

# Using video audit to improve trauma resuscitation — time for a new approach

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**T**rauma systems development and a systematic approach to the care of the injured have significantly improved outcomes following injury.<sup>1-6</sup> The coordinated reception and resuscitation of patients with major trauma in the hospital phase of care is pivotal to these improvements. Not only do critical resuscitative manoeuvres occur during this phase, but the clinical decisions made establish the basis for further care. The hospital reception and resuscitation of seriously injured patients requires many management decisions in a short space of time. During this phase of care, simultaneous processes proceed at different rates in an unpredictable and changing setting. Evaluation of the airway, ensuring adequate ventilation and the correction of circulatory shock coincide with the diagnoses and treatment of primary and secondary problems. Critical decisions and actions are confounded by the urgency and the variability that characterizes trauma resuscitation. However, even in the best centres, errors continue to contribute to adverse outcomes.<sup>7,8</sup>

## Errors in trauma resuscitation

Not surprisingly, most of the errors that arise during the emergency department/trauma centre phase of care relate to resuscitation.<sup>7</sup> Errors in trauma resuscitation may have little immediate effect but can eventually compromise the final outcome. Failure to intervene and reverse life-threatening conditions during this phase of care may be the result of inexperience, disorganized activity, an inability to recognize priorities, fixation error and failure to realize the complexity of the problem(s). The coordination of multiple activities may be just as critical for patient survival as making the correct diagnoses or performing the most appropriate procedures.

In Australia, the Victorian Consultative Committee 2001/2003 data on road traffic fatalities found that the average number of early management problems contributing to death in fatal trauma cases was at least 50% greater than in other areas of trauma care.<sup>7</sup> Between 2002 and 2003, a mean of 6.09 errors per fatal case were identified in the emergency department management of fatal

trauma cases, with 3.47 errors per fatal case judged to have contributed to death. Most of the errors related to resuscitation. Even in established major trauma services, 23% of deaths were considered preventable or potentially preventable. Most preventable errors occurred not because of ignorance or lack of resources but because the correct therapeutic and diagnostic measures were “not done at the right time, in the right amount or in the right order.”<sup>9</sup> Confounding the interpretation of the reported error rates are nonstandard and nonuniform approaches to care, as well as the retrospective identification of error that may be prone to the subjective assessment of the auditor(s).

Errors that contribute to preventable and potentially preventable death rates are a crude measure of performance<sup>10</sup> and are relevant to a small proportion of the total trauma population.<sup>11,12</sup> Errors that contribute to mortality may also be indicative of errors contributing to morbidity in survivors.<sup>13,14</sup>

Studies of trauma resuscitation have usually examined a single aspect of resuscitation in an attempt to

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lower mortality. Many have ended with equivocal conclusions.<sup>15-23</sup> Not surprisingly, research findings to date have repeatedly demonstrated that it is difficult to measure the impact of a single intervention in a complex, nonstandardized environment with multiple variables.

It is easy to become fascinated by single interventions and new technologies for trauma resuscitation. However, these do not address the major variables in resuscitation, namely, staff experience and team coordination of resuscitation practices.<sup>24</sup>

In an attempt to establish a standardized approach and limit the influence of these human factors, algorithms for trauma resuscitation have been introduced. Advanced Trauma Life Support (ATLS) is used internationally in civilian and military settings to deal with the complexities of the critically injured patient.<sup>25</sup> Although it is generally believed that ATLS has contributed to the overall improvement in the care of patients with trauma and has saved lives,<sup>26</sup> adherence to ATLS protocols is variable<sup>27</sup> and the protocols are quickly forgotten.<sup>28,29</sup>

The reporting of error in the care of patients with trauma has usually noted adherence to ATLS protocols, missed diagnoses, improved outcomes (typically using historical controls) and preventable deaths using cohort comparison.<sup>30-32</sup> The compliance of medical staff with pre-learned guidelines remains problematic.<sup>33,34</sup> The recognition of preventable error and compliance with algorithms is usually retrospective rather than in real time. This can be done by chart review. However, chart review can miss 80% of resuscitation errors identified through video review.<sup>35</sup> The most effective approach currently available is to measure the process of care by "video audit."

### **Video audit as a tool to improve trauma resuscitation**

Video audit has been used in simula-

tion and clinical environments, including primary and hospital care and civilian and military settings.<sup>36</sup> Audiovisual technology has lent itself to a subset of quality improvement in the management of emergency hospital presentations where, regardless of the time of day, continuous raw data may be recorded and available for subsequent audit.<sup>37</sup>

In particular, trauma team reception and resuscitation has been the subject of video audit.<sup>38</sup> Traditional audit methods may not capture the required information. Staff recall when verified by videotapes may not be accurate.<sup>39</sup> Other forms of self-report (anesthetic record, anesthesia quality assurance self-report form and post-trauma treatment questionnaire) may not identify airway management deficiencies uncovered by videotapes of actual care.<sup>40</sup> In addition, direct observation by a third party is likely to provide selective or biased data,<sup>41</sup> whereas chart review<sup>42</sup> may provide limited or incomplete information when compared with the audiovisual record. In 1993, Townsend and coworkers<sup>43</sup> concluded that trauma resuscitations can be improved with ongoing videotape review. The major demonstrable benefits were more efficient use of time, correction of conceptual and technical errors, and improved survival.<sup>43</sup>

It is difficult to measure objectively process changes in the resuscitation environment without video audit. Subjective, retrospective recall following the hectic few minutes of trauma resuscitation is likely to be flawed. Video recordings of trauma reception and resuscitation can be audited using objective criteria or specific performance indicators. This allows the scrutiny of a specific aspect of trauma resuscitation: for example, team leader performance using a validated measurement tool,<sup>37</sup> trauma resuscitation time and time to procedural intervention,<sup>44</sup> and the adequacy of universal precautions during trauma resuscitation.<sup>45</sup>

Videotapes/discs of trauma reception and resuscitation are usually audited using a process based on peer or expert review. This may allow a more global assessment of trauma resuscitations. With this approach, video audit of trauma resuscitation can identify system and process issues in trauma management,<sup>41,46</sup> including the factors underlying, for example, prolonged uncorrected esophageal intubation<sup>39</sup> or thoracostomy tube insertion.<sup>47</sup> It has also been used to assess the impact of ATLS training on trauma resuscitations. A video audit study from a level I United States trauma centre found an initial 23% deviation from ATLS resuscitation principles.<sup>48</sup>

Analysis of multiple video-recorded resuscitations may provide general quality-improvement changes that could reduce frequent trauma resuscitation errors or identify system failures. However, interrater reliability may not be optimal when expert opinion is used to quantify trauma resuscitations.<sup>49</sup> Variability in opinion, along with the resources required to run a video audit program, seems to be a key reason why video audit has not been embraced as a "standard of care." Resource constraints rather than medicolegal concerns appear to be the main reason for trauma centres not using video audit.<sup>50</sup> When combined with a lack of clear, objective and immediate feedback, the result is that few trauma centres routinely use video audit as an error reduction tool.

Unless video audit can be used to verify compliance with pre-agreed algorithms that are prompted to the trauma team in real time, it will remain somewhat subjective and prone to criticism. In addition, identifying errors long after they have occurred provides no immediate benefit to the patient and staff involved. Not surprisingly, given problems with staff acceptance, storage of the data and analysis of the data, video recording has drifted to be a niche subset of

quality improvement in the management of trauma.<sup>37,38</sup>

### Using video audit to measure compliance with computer-generated real-time algorithms

Algorithms for trauma resuscitation in emergency departments have been developed in an attempt to bring uniformity into complex environments that are often characterized by high staff turnover. Studies have demonstrated that formal algorithms encourage consistency, reduce error rates and significantly reduce resuscitation time.<sup>51-55</sup> The most rigorous application of algorithms in clinical decision-making involves rule-based computer systems. A recent study reviewed the use of a computer-based decision aide that used decision rules and logical deduction to generate management plans for the initial, definitive management of injured patients. Its use was confined to assessing penetrating thoracoabdominal injuries in nonpregnant adults. In a preliminary assessment, participants preferred computer-generated, patient-specific protocols for the acute management of injuries. The computer-generated protocols were also associated with improved care and potential improvement in outcome.<sup>56</sup>

In the complex environment of major trauma reception, communication remains problematic. Even when experienced clinicians are involved, communication of significant clinical decisions fails more than 50% of the time.<sup>57</sup> Linking computer-generated prompts via visual and auditory displays within the resuscitation bay may enhance clinicians' interaction and reduce errors of omission and miscommunication. Compliance with the prompts — rather than pre-learned algorithms — can then be reviewed using video audit.

It is time for a new approach to trauma reception and resuscitation. There is evidence that a standardized

algorithmic approach reduces error, real-time prompts increase compliance, and video analysis improves accuracy and compliance. We need to integrate clinical algorithms and point-of-care computer technology and link them to real-time decision-making and team coordination needs.

In Australia, the Victorian Major Trauma Services<sup>58</sup> are developing a scalable and exportable computer-prompted algorithm system for real-time use on patients with major trauma. Compliance will be guided by point-of-care, integrated resuscitation treatment algorithms and real-time computer-generated prompts. These algorithms will define the standard of care for trauma resuscitations in that study. Based on this treatment standard, an objective audit tool can be developed that will measure compliance with prompts and overcome the subjective nature and flawed reliability of expert opinion that has been a critical weakness in preventable-mortality studies and video audit for trauma to date. A video data acquisition system will intermittently overlay patient monitoring data onto the video recording.<sup>59</sup> A prospective, controlled, randomized trial is needed to evaluate the effectiveness of video audit in verifying compliance, error rates and subsequent patient outcomes. The goal is to reduce error through standardized decision-making, leading to a reduction in both preventable mortality and morbidity for patients with major trauma.

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