Critical care outreach: rationale and development

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Key points

Patients needing HDU care may be found on ordinary hospital wards.

Such patients may be identified using objective criteria.

Early detection of deterioration may prevent cardiac arrest and pre-empt emergency admission to intensive care.

Rapid response by critical care outreach teams (CCOT) prevents further deterioration.

Critical care outreach teams export ICU/HDU skills direct to the patient and have an educational and supportive role to ward staff.

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The demand for intensive care unit (ICU) beds seems to be ever increasing. The reasons for the increased demand include increased hospital activity, new developments in medical and surgical techniques, greater patient/relative expectations, decreasing levels of staffing on ordinary wards and increasing specialisation of staff leading to unfamiliarity with the practical aspects of treating critically-ill patients.

The provision of ICUs is a costly and scarce resource and admission to, and discharge from, ICU and/or high dependency units (HDU) has been the subject of Department of Health guidelines since 1996. These guidelines apply clinical indicators of organ dysfunction and objectively identify the patients who require either ICU or HDU support. The problem is that we can now identify patients who, while meeting these criteria, are being managed on general wards that cannot provide the required level of support. These patients fall into a 'gap' in care. While some patients become ill on the wards, others are prematurely discharged from ICU or HDU to make room for the admission of even sicker patients. There is evidence that these patients have a higher mortality.

The provision of more ICU beds and staff is too simplistic an approach. In reality, it is limited by availability of funds and the shortage of trained staff. For the problem at hand, the immediate response to prevent deaths must involve the export of critical care skills beyond the ICU to any area within the hospital where such patients exist. This is the fundamental concept of critical care outreach.

Critical care outreach – who needs it?

The most easily identified patients are those discharged from ICU. This is particularly important if the patient has been discharged at night when the risk of death is increased by up to 70%. Causes of this include premature discharge from the ICU and poorer quantity and quality of care at night, both during the transfer and at the destination.

Patients may also receive sub-optimal care prior to admission to ICU. A confidential inquiry into quality of care before admission to ICU suggested that 50% of patients had received substandard care on the ordinary wards prior to admission and approximately 40% of ICU admissions were potentially avoidable. The main causes of sub-optimal care were organisational failings, lack of knowledge, failure to recognise critical illness, poor supervision and reluctance to seek advice. An analysis of 40 UK medicolegal claims relating to patients admitted with acute medical emergencies found that junior doctors failed to recognise severity of illness or attempted to manage the severely ill without calling for senior help in >60% of cases. If senior clinicians had seen the patients shortly after admission, critical errors would have been avoided in over half of the cases. It has also been shown that patients admitted from ordinary wards had a higher mortality than patients admitted to ICU directly from accident and emergency or operating theatres, suggesting sub-optimal care on ordinary wards.

We require a system whereby ward-based doctors and nurses are trained to recognise those patients who are severely ill, at risk of deteriorating and need a higher level of care. The Department of Health criteria, listed below, have categories of organ system support, which may be used to aid identification of such patients:

Advanced respiratory support

- Mechanical ventilatory support (excluding mask continuous positive pressure (CPAP) or non-invasive ventilation).

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- Possibility of sudden deterioration in respiratory function requiring immediate intubation and mechanical ventilation.

Basic respiratory monitoring and support

- Need for more than 40% oxygen.
- Possibility of progressive deterioration to the point of needing advanced respiratory support.
- Need for physiotherapy to clear secretions at least 2 hourly.
- Patients recently extubated after a prolonged period of intubation and ventilation.
- Need for mask CPAP or non-invasive ventilation.
- Patients who are intubated to protect their airway but do not need ventilation.

Circulatory support

- Need for vaso-active drugs.
- Support for circulatory instability due to hypovolaemia from any cause unresponsive to modest volume replacement.
- Patients resuscitated after cardiac arrest where ICU or HDU care is considered clinically appropriate.

Neurological monitoring or support

- Central nervous system depression sufficient to suppress airway and protective reflexes.
- Invasive neurological monitoring.

Renal support

- The need for acute renal replacement therapy.

These are 'after the event' criteria and not really useful for identifying patients who are acutely deteriorating. However, they may be used as an assessment tool for determining the prevalence of patients at risk outside the ICU/HDU environment. In a prospective 30-day audit (prior to the development of a surgical HDU), the surgical wards in our own hospital yielded 154 patients who met these criteria for admission to ICU or HDU. In an earlier audit of our post-ICU discharge deaths, 1062 patients were discharged alive from ICU over a 2-year period and 90 of these died without referral for re-admission. Thirty-one of these patients would have fulfilled published criteria for re-admission to ICU but, at the time, were not considered for re-admission. Thus, there is a need for a change in education and mind-set of all staff to help detect deterioration and development of sensitive criteria to detect deterioration.

Can patients at risk be identified?

There are a number of common clinical features in patients who present prior to cardiac arrest. An American study analysed the clinical features present in 64 consecutive cardiopulmonary arrest patients over a 4-month period in a 1200 bed hospital. The majority had respiratory abnormalities and a respiratory rate elevated significantly above normal was the most common feature. Lack of information was not the problem, but there was a failure to recognise that certain clinical signs are antecedents to cardiac arrest. Therefore, although a high respiratory rate was recorded, no action was taken to treat the problem. In the UK, a similar pattern of early warning events has been reported during the pre-admission phase of ICU patients and respiratory rate, pulse and haemoglobin oxygen saturation have been found to be the most important physiological indicators of critical illness. In other studies, it has been shown that the cardiac arrest rate in former ICU patients is more than twice that of other in-patients and > 50% of arrests can be predicted by signs or symptoms.

Thus, it should be possible to formulate a series of physiological 'tripwires' which mark the limits of abnormality beyond which a response aimed at preventing further deterioration should be triggered. Such systems should be reliable, sensitive, specific and user friendly to ensure they are used consistently and effectively. The system has to be 'sold' to all grades of staff and must, once invoked, invariably produce a response from the team providing critical care outreach. The first report of such a system, the medical emergency team (MET), was published in 1995. Others have followed, notably the patient at risk team (PART), early warning score (EWS), modified early warning score (MEWS) and critical care liaison service (CCLS). All these systems have formulated abnormal physiological or clinical tripwires which trigger a critical care outreach team (CCOT) response. In addition to physiological variables, many systems use criteria to focus attention onto specific high-risk groups or clinical conditions. Focus criteria vary widely from system to system but often include: (i) cardio-respiratory arrest; (ii) depressed level of consciousness;

Table 1 Critical care outreach team (CCOT) scoring system

Score	3	2	1	0	1	2	3
HR	<40	41–50		51–100	101–110	111–129	≥130
RR	≤8			9–14	15–20	21–29	≥30
Temp	<35			35–38.4		38.5–39	>39
Sys. BP	<80	81–90	91–100	101–199			≥200
CNS				Alert	Voice	Pain	Unconscious
Urine (ml h^{-1})	Nil	<20					>400

(iii) post-ICU discharge; (iv) pancreatitis; (v) postoperative after major surgery; (vi) multiple trauma; and (vii) any patient causing concern to medical, nursing or physiotherapy staff.

In Nottingham, we use a CCOT scoring system shown in Table 1.

How does the team work?

The aims of the team include: (i) prevention of deterioration on the wards to the point where severe morbidity or death is likely to occur; (ii) follow-up of ICU patients after discharge; and (iii) enabling liaison between wards and ICU.

The team must be able to intervene using a range of skills in a competent and effective manner. Such skills are most often acquired through long practice in the ICU environment and, consequently, outreach practitioners should come from an ICU background. The team must be multi-disciplinary, consisting of nurses and physiotherapists backed up by appropriately skilled medical staff. Outreach is not solely about medical treatment; it has an educational and supportive role aimed at encouraging and developing ward-based skills. The nursing and physiotherapy members must be capable of independent practice, good teachers and communicators with a commitment to the concept of outreach. For this reason, we feel that it is better to recruit team members specifically rather than simply designating a nurse from the ICU shift, unless one can be sure that each shift will have an appropriate person. The team members must continue to have exposure to ICU practice to prevent 'skills fade'. The medical staff providing back up to the nurses and physiotherapists should also possess similar qualities. Ideally, the team should consist of specifically trained ICU nurses and physiotherapists with medical support from a senior ICU doctor and a junior trainee.

The initial call-out of the team may be provoked by focus criteria (see above) alone or by a numerical score above a certain level. Focus criteria enable direction of scoring systems to patients most likely to benefit from them. This prevents the CCOT from being swamped with unnecessary calls and the ward staff from the pointless task of undertaking scoring on patients who are not in any danger. The Nottingham system uses risk scoring guidelines (Table 2) to specify which patients should be scored.

Table 2 CCOT risk scoring guidelines

CCOT risk scoring should commence on the following patients:

Any patient:

- Following surgery (all large incisions)
- With peritonitis
- With pancreatitis – NBM, IVI and urinary catheter
- With obstructive jaundice post-PTC
- Following ITU/HDU discharge
- With chest injury – rib fractures, fractured sternum or lung contusions
- **OR at any time when the patient's condition causes concern**

The following patients should be referred immediately to CCOT/ITU and CCOT risk scoring should be commenced:

Any patient:

- With a compromised airway
- With GCS = 12
- On > 60% O_2 **OR** with progressive increases in O_2 requirements
- With arterial blood gas analysis showingpH ≤ 7.2 or ≥ 7.55

  PaO_2 < 8.0 kPa
  $PaCO_2$ > 6.5 kPa
- **OR at any time when urgent help is needed**

In our hospital, a team of 4 nurses (2 G grade, 2 F grade) and 2 physiotherapists provide an 8 am to 8 pm service Monday to Friday. Out-of-hours, CCOT is provided by the ICU consultants and juniors. Patients managed on the wards who have been entered into the CCOT programme are 'handed over' to the ICU staff each evening. At present, the team only covers surgical patients as our audit work has demonstrated these patients are at greatest risk. The team documentation displays a contact pager and phone number for its members who must respond to all calls in order to retain the credibility of the service. They must remain cheerful in the face of false call-outs!

Do outreach teams work?

Recent investment by the UK Government in the provision of increased critical care services has generated an expansion of

CCOT nursing posts but, as yet, few teams are fully operational. There is no consensus on staffing, activity or outcome end-points to assess effectiveness. Teams are expensive to set up and their members are often recruited from a diminishing pool of highly experienced ICU nurses. Consequently, they must be shown to be effective. Therefore, we are presently auditing the post-ICU discharge re-admission rate, incidence of cardio-respiratory arrest on surgical wards and number of 'emergency' admissions to ICU from surgical wards. In the last 12 months, the main activity for the CCOT system has been ICU follow-up (all areas) and scoring system surveillance from 2 general surgical, neurosurgery and spinal surgery wards and medical high dependency units.

Comparative historical pre-CCOT data based on post-ICU discharge deaths and re-admissions are difficult to interpret without analysis of demographics, severity of illness and rates of premature discharge to ensure comparability. The Nottingham CCOT system has specific documentation to aid the calculation of the CCOT score and an algorithm to help the ward staff respond appropriately.

Conclusions

Critical care outreach teams may help to support patients on the ordinary wards by taking the skills of ICU to the patient. They should not be developed in isolation from a hospital-wide strategy for critical care. This should encompass an adequate number of ICU and HDU beds to meet demand for emergency and elective workload in order to minimise premature discharge. Ward-based nurses should rotate to HDUs to develop their own skills and CCOTs should have an educative and supportive role on the wards as well as providing clinical support. Medical staff on CCOTs must be readily available and capable of providing the necessary clinical input. Medical education must respond to the need for teaching the necessary skills and this process should start at medical school and develop through anaesthesia/ICU pre-registration house-officer posts.

Key references

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See multiple choice questions 94 and 95.