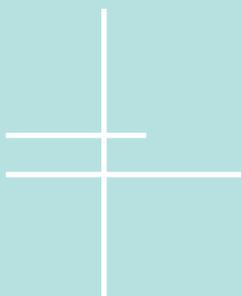
CPD and Curriculum mapping

CPD matrix codes: **1B04, 1C02, 2A06–08, 2A11, 2C01–02, 2C04–05, 2F01, 2F03, 2D07, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections: 3.8, 4.6, 5**

References

- 1 Sitzwohl C et al. Endobronchial intubation detected by insertion depth of endotracheal tube, bilateral auscultation, or observation of chest movements: randomised trial. *Br Med J* 2010;**341**:c5943.
- 2 Morgan GAR, Steward DJ. A preformed paediatric orotracheal tube design based on anatomical measurements. *Can Anaesth Soc J* 1982;**29**(1):9–11.



10.11

Incidence and management of new onset atrial fibrillation in patients admitted to intensive care

Dr R Henderson, Dr K Longman, Dr G Morgan

Why do this audit?

New onset atrial fibrillation (AF) occurs in about 10% of patients admitted to intensive care and may have an adverse effect on a number of outcome measures.^{1,2,3} We should do this audit to assess the incidence of new onset AF in critical illness, its contribution to adverse outcome and to establish an action plan for its recognition and management.

Best practice: research evidence or authoritative opinion

There is no specific best practice for the management of AF in critically ill patients. However, new onset AF is associated with increased severity of illness, increased incidence of sepsis, cardiovascular instability, acute kidney injury and risk of death. Risk factors for the development of AF associated with critical illness include: older age, blunt thoracic trauma, shock, the use of pulmonary artery catheters and previous treatment with calcium channel blockers.² In non-critically ill patients, treatment directed at restoring sinus rhythm shows no benefit over that directed at controlling heart rate.⁴

An agreed local action plan in Portsmouth includes formal documentation of new onset AF and implementation of a plan for investigation and treatment.

Suggested indicators

All patients admitted to intensive care in sinus rhythm who subsequently develop AF.

Proposed standard or target for best practice

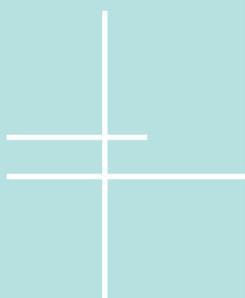
- D Recognition and determination of likely cause of new onset AF in 100% of cases.
- D ECG on admission to intensive care in 100% of cases.
- D Echocardiograph to assess ejection fraction in 100% of cases.
- D Documentation of treatment of rate or rhythm in 100% of cases.
- D Documentation of control of rate or rhythm in 100% of cases.
- D Record of outcome of patients with new onset AF.
- D Explicit arrangements for follow up of AF after discharge from ICU.

Suggested data to be collected

- D ECG of all patients admitted to intensive care.
- D Echocardiograph in patients with new onset AF.
- D Number of patients developing AF while in intensive care.
- D Day of intensive care admission when AF developed.
- D Ejection fraction of patients echoed.
- D % of patients with new onset AF who received specific treatment for rate control.
- D % of patients with new onset AF who received specific treatment for rhythm control.
- D % of patients restored to sinus rhythm.
- D % of patients deemed treated successfully.
- D Outcome in patients with new onset AF in ICU.

Common reasons for failure to meet standard

- D Lack of awareness of the incidence and clinical significance of new onset AF.
- D Failure to specifically record incidence of new onset AF.
- D Lack of consensus regarding treatment options.



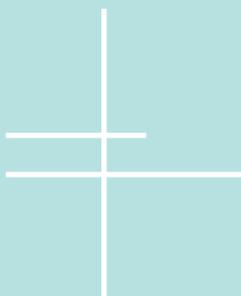
CPD and Curriculum mapping

CPD matrix codes: **2A07, 2C01**

Syllabus for the CCT in Intensive Care Medicine; **Domains and sections: 3.1, 2.1, 2.3, 5.1 I**

References

- 1 Pinski SL. Atrial fibrillation in the surgical intensive care unit: Common but understudied. Editorial. *Crit Care Med* 2004;**32**:3,890.
- 2 Goodman S, Shirov T, Weissman C. Supraventricular Arrhythmias in Intensive Care Unit Patients: short and long-term consequences. *Anesth Analg* 2007;**104**:880–886.
- 3 Segouin P et al. Incidence and risk factors of atrial fibrillation in a surgical intensive care unit. *Crit Care Med* 2004;**32(3)**:722–726.
- 4 Freudenberger RS et al. Comparison of rate versus rhythm control for atrial fibrillation in patients with left ventricular dysfunction (from the AFFIRM study). *Am J Cardiol* 2007;**100(2)**:247–252.



10.12

Therapeutic hypothermia after cardiac arrest

Dr B Harris, Dr D Pogson

Why do this audit?

Therapeutic hypothermia following out-of-hospital cardiac arrest has been shown to reduce mortality and improve clinical outcomes.^{1,2} Practical difficulties associated with therapeutic hypothermia after cardiac arrest include patient selection, starting cooling in other locations such as the emergency or cardiology department and achieving target temperatures during subsequent management. A local guideline was put in place following a review of practice in Portsmouth in 2008³ to standardise the procedure and to set out criteria for selecting patients for treatment. This audit provides the means to assess whether a guideline for the implementation of therapeutic hypothermia is properly implemented and to assess outcome after therapeutic cooling following cardiac arrest.

Best practice: research evidence or authoritative opinion

It was recommended by the International Liaison Committee on Resuscitation in 2003¹ that:

- D Unconscious adult patients with return of spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32–34°C for 12–24 hrs when the initial rhythm was VF
- D Such cooling may be beneficial for other rhythms or in-hospital cardiac arrest.

Local audit in Portsmouth in 2008 set out criteria for implementing therapeutic cooling and to resolve issues regarding cooling in locations outside intensive care, as well as addressing difficulties in achieving target temperatures using surface cooling.

Suggested indicators

All patients who present having suffered a cardiac arrest from VF.

Inclusion criteria for cooling:

- D Witnessed cardiac arrest in VF/VT of known duration with return of spontaneous circulation in or out of hospital.
- D Unconscious patient with no response to pain or eye opening.
- D Blood pressure of at least 90 mmHg systolic maintained without fluids or inotropes.

Exclusion criteria for cooling:

- D Other cause of coma.
- D Known terminal illness.
- D Valid DNAR (do not attempt resuscitation) status.
- D Pre-existing coagulopathy or haemorrhage.
- D Isolated respiratory arrest with no cardiac arrest.
- D Refractory shock unresponsive to inotropes.
- D Unwitnessed cardiac arrest of unknown duration, PEA or asystolic arrest should be cooled only after discussion with intensive care consultant in charge.

Proposed standard or target for best practice

- D 100% of patients with cardiac arrest where VF is the presenting rhythm should be cooled if they meet the three inclusion criteria.
- D 100% of patients should start their cooling in the emergency or other department.
- D 100% of patients cooled should achieve their target temperature within 4 hrs of cardiac arrest.
- D 100% of patients cooled should achieve target temperatures for a minimum of 12 hours.
- D 0% of patients cooled should have a temperature recorded that is less than 31°C.
- D 0% of patients should have a temperature of more than 38 °C in the 48hrs after return of spontaneous cardiac output.

Suggested data to be collected

- D Time of cardiac arrest.
- D Location of patient at time of cardiac arrest.
- D Rhythm producing cardiac arrest.
- D Duration of interval between cardiac arrest and return of spontaneous circulation.
- D GCS following return of spontaneous circulation.
- D Core temperature at time of arrest and at hourly intervals subsequently.
- D Duration of interval between cardiac arrest and admission to intensive care.
- D Method of cooling before admission to intensive care.
- D Method of cooling in intensive care.
- D GCS at discharge from intensive care.
- D Clinical outcome at discharge from intensive care.

Common reasons for failure to meet standard

- D Use of surface cooling, e.g. ice packs, cold fluids, wet sheets and fans. An intravascular cooling device is more effective.
- D Failure to commence cooling in the emergency department and to ensure it is continued if the patient is transferred to the intensive care unit via another department such as cardiology.

CPD and Curriculum mapping

CPD matrix codes: **IB04, 2A04, 2C04, 2F01**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections: 1.2–1.4**

References

- 1 Therapeutic hypothermia after cardiac arrest. International liaison committee on resuscitation advisory statement. *Circulation* 2003;**108**:118–121.
- 2 Hypothermia after cardiac arrest study group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *New Engl J Med* 2002;**346**(8):594–556.
- 3 Pogson D. Hypothermia after Cardiac Arrest Clinical Guideline 2008. Department of Critical Care, Queen Alexandra Hospital, Portsmouth, PO6 3LY.



10.13

Dose of haemofiltration prescribed and administered in critically ill patients

Dr R Greer, Dr A Manara

Why do this audit?

The volume of haemofiltration fluid administered may not equate to that prescribed. It may be difficult to assess what proportion of the prescribed filtration dose has actually been administered on a daily basis or over a number of days.

Best practice: research evidence or authoritative opinion

Unpredictable filter failure leads to interruptions in treatment while the machine is reprimed.¹ It is still unclear what the most effective dose of haemofiltration is.² A multi-centre prospective randomised controlled trial showed that, in critically ill patients with renal failure, there was no reduction in mortality when treated with continuous veno-venous haemodialfiltration (CVVHDF) at a dose of 40 ml/kg/hr compared with 25 ml/kg/hr.³ In the unit where this audit was completed, the standard dose was 35 ml/kg/hr.

This audit chose an arbitrary target for haemofiltration of 30 ml/kg/hr and retrospectively reviewed the intensive care charts of 23 patients receiving renal replacement therapy for a total of 170 days. The results of the audit showed that:

- D the mean dose of haemofiltration prescribed was 39.6 ml/kg/hr.
- D the mean dose of haemofiltration achieved was 35.7 ml/kg/hr.
- D the mean dose achieved was 83.6% of that prescribed.
- D the median hours of haemofiltration achieved daily was 16 hrs.

The audit concluded that patients received inadequate filtration on 36% of days but over the total time of filtration most were filtered over the target of 30 ml/kg/hr.

Suggested indicators

All patients receiving renal replacement therapy on the intensive care unit.

Proposed standard or target for best practice

- D An 'ideal' haemofiltration rate of 30 ml/kg/hr should be prescribed in 100% of cases.
- D An 'ideal' haemofiltration rate of 30 ml/kg/hr should be achieved in 75% of cases.
- D A haemofiltration rate of at least 25 ml/kg/hr should be achieved in 100% of cases.
- D Haemofiltration for 16 hrs per day should be achieved in 100% of cases.
- D The main points of the action plan following this audit were to improve the haemofiltration prescription and record and to ensure that the patient's weight was documented.
- D A separate audit of the causes of filtration failure could also be considered.

Suggested data to be collected

- D An audit record should be created.
- D Renal replacement therapy prescription to include:
 - D patient weight
 - D prescribed filtration rate
 - D daily filtration volume prescribed
 - D daily filtration volume achieved
 - D percentage of prescribed achieved
 - D cumulative filtration balance over days.

Common reasons for failure to meet standard

- D Unpredictable malfunction and downtime of filters.
- D Failure to record patient weight.
- D Failure to document prescribed filtration rate.
- D Failure to keep accurate fluid and filtration records.

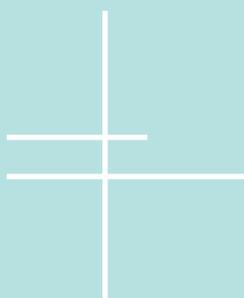
CPD and Curriculum mapping

CPD matrix codes: **1B04, 2C04, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 3.4, 4.1, 4.7**

References

- 1 Uchino S et al. Continuous is not continuous; the incidence and impact of downtime on uraemic control during continuous veno-venous haemofiltration. *Intens Care Med* 2003;**29**:575–578.
- 2 Bellomo R et al. Intensity of continuous renal replacement therapy in critically ill patients. *N Engl J Med* 2009;**361**:1627–1238.
- 3 Ronco C et al. Effects of different doses in continuous veno-venous haemofiltration on outcomes of acute renal failure; a prospective randomised trial. *Lancet* 2000;**355**:26–30.



10.14

Reducing volume of blood lost through sampling

Dr N Arora, Dr C Lowrie, Dr P Nightingale

Why do this audit?

Because the volume of blood drawn from intensive care patients during the course of their illness may render them anaemic. The requirement for blood transfusion may be associated with adverse outcomes.

Best practice: research evidence or authoritative opinion

It has been evident for many years that repeated blood sampling causes anaemia.¹ More recent studies confirm the high prevalence of anaemia and blood transfusion unrelated to acute bleeding in intensive care patients and an association between blood transfusion and organ failure and mortality.^{2,3}

This audit, completed in Manchester, showed that the mean volume of blood drawn per patient per day was 42.6 ml (19.3–65.0ml) with a mean volume of discard of 14.6 ml (6.0–22.5mls). The audit identified the volumes of blood required for a range of investigations.

Following the audit an action plan was compiled. It was proposed that a reduction in blood taken for tests could be achieved through the introduction of 'non-discard' arterial line sets and by keeping a record of tests requested to avoid duplication. The additional cost of the 'non-discard' sets was offset by savings on syringes, swabs and other disposables.

Suggested indicators

Patients admitted to intensive care.

Proposed standard or target for best practice

- D Documentation of the volume of blood drawn daily for tests in 100% of patients.
- D Documentation of all tests requested to avoid same day duplication in 100% of patients.
- D Non-discard arterial lines to be used in 100% of patients.

Suggested data to be collected

- D Volume of blood drawn from intensive care patients daily.
- D Volume of blood discarded daily.
- D Sequential haemoglobin values.
- D Record of duplicated and unnecessary blood tests.
- D Number of units of blood transfused for anaemia caused by non-acute bleeding.

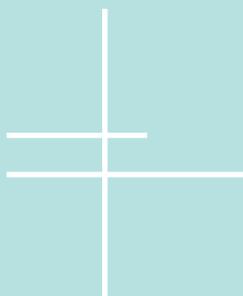
Common reasons for failure to meet standard

- D Lack of awareness of the extent of the problem.
- D Medical and nursing shift patterns and poor communication contributing to duplication of requests for investigations.

CPD and Curriculum mapping

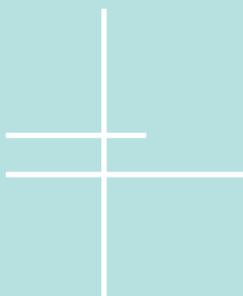
CPD matrix codes: **2C01, 2C07, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 11.2**



References

- 1 Burnum JF. Medical vampires. *N Engl J Med* 1986;**314**:1250–1251.
- 2 Vincent JL et al. Anemia and Blood Transfusion in Critically Ill Patients. *J Am Med Assoc* 2002;**288**(12):1499–1507.
- 3 Sakr Y et al. Anaemia and blood transfusion in a surgical intensive care unit. *Crit Care* 2010;**14**:R92 (<http://ccforum.com/content/14/3/R92>).



10.15

Compliance with the Department of Health guideline on taking blood cultures

Dr R Butchart, Dr I Welch, Dr J McNicholas

Why do this audit?

Poor technique when taking blood cultures may lead to contamination of samples and an incidence of false positive results estimated to be in the region of 10%. This may complicate and compromise the quality of patient care through the unnecessary or inappropriate prescription of antibiotics. The Department of Health (DH) has produced guidance to establish best practice.¹ We should do this audit to ensure that those taking blood cultures are properly trained in the technique and that the risk of contamination is minimised.

Best practice: research evidence or authoritative opinion

Best practice is set out in the Department of Health publication, 'Taking Blood Cultures, A summary of best practice'¹ which is part of 'Saving Lives: reducing infection'.²

Local implementation of the DH guideline in Portsmouth suggested that it could be simplified in terms of evidence base and ease of use without compromising its valuable purpose. An action plan as a result of the audit included a training programme and compilation of a simplified guideline. Repeated audits should demonstrate improved compliance with the guideline and a reduction in the incidence of reports of likely contamination (false positives) of blood cultures.

Suggested indicators

All patients from whom peripheral blood cultures are taken.

Proposed standard or target for best practice

- D 100% of those taking blood cultures have read the summary of best practice.
- D 100% of those taking blood cultures have been trained in the technique.
- D 100% of blood cultures taken according to DH guideline for best practice.
- D 0% false positive blood cultures reported by microbiology service.

Suggested data to be collected

Phase 1

- D Direct observation of blood culture procedure by auditor and assessment against DH guideline.
- D Enquire whether the operator has read the DH guidelines.

Phase 2

- D Provide guideline and supportive education to all blood culture takers on the unit including recording that they have read and understood the guideline, including demonstrating the technique using a mannequin.
- D Re-observe blood culture procedure, assessing against DH guideline.
- D Enquire whether the blood culture taker has been trained and read the guidelines.

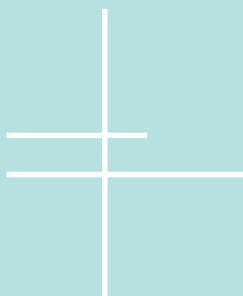
Common reasons for failure to meet standard

- D Failure to record results of blood cultures.
- D Ignorance of the existence of the guidelines.
- D Lack of training in the technique.

CPD and Curriculum mapping

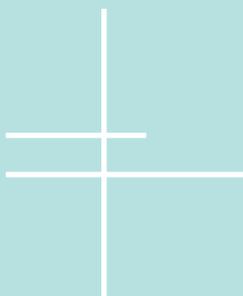
CPD matrix codes: **IE01, 2C03, 3A13**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 4.2, 11.2, 11.6**



References

- 1 Taking blood cultures: A summary of best practice. *DH*, London 2007 (http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_078118.pdf accessed 5 May 2012).
- 2 Saving Lives: reducing infection, delivering clean and safe care. *DH*, London 2007 (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_124265).



10.16

Time taken to insert an arterial line

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Why do this audit?

Trainees sometimes take a long time to successfully insert an arterial cannula (range 2–60mins). Consultants had no information apart from personal experience to suggest a suitable target time or the best cannula in use. Long times for arterial cannula insertion are associated with multiple attempts, patient discomfort, demoralisation among trainees, non-cost effective use of their time and interruption of other aspects of patient care.

Best practice: research evidence or authoritative opinion

A literature search generated no evidence to suggest a reasonable time for arterial cannulation. Authoritative opinion from a cohort of 10 consultants with regular practice of the technique suggested that it should be possible to site an arterial cannula in five minutes.

The audit was conducted in two phases, the first auditing performance before the introduction of a training programme and a purpose designed arterial cannula. During the second phase, all arterial cannulation devices apart from a purpose designed device were removed from stock. Performance of trainees improved between the first and second phases.

Evidence from this audit of practice of insertion of arterial cannulae by trainees concluded that successful cannulation of the radial artery by a trainee could be achieved within 10 minutes in 70% of cases. Success was achieved with one cannula in 53% of cases and using a second in an additional 33%.

Improvement in performance was associated with the introduction of a training programme, stable position of the wrist in an extended position and use of a purpose designed cannula.

The components of the action plan put in place on completion of the audit were:

- D Implementation of a training programme for new trainees.
- D Adoption of a purpose designed cannula.
- D Adoption of a purpose designed pack with adhesive window drape for the radial artery.

Suggested indicators

All patients in intensive care having an arterial line inserted.

Proposed standard or target for best practice

- D A target time of 10 minutes for siting an arterial cannula in the radial artery measured from the time of opening the pack in 100% of cases.
- D Aseptic technique used in 100% of cases.
- D Local anaesthetic infiltrated into insertion site in 100% of cases.
- D Successful cannulation of the radial artery at the wrist at the first attempt in 60% of cases.
- D Successful cannulation of the radial artery at the wrist in two attempts in 75% of cases.
- D Successful cannulation of the radial artery at the wrist using one cannula in 60% of cases.
- D Successful cannulation of the radial artery at the wrist using two cannulae in 90% of cases.

Suggested data to be collected

- D Date and time of procedure.
- D Identity of patient.
- D Use of sterile technique.
- D Use of local anaesthetic.
- D Correct position of wrist.
- D First choice of insertion site: R-radial, L-radial.
- D Type of cannula.
- D Time taken to insert cannula in minutes from skin prep to completion.
- D Number of attempts for successful cannulation.
- D Number of cannulae used.
- D Site of final cannulation.
- D Type of cannula finally inserted.

**Common reasons
for failure to meet
standard**

- ⓓ Failure to implement training programme.
- ⓓ Failure to use aseptic technique.
- ⓓ Incorrect choice of cannula.
- ⓓ Failure to position and sterilise wrist.

**CPD and Curriculum
mapping**

CPD matrix codes: **1A03, 2C01–03, 2C07**

Syllabus for the CCT in Intensive Care Medicine: **Domains and sections 1.1, 2.5, 2.7, 3.3, 3.8, 3.9, 4.4, 5.8, 6.2**

