



Controversies

ED intensivists and ED intensive care units[☆]

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In recent years, a group of emergency physicians (EPs) have chosen to pursue fellowship training in critical care. With this training, an EP can practice in inpatient critical care units. However, another role is open to these practitioners as well: the role of the emergency department (ED) intensivist (EDI) [1]. Some EDs have formed units capable of providing aggressive critical care during the patient's ED stay. These ED intensive care units (EDICUs) allow critical care to be provided to the patient regardless of the availability of an intensive care unit (ICU) bed.

All EPs must be adept at resuscitation, which generally encompasses the diagnosis and stabilization of a critically ill patient for the first 20 to 60 minutes of their ED stay. After this period, the traditional ED system is predicated on the patient rapidly moving upstairs to a critical care unit. However, overcrowding in almost all hospitals in the United States has led to a situation in which it may be hours or unfortunately in some cases days before a patient may get an ICU bed [2–4]. Even 20 years ago, Fromm et al [5] reported wait times for an ICU bed of up to 11 hours. Similarly, Varon et al [6] found critical care patients spending more than 18 hours in the ED without an ICU bed. The Institute of Medicine discovered that these times have not improved in the past few years and, in many EDs, have become worse [7].

Most EDs are not designed or staffed [8–10] to provide care beyond the initial resuscitation period, and yet, the patient remains in the department, sometimes languishing without optimal care [4,6,11–16]. Even with ample staffing, the meticulous management requirements in the care of the critically ill are unappealing to some EPs [17]. For the patient, it is obviously desirable to receive the same evidence-based aggressive intensive care regardless of location in the hospital. By bringing the intensive therapies of the ICU to the bedside in the ED, the EDI may mitigate the negative effects of hospital overcrowding on the critically ill patient [18,19].

The new field of emergency medicine critical care has outpaced the terms needed to describe it. Table 1 lists a vocabulary for the various practice patterns associated with this emerging subspecialty [20].

1. Models of practice

The practice model of the small number of ED intensivists currently in the United States has emerged in an ad hoc fashion. This has coalesced into 2 forms of practice: the resource intensivist model and the hybrid EDICU [20]. Examples of these practice models are provided at <http://emcrit.org/edicu>.

1.1. The resource intensivist model

In this model, the ED intensivist fulfills a standard clinical role in the attending roster of an emergency program. Whenever a critically ill patient is in the department, EDIs can lend their additional expertise whether they are primarily caring for the patient or advising a colleague. This exposes all members of the clinical team to the advanced level of care and unique aspects of ED critical care. Just as 1 toxicologist on an attending staff can elevate an entire department's care of poisoned patients, the presence of an ED intensivist may lead to similarly improved treatment.

This clinical role can be augmented with didactics, simulation, liaison with the ICU, quality improvement, research, and protocol creation and management. Interactions with the leadership of the other critical care areas of the hospital are also bolstered when an ED intensivist can bridge the gap between emergency medicine and intensive care medicine. Not unlike the ED emergency medical services specialist who streamlines care between prehospital and ED settings, the ED intensivist may be integral in facilitating consistent care for critical illnesses in which the first few hours of intervention cannot be limited by patient locale.

Resource intensivists may not limit their service to the ED. In some centers (see <http://emcrit.org/edicu>), resource intensivists may continue the patient's critical care in other areas of the hospital when they are not working in the ED. Emergency department intensivists may be called into the hospital as part of a dedicated service for a postcardiac arrest or severe sepsis cases and continue the resuscitation and management even after the patient has gone to their ICU bed.

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Table 1
New terminology

Emergency medicine critical care—a subspecialty of emergency medicine dealing with the care of the critically ill both in the ED and in the rest of the hospital
EP intensivist—a physician who has completed a residency in emergency medicine and a fellowship in critical care.
ED critical care—emergency medicine critical care practiced specifically in the ED
ED intensivist (EDI)—EPs who practice ED critical care as a portion of their clinical time
Resuscitators—EPs who have additional knowledge, training, and interest in the care of the critically ill patient
EDICU—a unit within an ED with the same or similar staffing, monitoring, and capability for therapies as an ICU
RED-ICU—a hybrid resuscitation area and EDICU allowing a department to adopt the ED intensive care model with minimal cost and no changes to the physical plant

1.2. The hybrid model

Many EDs already have a dedicated area for the resuscitation of critically ill patients. Some have even assigned dedicated attending staffing to these areas for at least a portion of the day. In this circumstance, the addition of an ED intensivist can easily shift the abilities of this resuscitation area to allow for the care of critically ill patients beyond the first hour. This unit can now offer a similar intensity of care as these patients will receive when their ICU bed becomes available. The resuscitation bay can evolve to become a hybrid resuscitation and ED ICU (RED-ICU).

The RED-ICU then becomes the destination of any new sick patients brought to the department as well as any patients that decompensate while being cared for in the main ED areas.

When the EDI is not present, the RED-ICU is staffed by general EPs. If the EDIs create protocols and care pathways, their EP colleagues can continue a more advanced care than standard ED management even when the EDI is not on shift. This is supplemented with by the availability of the EDI or other critical care physicians for consultation by telephone for any difficult situations that may arise.

In existing RED-ICUs, a key to success has been staffing the unit with dedicated residents and/or attending physicians whose responsibilities do not include noncritical patients. Although these physicians may help out when the patient load in the RED-ICU is light, it is understood that their time on these shifts should be used to maximize the care of the critically ill patients in the ED.

Equally vital to the success of a unit such as this is the nursing staff. Either by specific training or by spending time in standard ICUs, ED nurses can gain the advanced skills necessary for the expanded practice model. However, there must be enough nurses available to allow the provision of intensive care; in our experience, 1 nurse for every 2 patients is the minimum to allow optimal care of the sickest patients. In particular circumstances, such as postcardiac arrest management, ideal management may require 1 nurse to concentrate solely on the patient. In addition, the nurses that staff the RED-ICU bolster the consistency of care and adherence to unit protocols when outside rotators are staffing the unit. For a description of the nursing staffing patterns and solutions to nursing shortages in 1 RED-ICU, see the online appendix.

The potential capabilities of an integrated RED-ICU are delineated in Table 2. Although not all of these modalities may be immediately available to a newly created RED-ICU, the goal is to create a unit capable of matching the baseline care of the hospital's ICUs.

This hybrid RED-ICU then becomes a release valve for hospitals with a scarcity of ICU beds. Instead of the ED boarding time of critically ill patients being a potential hazard, it instead becomes an integrated part of their critical care. Furthermore, there are a number of patients who at the time of admission clearly require a critical care bed but, when exposed to high-level intensive care for 4 to 6 hours, become suitable for a step-down bed outside an ICU [19,21]. Examples of this group include those patients with severe diabetic ketoacidosis, acute pulmonary edema, and toxicological overdose [22–24].

The RED-ICU can become a cost-saving measure for a hospital with strained intensive care resources; once patients are admitted to an ICU, it often becomes difficult to transfer them out even when their illnesses have stabilized. The RED-ICU patients can be treated and then downgraded to a lower acuity bed before their entrance into the inpatient portion of the hospital. In most hospitals, the ED enjoys an increased priority for open beds, and because the RED-ICU is under the ED umbrella, it can take advantage of this easier bed access.

2. Clinical scenarios

Although any sick patient may benefit from the presence of EDIs in the ED, there are certain clinical scenarios in which their unique skill set can positively affect the care of the entire ED [20].

2.1. Airway management

Although airway techniques are in the skillset of all EPs, the EDI can bring additional advanced options to an ED. Experience with fiberoptic bronchoscope-aided intubations is possessed by a fraction of EPs, but all EDIs are skilled in the use of this device. Many EDIs also have experience with percutaneous and open tracheostomies [25]. In an ED program, the EDI can provide the initial education, skills review, and just-in-time training in the performance of emergent surgical airways and the management of emergencies in patients with existing tracheostomies and laryngectomies.

2.2. Respiratory failure

A large portion of a critical care fellowship is spent gaining experience with the management of acute and chronic respiratory failure. This gives the EDI knowledge of advanced modes of invasive and noninvasive ventilation and the salvage of acute respiratory distress syndrome patients. Most emergency residencies offer little training in the extubation of patients, but the EDI is facile with assessment of extubation fitness, ventilatory weaning, and the extubation of patients who have resolved the condition, which necessitated intubation [26].

2.3. Shock

An extensive knowledge of hemodynamic monitoring, vasoactive agents, and the ramifications of alterations of oxygen delivery and the microcirculation give the EDI a unique perspective on how the early

Table 2
RED-ICU or stand-alone EDICU capabilities

• Advanced hemodynamic monitoring: arterial pressure, continuous cardiac output, mixed/central venous oxygen saturation
• Respiratory monitoring: quantitative end-tidal carbon dioxide
• Neuroinvasive monitoring: fiberoptic intraparenchymal pressure monitoring, external ventricular drainage, and multimodality monitoring. These monitors then allow resuscitation targeted to cerebral perfusion pressure and regional/global brain tissue oxygenation.
• Ventilation with advanced rescue modes: airway pressure release ventilation, high frequency oscillatory ventilation, proning.
• Echocardiography: optimally with capabilities for transesophageal as well as transthoracic.
• Targeted temperature management for postarrest and neurologic emergencies
• Nutrition (for stand-alone EDICU)
• Fiberoptic bronchoscopy: for diagnosis and pulmonary toilet
• Continuous renal replacement therapies
• Cardiac support devices, such as aortic balloon pumps*
• Extracorporeal membrane oxygenation*
• Prophylactic measures: deep venous thrombosis prophylaxis, stress ulcer prevention, ventilator-associated pneumonia measures

* Only initiation and not ongoing maintenance of these therapies should be established in RED-ICUs, as these patients benefit from stand-alone units with intimate familiarity with these therapies for the maintenance phases.

actions in the ED can affect the patient's long-term outcome. Emergency department intensivists also have experience in rescue techniques such as intraaortic balloon pulsation and extracorporeal life support, when initial attempts at hemodynamic stabilization have failed. These devices can be placed in the ED [27,28] until the patient is transferred to a specialized unit.

2.4. Sepsis

Since Emanuel River's early goal-directed therapy (EGDT) study, the ED has taken a primary role in the care of the critically ill septic patient [29]. In addition to elucidating a bundle of therapies to manage the severely septic patient early in their hospital course, the study demonstrated that critical care in the ED is possible and lifesaving. One of the primary interventions present in the treatment group but not the control group of the EGDT study was an ED critical care team member at the bedside to direct therapy and optimize care. Emergency department intensivists possess a broad knowledge on antibiotic choices, aggressive source control, and advanced monitoring of the severely septic patient. Bronchoscopy skills allow the EDI to obtain bronchoalveolar lavage samples for early pneumonia organism identification.

2.5. Postcardiac arrest care and therapeutic hypothermia

Aggressive treatment of the postarrest syndrome, especially with an emphasis on early and consistent maintenance of induced hypothermia, is critical for good outcome in patients after cardiac arrest [30,31]. This level of care is beyond the resources of many conventional EDs for longer than the first hour of care. The EDI can spearhead a hospital postarrest program or be the primary clinician in the actual clinical management of these patients (see online appendix).

2.6. Trauma

Emergency department intensivists who have received their critical care training in a surgical/trauma program are uniquely suited to organize a trauma resuscitation program. Mastery of all aspects of the early management of the critically ill trauma patient including blood component transfusion, decisions on conservative vs operative management, timing of angiographic interventions, surgical airways, and the provision of damage-control resuscitation are in the purview of a trauma-trained EDI. The presence of such an EDI may allow a surgery department to safely reduce their on-call staffing, so long as a surgeon is readily available for the trauma cases that will require operative intervention [32].

2.7. Procedures

Emergency department intensivists by nature of their training and experience with potential complications may serve as hospital proceduralists. The unique practice patterns of many EDIs allow ample time for meticulous sterile technique. Emergency department intensivists have also garnered experience dealing with the long-term complications of procedures and how to rectify them. In some hospitals, the EDI may be an ideal practitioner to place elective bedside percutaneous tracheostomies, peripherally inserted central catheter, and arterial lines.

2.8. Palliative care

Aggressive ED critical care can be directed toward either a curative or a palliative path. All of the advanced therapies and monitoring modalities an EDI brings to the ED should be balanced with a focus on palliation and end-of-life care when appropriate. Given their training, EDIs have mastered the intricacies of advanced directives and family

discussions on palliation and withdrawal of care. This permits adaptation of care goals to best reflect the patient's wishes early during their care. The EDI may also have additional time and the opportunity for multiple discussions with the family and patient to discuss end-of-life issues [33].

3. Advantages to emergency medicine residency programs

A residency program with an EDI on faculty will provide residents with more in-depth exposure and potentially greater knowledge and appreciation of the role of critical care in the ED. In addition, the EDI is expert at adapting advanced critical care management techniques to the unique environment of the ED.

Although many resuscitation topics are covered, there are no specific critical care topics in the model curriculum of emergency medicine residents [34]. In some of our own programs, a dedicated ED critical care lecture series and the trauma lecture series are both taught by EDIs [35].

4. Advantages to all hospital types

Emergency department intensivists are well suited to provide quality improvement for ED mortalities and address discrepancies in the care of critically ill patients early in their course. At the hospital level, they can act as champion for initiatives such as severe sepsis care, therapeutic hypothermia, deep sedation, and advanced airway management.

Because EDIs have trained in both emergency medicine and critical care, they are an excellent resource for any hospital-wide protocols dealing with resuscitative medicine and critical care. Their expertise also makes them the ideal liaison between the ED and the ICUs.

In many community centers, the ED physician may be the only attending physician in the hospital at night. An EDI staffing the ED in these hospitals can provide a dramatic advantage by their availability for consultation or by managing critically ill patients in the ED until intensivists arrive in the morning.

5. Financial considerations

Early intensive care may lead to a reduction in inpatient admission days and lead to a significant cost savings. At Henry Ford Hospital, early intervention by a critical care team soon after the patient's arrival in the ED, lead to a savings of 11.5 million dollars per year and 3800 hospital days [36]. Studies of EGDT for severe sepsis patients have also shown cost benefits when intensive care is provided during the patient's ED stay [37–39].

Each hospital depending on payer mix and geography will have an individual approach to maximizing the financial benefits of EDIs and EDICUs. However, critical care billing for much of the time the EDI spends treating critically ill patients is appropriate. Patients being treated in departments with EDIs will likely have necessary, advanced procedures performed in the ED rather than deferring them to the unit staff. Procedural billing, at least with the current reimbursement system, is some of the best reimbursed care for the critically ill patient.

6. Arguments against ED intensive care

Many ED administrators are reluctant to cede their staff and physical plant to the care of the critically ill patient due to the belief that stabilizing the patient in the ED will slow the patient moving upstairs to the ICU. In addition, they are concerned that once an ED can care for these patients at the level of an ICU, the hospital expectation will become that they will do so consistently regardless of the circumstances of the department. Many department leaders are reluctant to add this additional burden to an already overwhelming degree of responsibility. A separate staffing pattern for the

critically ill patients in the ED may alleviate these problems, but the funding for such a staff is a major issue that would need to be weighed in each institution.

Another argument against ED critical care is that the care of the affected patients can be provided by in-patient intensivists who come down to the ED. This would obviate the need to create a dedicated ED intensive care staff. This may be a workable solution in hospitals with a surfeit of intensivists, but across the United States, this situation is a rarity [2].

Because ED intensive care is a nascent subspecialty, it is unknown whether the planned provision of intensive care in the ED will engender new political turf battles. The recent announcement of a certification path for EPs through internal medicine leads to some optimism that other specialties may accept this new role for emergency medicine practitioners.

7. The need for research

Although a few centers have already begun to use EDs and ED-ICUs (see online appendix), the benefits at this point are mostly anecdotal. Research is needed to demonstrate that the expenses of an ED critical care program are counterbalanced by demonstrable patient-outcome benefits. An ED critical care model can improve patient outcomes and may be a financially beneficial path for hospitals already on tight budgets, but a comprehensive cost analysis has not yet been performed.

A registry-based of ED critical care patients is in its nascent stages at the Elmhurst Hospital Center in New York City. Hopefully, as data accrue, many of the perceived advantages of early critical care in the ED will be proven and accepted.

8. Conclusion

Although the recent path for certification in critical care will allow EP intensivists to freely practice in inpatient ICUs, a unique path has always existed for critical care-trained EPs to practice in the ED. The EDI can bring advanced care to the ED with a variety of practice models. Additional benefits include teaching of both faculty and trainees, expertise for protocol development, and increased collaboration between hospital departments. We hope the presence of EDIs in our EDs will help to eliminate any disparities in the care of the critically ill patient based solely on location in the hospital.

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