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Relationship between multidisciplinary critical care and burn patients survival: A propensity-matched national cohort analysis

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ABSTRACT

Objective: The aims of this study are: firstly, to investigate if admission to specialized burn critical care units leads to better clinical outcomes; secondly, to elucidate if the multidisciplinary critical care contributes to this superior outcome.

Methods: A multi-centre cohort analysis of a prospectively collected national database of 1759 adult burn patients admitted to 13 critical care units in England and Wales between 2005 and 2011. Units were contacted via telephone to establish frequency and constitution of daily ward rounds. Critical care units were categorized into 3 settings: specialized burns critical care units, generalized critical care units and 'visiting' critical care units. Multivariate logistic regression analysis and propensity dose-response analysis were used to calculate risk adjusted mortality.

Results: Multivariate logistic regression analysis shows that admission to a specialized burn critical care service is independently associated with significant survival benefit compared to generalized critical care unit (adjusted OR for in-hospital death 1.81, [95% CI, 1.24, 2.66]) and 'visiting' critical care services (adjusted OR for in-hospital death 2.24 [95% CI, 1.49, 3.38]). Further analysis using propensity dose-response analysis demonstrates that risk-adjusted in-hospital mortality rate decreased as the dose of multidisciplinary care increased, with an adjusted odds ratio of 1 (specialized burn critical care units), 1.81 (generalized critical care units) and 2.24 ('visiting' critical care units).

Conclusions: Admission to a specialized burn critical care service is independently associated with significant survival benefit. This is, at least in part, due to care being provided by a fully integrated multidisciplinary team.

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1. Introduction

Critical care services have evolved over the last two decades, with the introduction of specialized critical care services

designed to focus care for specific patient populations. The relationship between management in specialized critical care units and clinical outcomes have been examined for several critical care services, ranging from paediatric critical care [1,2], neurocritical care [3–5] and cardiothoracic surgery [6], with the

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general finding that management in specialized critical care units results in superior clinical outcomes for selected patient groups. The reasons for this are not yet clear, but purported benefits of specialization include reduction of diagnosis and treatment variability, and increasing staff expertise and education [7].

Recently, it is increasingly being recognized that a well-functioning critical care unit is defined not only by the presence of multidisciplinary providers, but also by how well those providers work together—the multidisciplinary care [8]. Specialized critical care units are typically based on multidisciplinary approach, where tightly knit teams of providers with varying domains of expertise are present on the same site to provide critical care as a team. Although the multidisciplinary care teams have been shown to improve critical care survival [9], whether the multidisciplinary approach contributes to the superior clinical outcomes previously reported in specialized critical care units is unknown.

Patients with major burns are unique, representing the most severe model of trauma. The complex nature of burn injury necessitates the availability of diverse skills and knowledge in a fully integrated manner. The UK National Burn Care Review [10] recommended that if an adult burn patient benefits from critical care, it should be provided within one of the following three settings: first setting is a specialized burns critical care unit within a burn centre. Second setting is care provision within the burn unit where there is an adjacent or conjoined critical care unit from which the intensivists provide the critical care input. If, however, the burn unit and critical care service are within the same hospital but not adjacent (i.e. more than 50m away), it is recommended that the burn patient is managed within the general critical care unit with the burns team visiting to provide the burn care input.

Since the publication of the UK National Burn Care Review in 2001, there is no study that examine if any of the three recommended critical care settings is associated with superior clinical outcomes. Therefore, our objective was to determine whether the settings within which critical care is provided for burn patients has an independent effect on patient survival. We hypothesized that, after adjusting for burn severity and patient characteristics, admission to a specialized burn critical care service would be associated with reduced in-hospital mortality rate after severe burns.

We further hypothesized that, the multidisciplinary care—the cornerstone of all specialized burn critical care units, contributes to this superior clinical outcome.

2. Methods

2.1. Data source

We conducted a retrospective multi-centre cohort analysis of patients admitted (between January 2005–January 2011) to all 13 critical care services in England and Wales that admit burn patients. All 13 critical care services participate in the UK National Burn Injury Database (NBID). NBID is the largest inpatient burn care database in the United Kingdom that collects detailed patient demographics, burn injury

characteristics, clinical and outcome data on adult burns patients at participating hospitals for benchmarking and quality improvement [11]. NBID data are prospectively collected locally and uploaded monthly to a national server after removing patient-identifiable information. Data from NBID, blinded to hospital, critical care services and patients, were requested and released for the present analysis.

Furthermore all aforementioned 13 critical care services that admit burn patients were contacted via telephone. The frequency and constituents of the daily ward round staff was recorded. The units were then categorized into three doses of treatment:

1. High dose: specialised burn critical care units—MDT ward round led (assumption they have 3 whole-time equivalent (WTE) of combined service).
2. Intermediate dose: visiting critical care unit—surgeon led with visiting intensivist (assumption they have 2 WTE of combined service).
3. Low dose: generalized critical care unit—intensivist led with visiting surgeon (assumption they have 1 WTE of combined service).

We considered that the ideal MDT burns team consisted of a surgeon, intensivist, and allied health professionals. The units with the most integration of MDT working together would have all 3 WTE working together. Therefore this group was assumed to have 3 WTE of combined service. The least integrated generalized critical care unit may have similar elements, however these function with visiting burns surgeons and visiting allied health professionals reviewing the patient at different times. Effectively there is just 1 WTE looking after the patient at any given time. The intermediate group was assumed to be in the middle of these extremes, with 2 WTE of combined service, as there is burn surgeon and allied health professional input on the burn unit with visiting intensivist input. This provides some interaction in the MDT but not complete overlap between the three components of care.

2.2. Definition of critical care settings

In England and Wales, adult patients (age >16) with severe burns are admitted to critical care services across the National Network for Burn Care [12] depending on the geographical location of burn incidence. While the components of the clinical teams appear similar, the organizational structures of critical care services within these networks vary significantly. For the purpose of this study, critical care services included both intensive care units and high dependency units. A High dependency unit provides treatment to patients needing single organ support (excluding mechanical ventilation) such as renal haemofiltration or inotropic support with invasive blood pressure monitoring. They are staffed with one nurse to two patients. Intensive care provides care to patients with two or more organ support (or needing mechanical ventilation alone). They are staffed with one nurse per patient ratio and usually have a doctor present in the unit 24h per day.

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