

## Intensive care organisation: Should there be a separate intensive care unit for critically injured patients?

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### Abstract

In the last two decennia, the mixed population general intensive care unit (ICU) with a "closed format" setting has gained in favour compared to the specialized critical

care units with an "open format" setting. However, there are still questions whether surgical patients benefit from a general mixed ICU. Trauma is a significant cause of morbidity and mortality throughout the world. Major or severe trauma requiring immediate surgical intervention and/or intensive care treatment. The role and type of the ICU has received very little attention in the literature when analyzing outcomes from critical injuries. Severely injured patients require the years of experience in complex trauma care that only a surgery/trauma ICU can provide. Should a trauma center have the capability of a separate specialized ICU for trauma patients ("closed format") next to its standard general mixed ICU?

**Key words:** Intensive trauma care; Trauma intensive care; Critical care; Intensive care medicine; Trauma

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**Core tip:** Trauma is a significant cause of morbidity and mortality throughout the world. Major or severe trauma requires immediate surgical intervention and/or intensive care treatment. Severely injured patients require the years of experience in complex trauma care that only a surgery/trauma intensive care unit can provide.

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### INTRODUCTION

The contribution of organizational structure - in a wide variety of settings - for the delivery of critical care to patients has been the topic of study since the mid-

1980s<sup>[1-9]</sup>. The preponderance of evidence recommends that intensivist-directed patient management is related to a reduced length of intensive care unit (ICU) stay, reduced hospital length of stay, and most likely decreased mortality. In the last two decennia, the mixed population general ICU with a "closed format" setting has gained in favour compared to the specialized critical care units with an "open format" setting, especially in Europe<sup>[8-15]</sup>. Therefore, critical care physicians have taken responsibility for the treatment of critically ill patients, and more and more specialized units are embedded in the intensive care department. These units are subsequently transformed into overall general units with a mixed population of different diseases. Although there seems to be more positive results towards the general mixed ICU within a "closed format" setting in the literature<sup>[4,6-8,10,16-23]</sup>, there are still questions whether surgical patients benefit from a general mixed ICU. The only evidence accessible on this field comes from the neurosurgical intensive care; Intracerebral hemorrhage patients treated in a specialized neuroscience ICU had lower mortality, length of stay, and cost than those treated in a general ICU<sup>[24,25]</sup>; and from the burn intensive care<sup>[26-29]</sup>. Does this mean that we have to reorganise all specialized surgical units, even if those units are already working in accordance with the "closed format" setting? Several authors state that we should not reform all of our specialized surgical ICUs<sup>[30-33]</sup>.

Trauma has been called the unnoticed epidemic and the unheeded disease of modern society. Trauma every year impacts hundreds of thousands of individuals and cost billions of dollars in direct financial loss<sup>[34]</sup>. Trauma care has improved over the past 20 years, largely from improvements in trauma systems, assessment, triage, resuscitation, emergency and intensive care<sup>[34]</sup>. Trauma is a significant cause of morbidity and mortality throughout the world. Major or severe trauma requires immediate surgical intervention and/or intensive care treatment. Over one quarter of trauma patients are cared for in an ICU during their hospital admission in the United States<sup>[33,35]</sup>. Modern trauma care has become highly specialized, especially for the critically ill patient with multiple-system injuries<sup>[36]</sup>. The care provided in this setting plays a major role in ensuring survival following injury and might significantly influence functional outcome<sup>[33]</sup>. Nevertheless, the function and structure of the ICU has received very little awareness in the literature when examining outcomes from critical injuries<sup>[36]</sup>. The American College of Surgeons Committee on Trauma, whose criteria is used for the verification of trauma centers, recommends that the surgeon presuming first responsibility for the care of the injured patient should maintain that responsibility all through the acute care phase of hospitalization, including the ICU<sup>[37]</sup>. Nathens *et al*<sup>[30]</sup> have concluded that closed ICUs with a surgeon intensivist had the best outcome in the care of the critically injured trauma patient compared with the non-surgeon intensivists. Park *et al*<sup>[32]</sup> suggested that improved clinical outcomes, lower costs and reduced

length of stay are directly related to a separate closed trauma unit. And the most recent study of Duane *et al*<sup>[36]</sup> concludes that severely injured patients require the years of experience in complex trauma care that only a surgery/trauma ICU can organise. These patients air a number of exceptional challenges for the ICU physician including the need for ongoing resuscitation, drive of resuscitation endpoints, and treatment of early post-resuscitation complications. How well these are addressed may have critical implications for long-term outcome and survival<sup>[38]</sup>. Timing in treatment (especially re-operations in the first 48 h) of the critically injured patient is of great importance; and who is better to understand these circumstances than the surgeon intensivist (with experience in trauma surgery)? In a perfect world, should a trauma center have the capability of a separate specialized ICU for trauma patients ("closed format") next to its standard general mixed ICU? Critically injured patients requiring admission to the ICU often have multi-system injuries that require technically advanced medicine including resuscitation from shock. The ICU care of the trauma patient differ from that of other intensive care patients in many ways, one of the most important being the need to continuously combine operative and non-operative treatment. Though, development in the care of the injured has been made, death due to uncontrolled bleeding, severe head injury, or the development of multiple organ dysfunction syndrome remains all too common in this patient population. Additionally, due to the potential nature of the injuries, the problem not seldom arises that the optimum therapy for one injury or organ system, such as preoperative permissive hypotension in actively bleeding patients, may result in suboptimal or even harmful therapy in the existence of an other injury (such as traumatic brain injury)<sup>[39]</sup>. In addition, trauma leads to a state of relative immunosuppression with decreased humoral and cell mediated immunity<sup>[40-45]</sup>.

Trauma surgery critical care teams often consult multiple specialists to provide the complex care necessary to treat the most severely injured. It is true that this kind of advanced medicine is indeed available at each Level I trauma center general ICU. However, would the experience of highly trained personnel (trauma nurses, senior surgical residents, trauma fellows) contribute even more to a better patient outcome? With this kind of highly trained and experience personnel the possibility exists to perform small operations on the unit itself without having to wait and transport the critically injured patient to an operation theatre. Complex, high skilled nursing interventions such as volume replacement, correction of coagulopathy and hypothermia, invasive monitoring and the management of "damage-control" conditions demand understanding and experience that are not able to be gauged. These skills are obtained on a daily basis in Trauma ICUs where there is an excess of "hands-on" learning possibility. The development of such skills is critical for optimal results in life-threatening

blunt and penetrating trauma. An identical care is hard to attain even from staff that is experienced and exceptional in their non-surgical fields<sup>[36]</sup>. Even in our own intensive care patient organisation (concerning surgical patients and the critically injured patients on outcome), a difference in the dimensions of crude ICU outcome (short-term mortality/length of ICU stay and ICU readmission) was seen after the reorganization to a general ICU<sup>[46]</sup>. Should there not be an organised survey among different trauma centers to analyse the critically injured patient outcome. This should give critical care physicians and surgeons specialized in trauma insight in the question whether patient outcome could gain from separate trauma units or give us the conclusive information whether we should continue combining all specialized care units together.

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