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### ICU Care Prior to Admission to the ICU

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**The demand for ICU resources is high and continues to increase. This may challenge the ability of critical care services to expediently admit patients from other hospital locations. Critically ill patients are common in the Emergency Department (ED), and as ED waiting times increase, may result in prolonged management of patients in the ED if an ICU bed is not available. It is therefore likely that the management of critically ill patients in the ED will require increased resources due to current healthcare delivery issues.**

However, expert resuscitation in the ED is vitally important as early diagnosis and stabilisation has a substantial impact on patient outcomes. ED care may reduce not only mortality, but also morbidity such as organ dysfunction and hospital length of stay (LOS). Expert diagnosis and resuscitation in the early stages of critical illness may prevent disease progression, impede the development of multi-organ dysfunction, and decrease mortality and therefore imparts a significant morbidity and mortality advantage. In some cases, resuscitation in the ED may decrease the need for ICU admission.

Expert resuscitation includes simultaneous assessment, diagnosis and initiation of life saving therapies, regardless of patient location. The use of invasive procedures to optimise gas exchange, medication delivery, and physiologic monitoring is considered the standard of care to maximise good patient outcomes. Invasive procedures include emergent endotracheal intubation, central line insertion, and arterial catheter placement, among others. These procedures are often performed by intensive care physicians and emergency physicians.

Despite this, little is known about the duration of time critically ill patients remain in the ED prior to admission to ICU. Also, invasive procedures performed on critical ill patients during their ED phase of care have been incompletely described.

#### The Provision of Critical Care in a Canadian Tertiary Care Emergency Department

The provision of critical care in an academic Canadian emergency department has been recently described. Data of patients from the Queen Elizabeth II Health Sciences Center in Halifax, Nova Scotia, Canada who were resuscitated in the ED and admitted directly to a mixed

medical/surgical/neurosurgical intensive care unit during a one year period illustrates the care of critically ill patients in the Canadian healthcare system. This ED is an adult (age >17 years) tertiary care ED with approximately 70,000 patient visits per year. The ICU's are "closed" units and are staffed by 24 hour/day intensivists who provide consultant support to the ED and other in-hospital emergencies, in addition to the referral of critically ill patients from the provinces of Nova Scotia and Prince Edward Island, and on occasion from New Brunswick and Newfoundland.

Of the 68,765 patients which presented to the ED during the study period, 178 patients were admitted to an ICU (ICU admission rate 0.26 percent). The median age of patients was 55 years, 59.6 percent were male and the in-hospital mortality rate was 21.9 percent (39/178).

The median LOS in the ED for critically ill patients requiring ICU admission was 4.9h (mean 6.5h, range 1.4-28.2h) and the median hospital LOS was 9 days (mean 20.8 days, range 1-362 days). The ED diagnosis of critically ill patients varied. Patients who survived (139/178) were discharged home (111/178 62.3 percent) or to long term care or other facilities (26/178, 14.6 percent).

The majority of patients received at least one invasive procedure in the ED (Table 1). One hundred and twenty five patients (125/178, 70.2 percent) required endotracheal intubation during the first 24 hours of their hospital admission. The majority of intubations (118/125, 94.4 percent) were performed in the ED (80/125, 64.0 percent) or the prehospital setting (38/125, 30.4 percent). Central venous access was obtained in 56/178 patients (31.5 percent). Only 17.9 percent (10/56) of patients who had a CVC inserted in the initial 24 hours of ICU admission had this procedure

performed in the ED.

Interestingly, the majority of patients requiring central venous access (30/56, 53.6 percent) had the CVC inserted within the first six hours of admission to the ICU. Similarly, arterial catheters were inserted in 99/178 patients (55.6 percent) with 14.1 percent (14/99) inserted in the ED and 71.7 percent (71/99) inserted in the first six hours of ICU admission.

## Discussion

Critically ill patients remain in the emergency department for prolonged periods of time. Other studies have demonstrated that the mean duration of stay in the emergency department for critically ill patients is 4 – 6 hours, and patients remaining in the ED an additional 75 minutes after admission order are placed. Earlier implementation of invasive procedures and critical care therapy may improve patient outcomes. Early goal directed therapy, delivered in the ED during the treatment of sepsis, has been shown to significantly decrease patient mortality.

Our experience provides the most recent data on this patient population. We have confirmed that critically ill patients remain in the ED for a prolonged period of time. This in itself may not be significant if the care provided in the ED setting simulates that provided in the ICU environment. This means that the invasive procedures regarded as beneficial for patient outcomes are provided when a patient will benefit, despite their hospital location. If the patient is in the ED, necessary procedures should be performed during this phase of care.

Our data raises the issue of a potential delay in the insertion of

invasive procedures until after admission to an ICU, as the majority of central venous catheters and arterial catheters were not inserted until after ICU admission, yet emergent endotracheal intubation was performed in the ED. In addition, our finding that the majority of these procedures were performed immediately upon ICU admissions (<6 hours) may support this hypothesis. Therefore, the possibility that life saving treatments and/or monitoring may have been delayed 4.9 hours is possible, if invasive procedures are considered a surrogate to the provision of optimal patient resuscitation.

The reasons for our findings are unclear. It is possible that ED physicians at our institution are more comfortable with airway management than the other more invasive procedures. Physicians often obtain invasive procedure skills during training, and due to various reasons skill maintenance may be a factor.

The availability of other personnel with invasive line or arterial catheter insertion skills, such as a critical care consult service, may impact on the opportunity to perform these procedures. Other factors include volume of critically ill patients, ED nursing skill, time pressures inherent in a busy ED, in addition to others.

It should be noted that this study was not designed to determine the impact of invasive procedures on patient outcomes, yet the delays in these are striking. Further research is needed to confirm our findings, and to elucidate any association with patient outcomes.

Potential strategies to improve resuscitation practices:

1. Assess current practice in ED resuscitations: Hospitals should identify current practice and resuscitation deficiencies in order to determine potential solutions. Data on the provision of critical care in the ED is the initial step in improving ED resuscitations.
2. Provide Targeted Education: After identification of skill and knowledge deficits, educational strategies for healthcare providers involved in the resuscitation of critically ill patients should be developed. Educational programmes should target a wide audience, including physicians, nurses, and respiratory therapists. Programmes may include additional training in invasive procedures in concert with sessions on optimal resuscitation practices.
3. Ensure Skill Maintenance: Initial education and training need to translate into the maintenance of resuscitation skills over a period of time. Planning for follow up educational sessions to ensure skill maintenance is encouraged.
4. Provide Support for ED Resuscitations: Support between the specialties of critical care medicine and emergency medicine should be encouraged. In some situations, the presence of an intensivist in the ED during resuscitations may aid in improving patient outcome.

## Implications for the Administration of ICU Resources:

Optimal resuscitation should be available for critically ill patients despite their hospital location. Care provided in the ED is vitally important, as may allow rapid stabilisation and prevent progression to multi-organ dysfunction and death. The implementation of strategies to ensure aggressive resuscitation occurs in the ED should be a priority. Resources may need to be allocated for education, skill acquisition, and necessary equipment. If this is not possible, ICU services may also need to be readily involved in the early phases of ED resuscitation if optimal patient outcomes are to be achieved.



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