Crisis resource management, simulation training and the medical emergency team

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Principles of the medical emergency team

Recently there has been increased focus on improved detection and management of deteriorating patients in Australian hospitals. Several studies have revealed that about 10% of hospital admissions are associated with adverse events, many of which are unrelated to the patient’s underlying medical condition. Other studies have shown that, in the period leading up to the development of such events, there are objective signs of deterioration, such as derangement in the patient’s vital signs or increased oxygen requirements. In response to these observations, Lee and colleagues developed the medical emergency team (MET) model for responding to clinical deterioration.

The MET is activated by hospital ward staff when a patient fulfils objective criteria for deterioration that are primarily based on vital signs. In addition, there is typically a criterion for activation based on staff concern alone. The MET is summoned when there is a mismatch between the acute needs of a deteriorating patient and the ward resources available to assess and treat this deterioration.

About two-thirds of Australian hospitals with intensive care units report having a MET or MET equivalent, and several studies report increased use of the service with time. Common conditions associated with MET calls include heart failure, sepsis and arrhythmias.

A recent study of 39 Australian MET services revealed that regular ICU consultant involvement in the MET was infrequent, confirming registrar perceptions of an earlier survey. In 7/39 teams, the most senior member did not have skills in advanced airway management. Furthermore, existing evidence suggests that few systems have dedicated resources, implying that the task of responding to MET calls is often added to the role of caring for ICU patients. In addition, there may be variable support for the concept of the MET principle, given that a third of ICU-equipped hospitals report not having a MET or MET equivalent.

Combined, these observations suggest that the typical apprentice model applied for teaching how to assess and manage critically ill patients in the ICU appears not to be applied during management of MET patients. In addition, it suggests that training of MET staff may need to be tailored to individuals’ experience level and skill set, and that criteria for MET staff to escalate care to ICU and other consultants may also be needed.

There is currently no agreed model for training medical team leaders in management of MET calls. International models for training MET members may not apply to typical health care systems in New Zealand and Australia. A training approach applicable to regional rapid response systems must take into account the variability in seniority and skill set of the medical team leader. It should also consider the tasks required in managing a MET patient, and the multiple communication episodes involving MET members, ward staff, the patient and the patient’s relatives.

ABSTRACT

Recently there has been increased focus on improved detection and management of deteriorating patients in Australian hospitals. Since the introduction of the medical emergency team (MET) model there has been an increased role for intensive care unit staff in responding to deterioration of patients in hospital wards. Review and management of MET patients differs from the traditional model of ward patient review, as ICU staff may not know the patient. Furthermore, assessment and intervention is often time-critical and must occur simultaneously. Finally, about 10% of MET patients require intensive care-level interventions to be commenced on the ward, and this requires participation of non-ICU-trained ward staff.

To date, the interventions performed by MET staff and approaches to training responders have been relatively under investigated, particularly in the Australian and New Zealand context. In this article we briefly review the principles of the MET and contend that activation of the MET by ward staff represents a response to a medical crisis. We then outline why MET intervention differs from traditional ward-based doctor–patient encounters, and emphasise the importance of non-technical skills during the MET response. Finally, we suggest ways in which the skills required for crisis resource management within the MET can be taught to ICU staff, and the potential benefits, barriers and difficulties associated with the delivery of such training in New Zealand and Australia.
What is a crisis and how does it apply to the MET model?

The Oxford English Dictionary defines “crisis” as “a time of intense difficulty or danger”, “a time when a difficult or important decision must be made” and “the turning point of a disease when important changes take place, indicating either recovery or death”. Patients subject to a MET response or fulfilling MET criteria have an in-hospital mortality rate of about 25%,23-25 and about 10% will require admission to the ICU.23,24 It is not surprising, therefore, that the requirement for a MET response has been described as a crisis,21 as the patient is at risk of imminent harm15 or death.26 In all circumstances, there is a “disparity between what care a patient is receiving and what care he or she requires emergently”.15

The physiological instability that defines the typical MET patient results in a situation that is substantially different from the routine ward-based doctor–patient encounter (Table 1). The traditional medical approach to problem-solving (Figure 1a) is not sufficient for crisis management, as it involves the sequential or serial acquisition of information, and the primary aim is to formulate a differential diagnosis and then institute a management plan. Such a traditional response may also involve serial review by increasingly senior and more specialised medical staff.

In contrast, during MET review, an integrated and parallel model is required — one that prioritises correction of deranged physiology, emphasises simultaneous assessment and management, and promptly assembles a team of appropriate responders (Figure 1b). As with other crises, effective performance of multiple simultaneous tasks requires the coordinated efforts of a team of clinicians rather than an individual. Successful teamwork relies on agreed team objectives and defined roles for each member.27 However, achieving clarity of team function is problematic in the MET environment, for several reasons.

Firstly, the wide range of clinical conditions that instigate MET calls generates variable initial priorities. For example, in a surgical patient who develops tachycardia and hypotension 6 hours after laparotomy, exclusion of haemorrhage will be the primary objective. In contrast, in a medical patient who is admitted with urosepsis and presents with
similarly deranged physiology, a quite different set of issues and priorities will be generated. The tasks required of each MET member and the order in which these tasks are conducted may therefore vary between MET activations, even if the physiological trigger is the same. Furthermore, the ultimate or end objective of the MET response may vary significantly: in 10% of patients, therapy will be escalated to ICU-level care, while in up to 30%, aggressive intervention may be deemed futile or inappropriate and end-of-life care planning may be implemented. Accordingly, the ultimate aim may be to restore physiological normality or to provide comfort care, and patient disposition may vary considerably between cases. Such undifferentiated scenarios differ from situations such as a failed-intubation algorithm, where the approach and ultimate aim is relatively uniform between cases.

The second major impediment to coordinated team function during MET review relates to the ad-hoc nature of each MET call, resulting in different responders on the team at different times of day, on different days of the week, and in different locations. Thus, there are limited opportunities for team building, particularly in large hospitals. MET membership is usually drawn from several professional disciplines, and the perspective of each member is influenced by his or
her training and experience. For such disparate individuals to function effectively as a team, they need to complete a number of formative steps wherein interpersonal relationships evolve, boundaries are agreed to and a team structure or hierarchy is established. A lack of team cohesion is particularly problematic during the MET response, as ward-based staff may be unfamiliar with requirements for commencing ICU-type therapies at the bedside.

A further barrier to effective team functioning relates to the complex, time-pressured nature of the MET scenario, difficulties in acquiring and analysing important information, and subsequent decision making. Availability of information may range from sparse (in recently admitted patients) to overwhelming (in those with prolonged admission). Furthermore, available information may be biased by assumptions and labels attached to the patient by previous practitioners. MET patients may deteriorate not only due to progression of the original diagnosis, but also as a result of iatrogenic complications or an entirely unrelated disease process. Management of the medical crisis often requires the pooling of cognitive resources of multiple people, frequently from several disciplines. The optimal team possesses a shared awareness of the situation and a shared decision-making process that may provide some protection against the inherent risk of error related to the time-critical, high-stakes environment.

Additional sources of stress arise from the fact that many MET calls occur out of hours, when staffing is lowest. Furthermore, team members typically have other responsibilities for continuous patient care that must be put on hold to respond to the call. There are no data on whether this potential conflict of priorities affects behaviour or decision making, but it seems logical that there is a strong potential for interruptions to arise during the MET response.

Finally, the members of the MET may not have all of the necessary technical skills to manage all MET interventions, such as endotracheal intubation. Thus, the therapies that can be offered by the MET may

<table>
<thead>
<tr>
<th>System</th>
<th>Knowledge</th>
<th>Technical skill/task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway</td>
<td>Airway assessment and anatomy</td>
<td>Jaw thrust/chin lift</td>
</tr>
<tr>
<td></td>
<td>Signs of obstruction</td>
<td>Oral suction using Yankauer sucker</td>
</tr>
<tr>
<td></td>
<td>Intubation/secure airway</td>
<td>Insertion of oropharyngeal airway</td>
</tr>
<tr>
<td></td>
<td>Safe use of different airway devices</td>
<td>Insertion of nasopharyngeal airway</td>
</tr>
<tr>
<td></td>
<td>Management of tracheostomy tubes</td>
<td>Changing of tracheostomy tubes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insertion of ETT</td>
</tr>
<tr>
<td>Breathing</td>
<td>Assessment of patient with hypoxia, hypercarbia or respiratory distress</td>
<td>Examination of respiratory system</td>
</tr>
<tr>
<td></td>
<td>Knowledge of different oxygen delivery systems</td>
<td>Bag-valve mask ventilation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insertion of intercostal catheter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prescribing non-invasive ventilation</td>
</tr>
<tr>
<td>Circulation</td>
<td>Management algorithms for basic and advanced life support</td>
<td>Examination of cardiovascular system</td>
</tr>
<tr>
<td></td>
<td>Assessment and management of:</td>
<td>Insertion of venous cannulae</td>
</tr>
<tr>
<td></td>
<td>Hypotension</td>
<td>Insertion of arterial cannula</td>
</tr>
<tr>
<td></td>
<td>Arrhythmias</td>
<td>Taking of ABG (single stab)</td>
</tr>
<tr>
<td></td>
<td>Volume status</td>
<td>Appropriate CVC insertion</td>
</tr>
<tr>
<td></td>
<td>Peripheral perfusion</td>
<td>Performance of CPR</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>Performance of safe defibrillation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid administration</td>
</tr>
<tr>
<td>Neuromuscular</td>
<td>Assessment of:</td>
<td>Examination of nervous system</td>
</tr>
<tr>
<td></td>
<td>Consciousness</td>
<td>Lumbar puncture</td>
</tr>
<tr>
<td></td>
<td>Delirium</td>
<td>Assessment of epidural blockade</td>
</tr>
<tr>
<td></td>
<td>Focal neurology</td>
<td>Assessment of spinal sensory and motor level</td>
</tr>
<tr>
<td></td>
<td>Pain</td>
<td>Joint examination</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Assessment of acute abdominal pain</td>
<td>Examination of abdomen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insertion of NGT</td>
</tr>
<tr>
<td>Renal</td>
<td>Assessment of patient with:</td>
<td>Insertion of urinary catheter</td>
</tr>
<tr>
<td></td>
<td>Oliguria</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acute renal failure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chronic renal failure</td>
<td></td>
</tr>
<tr>
<td>Investigations</td>
<td>Universal precautions for sample collection</td>
<td>Bedside interpretation of test results:</td>
</tr>
<tr>
<td></td>
<td>Risks and benefits of transporting unstable patient for imaging (eg, CT, MRI)</td>
<td>Blood tests</td>
</tr>
<tr>
<td></td>
<td>MRI safety principles</td>
<td>Other pathology tests</td>
</tr>
<tr>
<td></td>
<td>Differential diagnoses for laboratory abnormalities</td>
<td>Imaging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preparing and monitoring of unstable patient for safe transport</td>
</tr>
<tr>
<td>Prescribing</td>
<td>Indications, contraindications and potential side effects of a broad range of medications</td>
<td>Titration of vasoactive medications</td>
</tr>
<tr>
<td></td>
<td>Altered pharmacology in the acutely unwell patient</td>
<td>Safe preparation and administration of intravenous medications</td>
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<td>Blood product administration</td>
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ABG = arterial blood gas. CPR = cardiopulmonary resuscitation. CT = computed tomography. CVC = central venous catheter. ETT = endotracheal tube. MET = medical emergency team. MRI = magnetic resonance imaging. NGT = nasogastric tube.
differ between hospitals (and even between shifts in the same hospital). Accordingly, training may need to be tailored to the skill sets of MET members. In situations in which the clinical scenario requires skills or knowledge that are beyond the capabilities of the MET members, the crisis continues until new resources are obtained to match the needs. Ideally, team members should recognise these situations and have a plan, agreed in advance, to assemble the necessary resources (Figure 2, Table 2). An a priori acknowledgement of the MET skill set establishes realistic expectations of MET capability, and permits an agreed plan to assemble resources when such scenarios are encountered.

Thus, while effective MET performance requires personnel with knowledge of pathophysiology and pharmacology of acute illness and competence in practical skills of critical care, the delivery of such skills in a ward-based medical crisis may require additional expertise. Traditional critical care training focuses on what should be done (technical skills) rather than how it should be done (non-technical skills [NTS]), and a traditional educational approach may lead to poor performance during crisis, even in highly skilled staff.33-36 To understand how ICU registrars may be best trained for the crisis environment of the MET, it is useful to examine the experience of other professional groups exposed to high-pressure, time-critical situations outside their “usual” environment.

Non-technical skills and Crisis Resource Management

In-depth analysis of human performance in high-stakes situations was pioneered and refined by the aviation industry when human factors (rather than equipment failure) were found to be the most common cause of serious accidents.37-40 Suboptimal performance among highly trained pilots was not always the result of lack of knowledge or deficiency in technical ability, but often due to shortcomings in communication, leadership, situational awareness, decision making and/or teamwork. These so-called “non-technical skills” became a key component of pilot training and were integrated into everyday operations with the introduction of a system known as cockpit resource management (CRM).41,42 Training in NTS was subsequently introduced into numerous other industries, and the word “cockpit” in CRM was replaced with “crisis” (crisis resource management) to reflect a move away from aviation while retaining the original principles (Box 1).

The importance of NTS in health care was recognised by anaesthetists,43 who developed the first formal medical NTS training course. Anaesthesia crisis resource management (ACRM), which focused on perioperative emergencies, was piloted in 1990.44 The use of NTS training in health care has since been endorsed by the United States Institute of Medicine45 and the US Agency for Healthcare Research and Quality46 as a means of improving patient safety. The NTS model has subsequently been adapted to emergency situations in obstetrics,47-49 paediatrics,50 emergency medicine,51 critical care52 and prehospital care,53 and has been applied in cardiac arrest teams54 and, recently, the MET.35 Additional models that focus on a less hierarchical and more “roles and goals”-based approach have also been developed.55

To implement NTS in health care teams effectively, lessons learned in aviation need to be adapted to the hospital environment.56 Although the core components of NTS identified by the aviation industry are broadly applicable to health care personnel, the cockpit and the ward are not comparable domains. Data from critical incident reports,
surveys, theoretical models and observations of real and simulated crises have therefore been used to develop NTS principles specific to health care. One such health-care-specific classification, the Anaesthetists’ NTS (ANTS) behavioural marker system (Table 3), has been used as a basis for assessment and training of NTS in the operating theatre and intensive care environments.

The major domains of CRM include task management, team working, situational awareness and decision making (Table 3). The individual elements of NTS are not novel and do not serve as a rigid system in which to operate. Instead, they are a set of ideals that, when implemented effectively, create a climate for optimal team performance. Outlining these ideals and integrating them into the ethos of the team provides a framework within which members can be trained and assessed, and establishes a commonly understood system by which to operate.

What are the potential benefits of CRM training for the MET?

Recognising the importance of NTS to the MET has a number of advantages for education and training. Any approach would need to consider the ad-hoc assembly of the team, and which members would require more intensive CRM training. Application of NTS and CRM principles might allow the development of predefined roles and responsibilities of the MET members (Table 2). The term Crisis Team Training has been used to describe this “roles and goals” team-training approach. It differs from CRM in that the staff roles are more predefined. This approach may reduce the workload of the team leader and overcome some of the problems resulting from ad-hoc and infrequent team assembly. Such roles would require some flexibility, depending on team composition, level of experience and the skill set of the assembled team members. A MET may be expected to have a minimum of four, but as many as eight, staff members, depending on staff availability, patient acuity and the time of day (Figure 2). Such training would also emphasise the importance of the ward staff handing over to the arriving MET in a standardised manner.

Principles of CRM training would also teach MET members how to manage a MET call, which would complement the technical skills or roles outlined above. Appreciation of the need for NTS would permit development of resources to teach such skills, and might guide the development of a curriculum for both technical skills and NTS (Table 2). The use of CRM in the MET model, and indeed in clinician training, is still relatively new, and outsiders should anticipate the need to go through the same evolution as occurred in the aviation industry, rather than expecting instant solutions. Thus, for example, NTS might be either delivered as a discrete module or incorporated partly in the MET and partly in other domains of ICU training (e.g., difficult intubation, management of the bleeding patient, advanced cardiac life support). A longer-term goal may be to incorporate components of NTS into all aspects of undergraduate and postgraduate clinician training.

Standardising MET management may also reduce undesirable practice variation by allowing standardisation of equipment, assessment and intervention, as well as handover and communication. It may also assist the development of guidelines or protocols for common conditions encountered during MET review.

Issues surrounding implementation and teaching of non-technical skills

Introduction of NTS to a particular clinical domain first requires evaluation of the specific non-technical issues encountered in that area of practice. This may take the form of evidence-based analyses (such as critical incident reports), questioning techniques (such as focus groups) and observational techniques (of either real or simulated events). While no complete analysis of the non-technical needs of the MET within the Australian health care system has yet been conducted, a wealth of information is available from evaluation of related areas of care, including resuscitation teams, anaesthesia and intensive care medicine. Although these resources provide an initial reference point, there may be a need to more clearly understand the roles and responsibilities of each of the MET members.

To date, teaching of NTS principles has primarily been delivered in specialty-specific courses, many of which follow the format of the original ANTS course (ACRM), combining didactic teaching of NTS principles with immersive simulation exercises. Simulation, as an educational concept, is now considered an integral component of training in acute medical specialties. Simulation allows trainees to learn and develop skills in an environment that reflects reality, with no risk to patients and the opportunity for instruction and feedback from experienced practitioners. The term simulation encompasses a range of educational tools, from easily disseminated computer-based scenarios to simplistic role play to fully immersive simulation with highly technical mannequins in realistic clinical environments. Regardless of the level of technology, high-fidelity (realistic) simulation with clearly defined rubrics is considered important for achieving sustained learning.

Adult learners develop new skills through repeated experience with simulation, allowing repeated exposure to both common and rare clinical scenarios. If conducted well and accompanied by structured and constructive feedback,
simulation has been shown to improve trainee performance and confidence when faced with a similar situation again, and is found to be both beneficial and enjoyable by participants.50,67 Conducting simulation in a team context allows the opportunity for team building and development of interpersonal skills.

Despite the theoretical benefits of team training using simulation for teaching NTS, there are several barriers and risks associated with the process. The lack of consultant-level involvement in MET calls or even MET services is a significant potential barrier to teaching all relevant skills, including NTS. The lack of participation of intensive care consultants in MET events is a lost opportunity for leadership and coaching of NTS in clinical practice. A major obstacle to applying NTS for MET training is the novelty of this field to intensive care medicine. As relatively few intensivists would have trained in an environment of mannequin-based simulation training, they may lack comfort, experience and expertise in this domain.

In addition, costs of training may be prohibitive, particularly for high-end immersive simulation, which requires medical equipment, a mannequin, personnel, simulation programming and facilities. For this reason, simulator equipment may need to be centralised as a shared resource. However, centralisation creates a geographic barrier to attendance by trainees and requires their removal from the workplace for training, with an associated need for back-fill. An alternative to centralised immersive simulation is less intensive, in-situ simulation that is run in the hospital setting.68 But a barrier to this strategy is the requirement for motivated and appropriately trained facilitators, without whom simulation is at best wasteful and at worst detrimental to clinician confidence.59 The feasibility of engaging personnel from aviation and other industries who are familiar with CRM principles might need to be explored.

Thus, while simulation has the potential to impart NTS and facilitate strong individual and team performance within the MET, without clear learning objectives and motivated staff, it risks being expensive and detrimental to staff morale. There is a need to assess the elements of a CRM and simulation training model as it is applies to the MET, and then develop studies to assess the effectiveness of such programs on team performance as well as patient-centred outcomes. Attempts to demonstrate effectiveness of these educational techniques in the field of anaesthesia have proven challenging.43,70

Conclusion

With the advent and promulgation of the MET model of care, advanced intensive care trainees in New Zealand and Australia will increasingly be involved in assessing and managing deteriorating ward patients. The clinical, environmental and interprofessional interactions encountered in MET review differ from traditional doctor–patient encounters not only for ward patients but also for ICU patients. There is a need to further assess the technical and non-technical skills required to provide optimal MET review, and to develop evidence-based, centralised, hospital-specific strategies to teach and implement them.

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