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Management of the critically ill patient in the emergency department: focus on safety issues

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Over the past decade there has been an increasing number of critically ill patients treated in emergency departments (EDs) throughout the United States. ED visits increased from 42 million per year in 1960 to over 92 million in 1990 [1]. Today EDs have an average of 100 million annual visits nationally, accounting for 40% of total hospital admissions [1]. Twenty-five percent of those patients admitted are considered critically ill [2]. Lambe and colleagues [3] recently reported that critical visits increased by 59% from 1990 to 1999 in California EDs. There have been many theories attempting to explain the increase in number of critically ill patients in the ED. One of the most reasonable explanations for this observation is the increased life expectancy in the United States is associated with higher numbers of patients with multiple and complex medical problems [4]. A recent study by Fromm and colleagues [5] revealed that approximately 186 days of critical patient care per year are provided in the urban ED setting. This data emphasizes the integral role EDs have in managing critically ill patients.

Not only is the quantity of critically ill patients being evaluated in the ED increasing, but the average length of stay for these patients in the ED is longer than that of the average patient. The increased length of stay of these patients in the ED is multifactorial, and the reasons have not been clearly delineated in the recent literature [6]. Some of the reasons that contribute to an ED length of stay include high levels of acuity, limited hospital bed availability, increasing patient volume, laboratory delays, and the use of the ED as the first contact for primary care [1]. Svenson and colleagues [6] found that the average length of stay in their ED for critical surgical and nonsurgical patients was over 6 hours and that transfers to the intensive care unit (ICU) were not delayed because of ED

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Box 1. Potential high risk areas

- Triage
- Patient evaluation
- Drug administration
- Procedures
  - Stabilization
  - Resuscitation
- Transfers

procedures being performed. Meggs and colleagues [7] reported a 152% increase in the number of patients with ED length of stay greater than 6 hours from 1988 to 1997. Another study by Varon and colleagues found the average length of stay of critically ill patients in a large urban public hospital was 284.5 ± 212.6 minutes, and some patients remained in the ED more than 18 hours [8]. This literature provides us with a better understanding of the ED's time commitment in providing care for the critically ill.

The role of the ED in stabilizing and significantly improving outcomes in critically ill patients must be emphasized. Recently, there have been many studies that have concluded improved outcomes in patients with severe sepsis and septic shock treated with early goal-directed therapy in the ED. Rivers and colleagues [9] established that there were significant short and long term benefits in early goal-directed therapy of critically ill patients in the ED. The authors concluded that there was an absolute reduction of 16% in hospital mortality. After ICU admission, goal directed therapy group required less fluid, vasopressors, mechanical ventilation, and pulmonary artery catheterization. Other studies have concluded that a significant reversal of physiologic derangement could occur during a patient's ED stay [10]. All of these factors support the vital role of ED management in providing intensive care toward critically ill patients.

Management of the critically ill patient in the ED occurs on many different levels. From the transport of the patient to the ED by emergency medical services to the resuscitation and stabilization procedures provided by the ED, there are multiple steps for the successful and expedient treatment of these patients. Some of the potential risks within the ED environment during the management of the critically ill patient are reviewed in the following discussion (Box 1).

Potential high risk areas

Triage

The concept of prioritizing patients and providing immediate care to the most seriously injured was introduced in France in the early nineteenth century. The

word *triage* is derived from the French word *trier,* meaning "to sort" [11]. Triage incorporates the rapid clinical assessment of patients to determine the severity of illness/injury and disposition of the patient into the appropriate treatment area for physician evaluation, diagnosis, and disposition.

Once a critically ill patient presents to the ED, they are initially evaluated by a triage nurse and sent to a particular area of the ED that has the capabilities in providing appropriate resuscitative and stabilizing management. There are criteria that provide the triage nurse with a systematic process for adequately stratifying patients; however, these criteria are subject to individual interpretation. As Cosby [12] points out, triage errors include rule-based violations, insufficient triage rules, and errors in judgment. There are different regions of an ED in which a patient can be triaged. These regions include an area for relatively stable medical and surgical patients; an advanced care or "fast track" area, where patients with minor wounds and orthopedic injuries are treated; a pediatric ED area, where acute medical care and resuscitations take place; and a trauma area that is equipped with advanced monitoring systems, airway equipment (eg, intubation trays and ventilators), defibrillators, and resuscitative procedural equipment (eg, multilumen catheters, chest tubes, transvenous pacing wires, thoracotomy trays, diagnostic peritoneal lavage kits, and so forth).

Nelson and colleagues [2] evaluated critical care in an urban ED by looking specifically at triage acuity assignment. In this study, less than 1% of ED patients receiving critical care were triaged as nonemergent, meaning that the ED triage system accurately predicted patients in need of critical care admission. The triage acuity assignment used criteria previously described that have been in place for 10 years with minor modification. It is somewhat difficult at times in a busy ED to rapidly and efficiently transport patients intradepartmentally. For example, a deteriorating patient with severe respiratory distress requiring urgent airway management who was initially triaged as a minor allergic reaction and placed in a general medical room may cause a delay in management. Recently, there has been a trend to have a designated area of the ED solely for the management of critical care patients. Henry Ford Hospital in Detroit, Michigan, has taken this approach; critical care in this institution is provided by a dedicated ED staff (an early intervention team), and a cost analysis has revealed a savings of $11.5 million per and a reduction in hospital days of 3800 per year [1]. It is essential for patients to be appropriately triaged primarily for early and aggressive management, which has been proven to reduce significant morbidity and mortality [1,9].

Patient evaluation

There are always potential risks involved in the initial evaluation of any patient who presents to an ED. The ED carries a greater risk of infection for patients and staff than any other department within a hospital. This is partly attributed to the large volume of patients whose conditions are generally un-

known to the ED physician and nursing staff. [13] It is not uncommon for a thorough medical history to be unobtainable because of the patient's condition (eg, altered mental status secondary to a metabolic derangement, sepsis, traumatic brain injury, drug overdose), the unavailability of family members or close contacts, or the existence of a language barrier between the medical staff and the patient. Often, the resuscitative status of a nursing home patient is not known by the emergency medical service transporters or is unclear from the medical information sent by the nursing facility. This adds to management dilemmas, which may hinder the ED physician from executing critical time-dependent decisions regarding patient management.

Drug administration

The treatment of critically ill patients, particularly in the ED, is comprised of aggressive and time-dependent management. This management includes a host of pharmaceutical interventions, including vasopressors, vasodilators, sedatives, paralytics, antibiotics, thrombolytics, and anticoagulants. In terms of lives cost, patient safety is as important an issue as worker safety. Every year, over 6000 Americans die from workplace injuries [14]. Medication errors alone, occurring either in or out of the hospital, are estimated to account for over 7000 deaths annually [15,16]. The Harvard Medical Practice Study revealed that the largest number of adverse events in medical care occurs around the ordering and delivery of medication [17]. There are many systems that are currently in place to limit the potential for medication error in the ED. Many ED medications are obtained through an automated drug delivery system (Pyxis system, Pyxis Corporation, San Diego, California) the advantages of which include controlled access to medications and improved reporting of medication use with automated charting [18]. Although there are limitations to this device, interdepartmental planning and cooperation can help smooth the way to successful implementation and error reduction [19]. Many of the medications are administered according to the weight of the individual patient; consequently, many EDs are developing easy-to-use bedside drug dosing booklets that simplify drip rate calculations, thus limiting the potential for medication error. There is an extensive wealth of literature that focuses on medication error and techniques to ameliorate or eliminate this problem. It is also important to point out that the administration of many of these medications requires close monitoring and titration according to the patient's hemodynamic profile by the ED nursing staff. At times this close observation by an ED nurse may place an increased strain on an already undersupplied field. According to the American Association of Critical Care Nurses, in the last year requests for ''traveler'' nursing agencies jumped 45% for adult ICU nurses, 60% for pediatric ICU nurses, and 140% for ED nurses [20]. Because there continues to be an increase in the critically ill patient population among EDs, there will be a continued increased demand for ED nursing staff.

Procedures

One of the main reasons medical students choose emergency medicine as a career is the multitude of procedures that are performed on a daily basis in the ED. This is particularly exemplified in the management of a critically ill patient in the ED. Critical care patients are a subset of individuals where procedures are performed more extensively than other patients. A study by Svenson and colleagues [6] examined the length of stay and the initiation of intensive care procedures of critically ill patients in the ED. They concluded that the lack of beds in the ICU, not the timing of procedures in the ED, was the main factor for prolonged stay in the ED. The authors divided procedures into stabilization procedures that included intubation, central venous catheterization, chest tube placement, cardioversion, and pacemaker placement, and monitoring procedures that included arterial catheterization, central venous catheterization for monitoring, and intracerebral pressure monitoring. The timing of both resuscitative and monitoring procedures indicated that they were performed when necessary for patient care regardless of ED or ICU setting. In their retrospective review, stabilization procedures were performed on 45 (27%) ED patients; of these, 9 patients received more than one stabilization procedure. Monitoring procedures were performed on 35 (21%) ED patients; of these, 9 received more than one monitoring procedure. In a prospective observation study conducted by Nelson and colleagues [2], 15% of all critical care was delivered in the ED. This study also concluded that the types of procedures performed in the ED were similar to those performed in the intensive care units. Table 1 reveals the comparison of procedures performed on the patients in the ED and the ICU.

ED procedures are performed under sterile conditions to limit the potential risk of catheter-related infections. A sterile gown, mask, head covering, sterile gloves, and sterile drapes are considered standard practice. More than 15% of patients who receive central venous catheters develop complications [21]. Mechanical

Table 1
Procedures performed on critically ill patients in the ED and the ICU

	Adult		Pediatric (<17 years)		Total	
	ED	ICU	ED	ICU	ED	ICU
Procedure						
Telemetry	254	97	86	89	340	186
A-Line	1	12	0	2	1	14
Central line	10	11	0	1	10	12
Intubation	34	27	5	6	39	32
ACLS/PALS protocols	16	2	1	1	17	3
Thoracostomy tube	1	1	0	0	1	1
Tracheostomy	0	1	0	0	0	1

Abbreviations: A-line, arterial line; ACLS, advanced cardiac life support; PALS, pediatric advanced life support.

Data from Nelson M, Waldrop RD, Jones J, et al. Critical care provided in an urban emergency department. Am J Emerg Med 1998;16:56–9.

complications are reported to occur in 5% to 19% of patients, infectious complications in 5% to 26%, and thrombotic complications in 2% to 26% [21]. A prospective study by Miller and colleagues [22] enrolled patients in the ED and performed central venous access (CVA) using ultrasound guidance technique. The mean number of CVA attempts in the ultrasound group was 1.6 versus 3.5 in the traditional landmark group ($P < .0001$). Patients considered to be "difficult sticks" required a significantly longer amount of time ($P < .001$) for CVA via the landmark technique than patients considered to be "difficult sticks" who had CVA with ultrasonic guidance [22]. From the results of their study they concluded that emergency physicians with limited training and experience are able to use ultrasound as an adjunct for CVA. During internal jugular venous catheterization, ultrasound guidance reduces the number of mechanical complications, the number of catheter-placement failures, and the time required for insertion [22]. In another study by Hudson and Rose [23], in patients with nonexistent or ambiguous external anatomical landmarks a real-time ultrasound guided approach to internal jugular vein cannulation was found to be useful. A retrospective observational study by Steele and Irvin [24] set out to identify rates of mechanical central line complications (ie, pneumothorax, hematoma, or line displacement) in patients presenting at an academic urban ED institution. A total of 643 central lines were placed with an overall complication rate of 3.4% (22 of 643). It is clear from this literature that ED physicians are highly trained individuals who have the ability to perform resuscitative and stabilizing procedures with a low risk of complications.

Airway management is considered an essential aspect of an emergency medicine physician's training. A study by Sakles and colleagues [25] at the University of California–Davis Medical Center, a level one trauma center, compared methods, success rates, and immediate complications of tracheal intubations performed in the ED. A total of 610 patients were included in the study; of those, 569 (93%) were intubated by emergency medicine residents or attending physicians. Forty-seven percent of the patients requiring intubation were considered trauma patients and 52% were considered medical intubations. Some of the medical diagnosis included episodes of congestive heart failure, chronic obstructive pulmonary disease exacerbations, sepsis, and patients with altered mental status. A total of 563 of 569 (98.9%) patients were successfully intubated by emergency physicians. There were a total of 52 immediate complications in 45 patients (7.9% of those intubated by emergency physicians), including desaturation, mainstem intubation, and vomiting. Most of these immediate complications were considered minor and resulted in no morbidity.

Transfers

The transfer of a critically ill patient from one institution to another has many potential risks. Many aspects regarding the patient must be taken into consideration before beginning the transfer process. The condition of the patient as well as the potential risk for hemodynamic deterioration en route to the hospital

must be taken into account. Because of these potential dangers, in 1985 the United States Congress developed the Emergency Medical Treatment and Labor Act (EMTALA) as part of the Consolidated Omnibus Budget Reconciliation Act [26]. This act was designed to prevent hospitals from refusing to treat patients who were unable to afford medical care. The primary obligations that hospitals have under EMTALA include the provision of a medical screening examination to determine whether an emergency medical condition exists, and if one exists, they must either provide treatment until the patient is stabilized, or if they do not have the capability, transfer the patient to another hospital. Another important obligation hospitals have under EMTALA is that they must accept transfers if they have the capabilities to treat them. All patients should be provided a medical screening examination and stabilizing treatment within the capacity of the facility before transfer, agreement to accept the patient should be obtained from the emergency physician at the receiving hospital before the transfer, and appropriate laboratory work, radiographs, diagnostic studies, and other pertinent records should accompany the patient to the receiving facility. In a European study by Gray and colleagues [27], the nature, frequency, and characteristics of critically ill and injured adult transfers were evaluated. Most of the patient transfers (22%) were for nonclinical reasons, such as the unavailability of a critical care bed at the referring hospital. Critical care transfers originating from the ED accounted for 25% to 30% of all transfers, and emergency medicine specialists were closely involved in liaisons with an organization of ambulance services. Although they concluded that the quality of care of these patients was poor with a significant critical incident rate (15%), another study by Selevan and colleagues [28] concluded results contrary to this. Their study was a retrospective protocol that evaluated the relationship among interfacility transfers and adverse outcomes. They studied patients who would be at highest risk during or after interfacility transfer—known or suspected cardiac conditions between 1990 and 1996. The results suggested that patients with potentially acute cardiac conditions who are transferred by critical care transport are not different from patients who are directly admitted to the plan's hospitals in terms of in-hospital mortality, readmission, and resource use.

Summary

The management of the critically ill patient in the emergency department is an evolving process. Currently there is sufficient evidence substantiating the central role of the ED in the management of critically ill patients. Understanding the tremendous impact ED physicians have in the care of critically ill patients will serve as an impetus for emergency medicine residents to pursue a critical care subspecialty. The recent implementation of an emergency medicine critical care fellowship at the University of Maryland Shock Trauma Center is a reflection of this increased awareness [29]. With the continuous increment of critically

ill patients presenting to EDs throughout the country, the nationwide shortage of critical care physicians, and the limited availability of ICU beds throughout hospital systems, there will be an increased focus on managing these patients in the ED. As the field of emergency medicine continues to mature, the ED physician must take notice of the potential risk areas within the management of the critically ill patient to continue to improve these patients' short- and long-term survival.

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