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LITERATURE REVIEW

Assessing, monitoring and managing continuous intravenous sedation for critically ill adult patients and implications for emergency nursing practice: A systematic literature review

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KEYWORDS

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Summary

Background: Critically ill mechanically ventilated patients in ED have complex needs; chief among these is adequate sedation in addition to effective pain-relief. Emergency nurses are increasingly responsible sedation and analgesia for this complex cohort of patients. The aim of this review was to examine (1) the evidence around assessing, monitoring and managing continuous intravenous sedation for critically ill adult patients, and (2) the implications for emergency nursing practice.

Study design: Systematic review.

Method: The review of literature extended from 1946 to 2013 and examined peer review journal articles, policy and guidelines to provide a more complex understanding of a phenomenon of concern. A total of 98 articles were incorporated and comprehensively examined.

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Results: Analysis of the literature identified several implications for emergency nursing practice and the management of continuous intravenous sedation: workload, education, monitoring and assessing sedation and policy.

Conclusion: Limited literature was found that directly addressed Australasian emergency nursing practices' in managing on-going intravenous sedation and analgesia for patients. Balancing patient sedation and analgesia requires highly complex knowledge, skills and expertise; the degree of education and training required is above that obtained during pre-registration nurse training. No state or national models of education or training were identified to support ED nurses' practices in managing sedation. Little research has addressed the safety of continuous sedation use in ED.

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What is known

- The number of critically ill patients admitted to EDs has increased by over 25%, some of whom require mechanical ventilation and continuous intravenous sedation.
- Emergency nurses working in the resuscitation area are increasingly responsible for the management of analgesia and sedation for critically ill patients, which requires highly developed skills, knowledge and expertise.
- Adequate analgesia and sedation are paramount in optimising comfort, pain-relief and well-being of critically ill patients, who are often inflicted with a wide range of noxious stimuli with limited physiological reserves.

What this paper adds

- There is little research exploring the role of the emergency nurse in managing continuous intravenous analgesia and sedation for critically ill mechanically ventilated patients.
- Research and policy have primarily focused upon the safety and effectiveness of procedural sedation administered in ED.
- Unlike other roles emergency nurses undertake (e.g. Triage), there are no practice standards, education or training programs to support nurses transitioning into the resuscitation nurse role, and to manage of continuous intravenous analgesia and sedation for critically ill mechanically ventilated patients.

Introduction

Two areas of practice involving the use of sedation have emerged within the emergency department setting. The first area concerns procedural sedation to enable patients to tolerate succinct, definitive interventions such as cardioversion, orthopaedic procedures, incision and drainage and insertion of chest drains. The second area involves the critically ill patient group, who often require continuous

sedation to tolerate necessary life-supporting invasive, agitating and painful interventions such as mechanical ventilation and endotracheal intubation.¹ While the incorporation and effectiveness of procedural sedation in ED has been well documented,^{2–6} the safety and effectiveness of continuous intravenous sedation in ED has not.⁷ Emergency nurse are responsible for the continuity of patient care, assessment, monitoring and optimisation of sedation and pain control for critically ill sedated patients. Emergency nursing practice often occurs in isolation due to geographical layout of the resuscitation area and workload demands of other clinicians. Therefore, the safety and effectiveness of continuous intravenous sedation for the critically ill adult patient in ED is dependent on the skill, knowledge and decision-making abilities of the emergency nurse.

Adequate sedation and analgesia are paramount in optimising comfort, pain relief and wellbeing of critically ill mechanically ventilated patients,⁸ who are inflicted with a barrage of noxious stimuli and invasive procedures such as insertion of endotracheal tubes, central venous catheters, indwelling urinary catheters and monitoring devices. Critically ill or injured patients require sedation and analgesia balanced to their needs and physiological tolerances.^{2,6} Within the ED, emergency nurses are increasingly responsible for managing sedation and analgesia of critically ill patients,⁹ therefore the knowledge, skills and expertise of the emergency nurse are paramount for maintaining patient comfort, wellbeing and safety. The aim of this systematic literature review was to examine (1) the evidence around assessing, monitoring and managing continuous intravenous sedation for critically ill adult patients, and (2) the implications for emergency nursing practice. We also define areas of education, research, policy and standards that have not been covered and suggest some potential courses of action.

Review search strategy

The search covered the period from 1946 to 2013. No date or language restrictions were applied. Several search terms were used to identify potential studies concerning the assessment, monitoring and administering continuous intravenous sedation for the critical ill adult (>16 years) patient in ED: 'assessment AND sedation AND emergency department', 'sedation AND emergency department', 'continuous sedation', 'emergency OR nurse AND sedation', 'measuring sedation' and 'sedation scale'. A total of 210 articles

Figure 1 Search results.

were initially identified using the above search terms. After removing duplicate records ($n=35$) 175 articles remained. Of the 175 articles, 77 (44%) were excluded as they lacked relevance to any aspect of the research question. Of the total articles ($n=210$) identified, 98 (47%) were incorporated and comprehensively examined using the Critical Appraisal Skills Program 'Making Sense of Evidence Tools' ¹⁰ (Fig. 1).

Databases accessed

A systematic literature search was conducted using the following databases: Cumulative Index to Nursing and Allied Health Literature, EMBASE, Medline, ProQuest and Science Direct. The Cochrane Library and the National Institute of Clinical Excellence databases were also searched. The review was supplemented with a manual search of reference lists from relevant research studies and grey literature. Grey literature included organisational and professional associations related to emergency, sedation or critical care and Google Scholar. The grey literature was explored for policies, guidelines and recommendations relating to sedation.

Results

The literature review revealed a number of areas of importance relating to the management of critically ill

patients receiving continuous intravenous sedation, which have implications for emergency nursing practice. Analysis of the literature highlighted the highly complex knowledge, skills and expertise required by nurses to safely manage sedation for the critically ill patient, which is above that obtained in pre-registration nurse training. This in turn highlighted the issue of post-registration education and training of emergency nurses in the sub-speciality role of resuscitation nurse; an essential precursor to safely managing sedation for critically ill patients in the resuscitation area. Further analysis of the literature revealed an increased focus on the assessment of sedation with validated observation sedation scoring tools, and that in the absence of their use, it was noted to negatively impact upon the quality of clinician communication and responsiveness to patients' sedation needs.

The emergency nurse and the resuscitation area

Emergency nurses undertake numerous clinical activities, often simultaneously or for multiple critically ill patients while working within the resuscitation area. A recent study by Green et al.¹¹ examined the impact of critical care procedures conducted in the ED. The ED retrospective medical record audit of critical care patients ($n=178$) identified that the majority (80/125, 64%) of procedures related to

endotracheal intubation, insertion of central venous (3/10, 30%) and arterial (14/99, 14%) catheters, and chest tube insertion (4/8, 50%). Green et al. concluded that while critically ill patients were managed in the ED for a considerable length of time (mean 6.5 h, median 4.9 h, range 1.4–28.2 h), critical care ED procedures conducted did not impact on overall patient length of stay. This finding was consistent with other authors.^{12–15}

A study by O'Connor et al.¹⁶ and colleagues calculated nursing care time using the Therapeutic Intervention Scoring System-28 (TISS-28) based on documented resuscitation area clinical interventions. In the retrospective medical record audit of critically ill ED patients ($n=69$) the median TISS-28 score for patients was 19 (range 9–34). One TISS-28 point equates to 10.6 min of each 8 h nurses' shift. Therefore, the range of nursing care time per patient was 95–360 min (1.6–6 h), with a median value of 201 min (3.4 h). The total demand on nursing care time for patients was 13,356 min (222 h, or 9.25 days). Comparatively, in a time-and-motion study examining the impact of critically ill patients ($n=50$) and emergency physician workload, Graff et al.¹⁷ calculated that the median time demand was 32 min (0.5 h) of doctors' time per patient.

Importantly, ED physicians rely on emergency nurses allocated to the resuscitation bay to assess, monitor and initiate care to maintain patient safety and welfare, and consultative input from intensive care medical specialists.¹⁸ In the ED, emergency physicians are unable to provide continuous care to critically ill patients given that they manage the needs of other patients. Therefore, management of critically ill patients and the role of the emergency nurse in providing care is essential to optimising patient outcome and survival.^{19,20} Nonetheless, there is a paucity of literature of how emergency nurses undertake care practices within the resuscitation area for critically ill patients.

Emergency nurses manage critically ill patients for increasing lengths of time in the resuscitation bay until they transfer the patient to the intensive care unit (ICU).^{7,19} In Australia, Carter et al.²¹ retrospectively explored the relationship between ED length of stay (LOS) for critically ill patients ($n=48,803$) and ICU mortality across 45 hospitals. It was noted that the majority ($n=39,470$, 81%) of severely ill patients had a median LOS of 3.9 h (IQR 2.0–6.8) in ED, with nearly one fifth ($n=9,273$; 19%) of patients spending longer than 8 h in the ED prior to transfer to the ICU. In a later prospective study conducted in Brazil, Cardoso et al.²² found a significant ($p=0.002$) increase in mortality for patients delayed in being admitted to ICU. The mortality risk attributable to ICU delay was 30% (95% CI: 11.2–44.8%), with each hour of delay independently associated to an increased risk of ICU death of 1.5% (hazards ratio: 1.015; 95% CI 1.006–1.023; $p=0.001$). These studies demonstrate that critically ill patients are staying longer in ED and so increasing the importance of the role of the emergency nurse given that they provide much of the on-going care while the patient waits to be transferred to ICU.

Many patients while awaiting transfer to an ICU require on-going assessment by emergency nurses to determine care needs. More specifically, emergency nurses will reassess the patient to determine the on-going need for intravenous sedatives, analgesics and or paralysing agents. The literature suggests that the nurse's use of sedatives, analgesics

and paralysing agents is to ensure the comfort and stability of the patient and interventions such as mechanical ventilation. Hence, emergency nurses are relied on to frequently assess for and manage continuous intravenous sedation infusions. The emergency nurse is essential to ensuring the safe management of the critically ill patient receiving continuous intravenous sedation infusions in the ED until the patient is transferred to ICU.²³

Knowledge and skills in managing sedation

The degree of knowledge and skills required to safely manage sedation for a critically ill patient is highly complex, and is an integral part of critical care.²⁴ Sedative agents are administered in an attempt to reduce anxiety and promote comfort. However, managing the sedated critically ill mechanical ventilated patient also requires knowledge and skills in the use of non-invasive and invasive equipment (e.g. mechanical ventilators, arterial lines and syringe drivers), being able to interpret and integrate diagnostic and physiological examination results into clinical decision-making, have a detailed understanding of the role and use of a broad range of pharmacological agents such as sedatives, analgesia, paralysing agents and anticipating and prioritising life-threatening medical problems with limited information and resource management.^{7,8,24} Developing knowledge, skills and expertise therefore demands specialised training and education above that which is provided at a pre-registration level. While a review of the literature identified standardised state-based education programs to support nurses transitioning into emergency nursing practice,²⁵ Triage,²⁶ and the Clinical Initiatives Nurse role,²⁵ no Australian or state-based education programs or professional standards have been published relating to preparing emergency nurses for the role of resuscitation nurse and the critically ill sedated patient. Historically, EDs have developed educational programs to assist nurses to undertake various clinical roles in the absence of formal training programs.^{27–29} Transitioning, the process of assuming and developing into a new role, is commonly experienced by emergency nurses throughout their careers as they achieve certain levels of experience, expertise and competence.³⁰

Transitioning into a new work role has long been identified as a difficult process,³¹ and more recent research demonstrates the process remains daunting.³² Self-directed learning and supervised practice are common approaches used in clinical education to help transitioning practitioners assimilate and apply clinical concepts to new patient care situations.^{33,34} However, such informal approaches are constrained and variable.^{35,36} In addition to developing sufficient levels of knowledge, skills and expertise, developing confidence is a process that requires time and the ability to apply the knowledge, skills and decision-making in an applicable setting.³⁷ As Weinert et al.³⁸ and Guttormson et al.³⁹ demonstrated, obtaining critical care experience prior to transitioning into the role of the resuscitation nurse was associated with increased confidence in managing critically ill patients, and in managing and adjusting sedation and analgesia.

Monitoring sedation in critically ill patients

Critically ill patients' haemodynamic status can change minute-by-minute, and therefore monitoring is a crucial part of the care of the critically ill patient in the ED, as the physiological response to critical illness is linked strongly to outcome. The term 'vital signs' is generally used to describe a set of physiological measures that includes heart rate, blood pressure, respiratory rate, temperature, peripheral oxygen saturation, pain severity/level and level of consciousness. Patient vital signs are commonly used by nurses as a means of providing objective information about a patient's response to sedation.⁴⁰ Vital signs are measured and recorded electronically through monitors attached to the patient, and displayed in continuous real-time on monitors located at each patient's bed space. While emergency nurses rely on evaluating vital sign information to regulate and manage critically ill patients requiring sedation, research suggests that other physiological indicators of sedation are also important. Young⁴¹ argued that the depth of sedation must be individualised to the patient's injuries or condition and sedation needs. If the indication for sedation is one of injury prevention, a lighter state of sedation may be aimed for to allow the patient to communicate with staff.⁴² If the indication for sedation is to facilitate an individual clinical goal, the sedation level may need to be somewhat deeper.⁴¹ For the emergency team achieving and maintaining a specific depth of sedation without jeopardising patient or staff safety, requires significant on-going nursing vigilance.⁴³

Patients' responses to sedation can be unpredictable; not only within and between patient populations, but also within a single hospital stay for an individual patient.^{1,44–46} Hence, the challenge for emergency nurses in maintaining an appropriate depth of sedation suitable to the critically ill patient's needs and metabolic capabilities also requires on-going monitoring of the patient's neurological status.⁴⁷ Emergency nurses therefore require expert skill and knowledge to respond to events such as drug accumulations, minute-by-minute changes in the patient's physiological status, changes in renal, liver and endocrine function and the synergistic or drug-to-drug interactions to increase or decrease the effectiveness of sedation.

Sedation assessment

Intravenous sedation has been associated with higher levels of patient mortality, ranging from 30% to 52%.^{48,49} Excessive administration of intravenous sedation can depress protective airway reflexes such as coughing and gagging, and thereby increase the risk of passive regurgitation and aspiration of gastric contents. Complications and adverse events have been noted to arise from maintaining patients at deeper sedation levels than necessary.⁴⁷ It is therefore critical that emergency nurses, in addition to frequently assessing the physiological state of the patient, also ascertain whether it is sedation that is required or pain relief. Aiken⁵⁰ suggested that the physiological data typically gathered by emergency nurses, may assist in determining

the type and quantity of pharmacological agents to support care practices. Typically, sedation assessment involves gathering information, both physically and physiologically.⁷ Physical information can alert the emergency nurse that the patient requires an alteration in sedation treatment. Examples include: head thrashing and pulling at invasive lines/devices such as intravenous cannula or indwelling urinary catheter. Physiological data provides the means for understanding different components of consciousness that create a more comprehensive overall picture of the patient's sedation level and requirements. Physiological information includes: increased breathing rate, cardiac changes, radiographic data and laboratory findings. Sedation management is highly complex. Undertaking sedation management demonstrates advanced skill and knowledge for understanding how physiological changes may reflect sedation and analgesic patient need.⁵⁰ Further, there is growing evidence to suggest that observational sedation-scoring assessment tools may enhance nursing management of sedation of critically ill patients receiving continuous sedation.

Within the literature, the only common tool used within the ED setting to assess patient depth of sedation was the Glasgow Coma Scale.⁵¹ The GCS however, was not developed to measure sedation but was designed to objectively measure and quantify the prognosis of a brain injured patient.^{52–56} Furthermore, it is not supported within the context of assessing, monitoring and administering sedation.^{57–60} The literature review identified 27 observational sedation assessment tools developed and tested with varying degrees of validity, reliability, responsiveness and applicability in the critically ill patient population. Observational sedation assessment tools have been developed by various authors, and are similar in form and format. The tools rate the level of sedation based upon a single direct observation and interaction with the patient such as in response to applying a noxious stimulus. In the literature review there was no evidence that sedation tools have been developed or tested within the ED setting. However observational sedation-scoring tools have been developed and validated within the intensive care setting, supporting ICU nurses to determine when and how to adjust sedative dosages. Use of sedation-scoring assessment tools in critical care environments has been demonstrated to improve nurse assessment and titration of sedation.³⁹ Further, nurses' attitudes towards the efficacy of sedation for mechanically ventilated patients, their sedation practices and confidence to administer sedation improved when using observation sedation-scoring tools.^{57,61} A key factor that differentiated between those utilising sedation-scoring tools concerned the improved quality of communication between the nurse and physician.⁶² In a recent multicentre ($n=41$), bi-national (Australian and New Zealand) point prevalence study⁶³ of ICU patients ($n=569$) and the assessment and management of analgesia, sedation and delirium, four observational sedation-scoring scale tools were commonly used: Ramsey Sedation Score,⁶⁴ Sedation-Agitation Scale,⁶⁵ Motor Activity Assessment Scale⁶⁶ and the Richmond Agitation and Sedation Scale.⁶⁷ These scales could be explored within the ED setting. Further, by using the same sedation-scoring scale as ICU, continuity of care may be increased.

Sedatives and the critically ill patient

Agitation and anxiety occur frequently in critically ill patients and are associated with adverse clinical outcomes, to which sedatives are commonly administered.⁶⁸ Sedation, as Jacob⁶⁹ described it, is part of a continuum of decreasing levels of consciousness, caused by the effect of sedatives on the brain. Historically, within the ICU setting, benzodiazepines and propofol have been commonly used to sedate critically ill patients. Recent surveys examining sedation practices in ICU demonstrate that midazolam and propofol remain common sedatives of choice in maintaining patient sedation.^{70–74} Sedatives can be titrated to maintain the patient at a light level (i.e. patient is arousable and able to follow commands) or deep sedation (i.e. patient is unresponsive to painful stimuli). Multiple studies^{47,75–88} have examined depth of sedation in relation to several clinical outcomes: duration of mechanical ventilation, ICU length of stay, physiologic/psychological stress. Results of these studies suggest that maintaining critically ill patients at a light level of sedation is favourable compared to deep sedation,^{47,75–79} yet not all studies agreed.^{81,84,85} Three studies demonstrated increased physiologic stress in terms of raised catecholamine levels, and increasing oxygen consumption.^{81,84,85} The clinical significance of this is unclear, as no clear relationship between catecholamine levels and clinical outcomes, such as myocardial ischemia, was reported.^{81–83} The overall quality of evidence examining depth of sedation and physiologic stress is low, and has produced conflicting results. Despite conflicting results, it is currently recommended that critically ill patients should be maintained at a light level of sedation, as the benefits of being lightly sedated appear to outweigh the risks if appropriately titrated.⁴⁹

Inadequate titration of sedatives can lead to increased patient agitation and injury, and decreased patient safety. Patient agitation may result in unplanned self-extubation, increased oxygen consumption, haemodynamic instability, injury to self or others, and an inability to participate in therapeutic interventions (e.g. mechanical ventilation). Agitation is described as excessive restlessness, characterised by non-purposeful mental and physical activity due to internal tension and anxiety.^{69,89} Agitation occurs often in the critically ill or injured patient as a result of inappropriate levels of sedation.^{90,91} However, prompt identification and treatment of other possible causes of agitation, such as pain, delirium, hypoxiaemia, hypoglycaemia, hypotension, or withdrawal from alcohol and other drugs is also important.⁴⁹

To date, the risk of complications and adverse events in relation to critically ill or injured patients receiving on-going intravenous sedation in the ED is largely unknown in Australia.⁷ Critically ill patients, with reduced capacity to independently maintain optimal homeostasis, are vulnerable to deterioration in the presence of improperly managed sedation. The assessment, monitoring and resuscitation skills of the emergency nurses are therefore critical to maintaining appropriate sedation levels for critically ill patients.⁹²

Sedation policies and guidelines for nurses

The American Nurses Association⁹³ recommended that registered nurses who administer and monitor procedural sedation and analgesia be able to identify and differentiate the various levels of sedation; demonstrate the acquired knowledge of anatomy, physiology, pharmacology, cardiac dysrhythmia recognition; detect complications related to moderate analgesia and sedation and appropriately intervene; demonstrate competence in pre-procedural, procedural, and post-procedural nursing care from the initial patient evaluation to patient discharge; anticipate, recognize, and address potential complications during the process; and, understand the medico-legal aspects of procedural analgesia and sedation.

There is however no evidence of any Australian emergency nursing policies and/or standards of practice unlike, the USA^{9,94} and Canada.^{5,95} Conversely, medical guidelines have been published in Australia,⁴⁴ the UK,^{96,97} Canada⁵ and the USA^{9,93,94,98–100} to ensure that sedation is performed with optimal safety for the patient and to diminish risks for medical clinicians.

Discussion

Our review of the literature reveals that the knowledge, skills and expertise required by emergency nurses⁹ to safely balance time-sensitive procedures, medical therapies with pharmacological agents in the presence of patient haemodynamic instability and limited physiological reserves, is highly complex.⁵⁰ Continuity of care for the critically ill patient remains the responsibility of emergency nurses, and is therefore dependent upon the knowledge, skill and expertise of emergency nurses until the patient is transferred to an ICU. The specialised skills, abilities and knowledge necessary to safely care for critically ill or injured patients receiving continuous sedation in the resuscitation bay remain unclear. While obtaining critical care experience prior to transitioning into the role of the resuscitation nurse was associated with increased confidence in managing critically ill patients, and in managing and adjusting sedation and analgesia, this has not been explored within the ED setting. To date, little research has been published focusing upon the practices of emergency nurses managing continuous intravenous sedation for critically ill patients in the ED. Emergency nurses need to be able to assess for and manage the required and appropriate depth of sedation and provision of analgesia for critically ill patients.^{41,47,74} The review identified several validated observational sedation-scoring tools however these have not been trialled in ED. Future research should include exploring the use of an observational sedation-scoring tool within the ED setting.

Current research concerning sedation in ED has largely focused upon procedural sedation conducted with haemodynamically stable patients, physician approach and pharmaceutical choice. Research is needed to examine the use of continuous intravenous sedation in ED, and emergency nursing practices in managing sedation for this complex patient cohort. Nursing clinical practices in managing continuous sedation is highly complex, as such, policy and

education need to be developed to provide guidance and credentialing for what is seen as advance practice.

Limitations

Identification of studies was done by one reviewer and selection bias may need to be considered. Identification and review of the literature, may have resulted in selection bias and this needs to be considered. There may have been a language bias as non-English articles were excluded. However, strengthening this review was the extensive database search and chronological review of literature. While some grey literature was captured by the search strategy, not all may have been identified.

Conclusion

To date, limited literature was found that related specifically to Australasian emergency nursing safety, assessment, monitoring and methods of management for the on-going intravenous sedation of patients. However, balancing the critically ill patient's sedation level appears to be a highly complex activity that is regularly undertaken by ED nurses in a time-sensitive and highly pressured environment. While international tools, policies and guidelines exist to optimise sedation practices, these appear not to be used within Australian emergency settings. While numbers of ED patients receiving continuous sedation has increased, it remains unclear how Australian emergency nurses manage continuous intravenous sedation in the critically ill patient. To date no Australasian policy or guidelines articulate the role of the emergency nurse in managing sedation in the critically ill patient. Yet, it is the emergency nurse that is responsible for the on-going assessment sedation practices for the critically ill patient.

Provenance and conflict of interest

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