Journal of Critical Care (2008) **23**, 550–555

ELSEVIER

Journal of Critical Care

Additional Topics

Mortality rates under the care of junior and senior surgery residents in a surgical intensive care unit/neurologic intensive care unit: A 5-year retrospective cohort study at Taoyuan Armed Forces General Hospital

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Keywords:
Mortality rate;
Length of stay;
Surgery residency;
Intensive care unit

Abstract

Background: The quality and outcome of health care administered in intensive care units (ICUs) of teaching hospitals are dependent on a myriad of factors; however, few studies have assessed mortality rates and length of stay in surgical intensive care and neurologic intensive care units (SICU/NICU) in relation to the experience of junior and senior surgery residents.

Objective: The aim of this study was to determine whether there were differences in the outcomes of ICU patients cared for by junior surgery residents or senior surgery residents by assessing mortality rates and length of stay in the SICU/NICU.

Design: This was a retrospective cohort analysis. Mortality rates, length of SICU/NICU stay, and baseline characteristics were assessed in 2 patient groups: group 1, patients managed by junior surgical residents; group 2, patients managed by senior surgical residents. Categorical variables were compared by χ^2/Fisher exact test, and continuous data (age and ICU stay) were compared using the Mann-Whitney *U* test. Acute Physiology and Chronic Health Evaluation II score was used for ICU prognostic models.

Setting: The Taoyuan Armed Forces General Hospital (Taoyuan, Taiwan, ROC) consists of an 8-bed SICU and an 8-bed NICU.

Patients: Data were collected from 2274 patients from January 1, 2002, to December 31, 2006, from the intensive care units (SICU/NICU) of the department of surgery.

Interventions: None.

Results: Significant differences between the 2 groups were found in total patient mortality and the duration of intensive care unit stay. Of 1806 patients in group 1, 446 (24.7%) died, whereas 83 (17.7%) of 468 in group 2 died ($P = .002$). The major difference of mortality rate was in the division of neurology surgery; 291 (26.6%) of 1092 patients in group 1 died, whereas 55 (19.2%) of 287 in group 2 died ($P = .009$), with most deaths due to spontaneous intracranial hemorrhage ($P = .012$) and central nervous system tumors ($P = .048$). Median length of SICU/NICU stay for group 1 was 3.0 days vs 3.5 days for group 2 ($P = .003$).

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0883-9441/$ – see front matter
doi:10.1016/j.jcrc.2008.03.039

Conclusions: The quality of care of critically ill patients is improved when more experienced residents are providing care. We suggest that residents rotated into the special units such as SICU/NICU for care of critically ill patients should be at least at third year of training.

1. Introduction

The quality and outcomes of health care administered in intensive care units (ICUs) of teaching hospitals are dependent on a myriad of factors such as nurse-to-patient and resident physician-to-patient ratios [1] and house staff workload [2]. Intensive care unit patients admitted during overloaded medical work phases procure a greater risk of mortality and adverse outcomes attributed to human error, increased risk of iatrogenic complications, delayed mechanical ventilation, and hospital-acquired infection [3-5]. Studies have shown the impact of human errors due to inadequate arithmetic skills in dosing [6] and substandard performance secondary to sleep deprivation among interns and residents [7]. Few studies have assessed mortality rates and length of stay in a surgical ICU (SICU) or neurologic ICU (NICU) in relation to the experience of junior and senior surgery residents. Early studies [8,9] on the quality of care provided in teaching hospitals by surgery residents were based on administrative data that were susceptible to statistical differences and confounded by variations in illness severity.

The purpose of this study was to determine whether there were differences in ICU patient outcomes between patients cared for by junior surgery residents or senior surgery residents. We examined in-hospital mortality rates and length of stay for patients admitted to the SICU and NICU at our institution who were cared for by a junior or senior surgery resident.

2. Patients and methods

2.1. Study design

This was a retrospective cohort analysis of data from January 1, 2002, to December 31, 2006, collected from the SICU/NICU of the Department of Surgery at Taoyuan Armed Forces General Hospital. The need for informed consent was waived by the institutional review board.

2.2. Hospital

Taoyuan Armed Forces General Hospital is a teaching hospital located in Taoyuan, Taiwan. The SICU consists of 8 beds and the NICU has 8 beds. The ICU service team includes attending physicians, one junior or senior surgical resident, critical care pharmacists, critical care nurses, nutritionists, and respiratory therapists. The same junior or senior resident cared for patients in both the SICU and NICU. Only one resident (junior or senior) was covering the ICUs at any one time. Residents rotated call to provide night staffing.

Each ICU patient was assigned an attending physician who assumed responsibility at all times (including surgical intervention), monitored and assessed patients at bedside twice a day, supervised the resident physician, were consulted by phone after hours, and saw patients in the ICU as needed. Two or 3 new surgery residents were enrolled in this department each year. Junior residents include first- and second-year residents. Senior residents include third- and fourth-year residents. In most situations, senior surgery residents perform most surgical procedures, whereas junior residents are responsible for patient care in the SICU/NICU. Junior residents cared for patients in the SICU/NICU for 47 months of the study period vs 13 months for senior residents and were randomly rotated for 1 to 3 months at a time (Fig. 1). Senior residents had no operating room responsibilities when covering the ICUs. The nurse-patient ratio in the SICU/NICU was 1:2 during the daytime and 1:2 to 1:3 at night.

2.3. Patients

The study cohort consisted of 2274 consecutive eligible patients admitted to the SICU/NICU who had undergone general, neurologic, cardiovascular, plastic, urologic, and/or chest surgery, or patients with neurologic or other conditions requiring critical care. Criteria for ICU admission were need of mechanical ventilation, unstable vital signs or consciousness level, post major operation, and/or major trauma. Patients who died within the first 24 hours after ICU admission were excluded. Patient data were stored in a spreadsheet database (Microsoft Excel) and included the patient's attending physician, training year of residents, admission day, admission categories, diagnosis, age, sex, operative procedure, days of intensive care unit stay, and outcomes. Acute Physiology and Chronic Health Evaluation (APACHE) II score was used for ICU prognostic models. Hospital mortality was defined as death in the SICU/NICU or before hospital discharge.

2.4. Statistical analysis

Categorical variables were compared by χ^2/Fisher exact test, and nonparametric data (age, ICU stay, and APACHE II score) were compared using the Mann-Whitney U test.