Original Article

Characteristics and Outcomes of Patients Readmitted to The Medical Intensive Care Unit: A Retrospective Study in a Tertiary Hospital in Taiwan

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SUMMARY

Background: This study aimed to evaluate outcomes of patients and the difference between geriatric and young patients readmitted to the medical intensive care unit.
Methods: From January 1, 2011 to December 31, 2013, 117 medical ICU readmissions were included.
Results: The study population had a mean Charlson comorbidity score of 7.2 and stayed 12.3 days in the ward before ICU readmission. The most common cause for readmission was respiratory disease in 49 (41.9%) patients, and the average readmission duration was 10.1 days. There were 74 patients (63.2%) who survived. Among the survivors, only 50 were discharged from the hospital. The overall mean duration of hospital stay was 51.5 days. Those who survived the hospital course were younger (64.1 vs. 75.6 years) and had a higher coma score (10.2 vs. 7.5), lower Charlson score (6.4 vs. 8.6), and lower APACHE II score (24.4 vs. 31.3) (p < 0.05). Compared with older patients, younger patients had lower scores on readmission (APACHE II: 24.9 vs. 31.2 and Charlson score: 5.4 vs. 8.3) and had less probabilities of receiving mechanical ventilation (p < 0.05). Although there was no difference between the groups in the durations of ward stay and ICU readmission as well as in the outcome, the younger patients had a better chance of hospital survival (p < 0.05).
Conclusion: Readmitted ICU patients, especially the geriatric group, had a very poor prognosis. The worsened APACHE score might be a good predictor for readmission survival. The Charlson score was an important hospital survival predictor.
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1. Introduction

Intensive care unit (ICU) beds are valuable commodities that need to be used optimally. Discharging patients from the ICU as soon as possible reduces excessive use of this specialized healthcare resource and provides available beds for other critically ill patients. However, if patients are discharged prematurely and inappropriately, the chance of readmission increases. On the other hand, delaying the discharge of patients from the ICU might not provide benefit and can increase medical cost. Therefore, choosing the optimal time to discharge patients from the ICU is a challenge.

Patients readmitted to an ICU during the same hospital admission represent a population that requires special attention. Many studies reported that 8%–10% of patients were readmitted to ICUs.[1–3] A higher readmission rate was associated with several risk factors, including older age, higher APACHE score, and early discharge from the ICU.[4] ICU readmission has also been associated with worsening patient condition, longer ICU and hospital stays, higher hospital cost, and mortality.[1] Most published studies have been conducted in Western countries, and only few were reported from a surgical ICU in Taiwan.[5,6] In addition, most studies compared patients according to whether they were readmitted to the ICU.

Therefore, this study aimed to study the following aspects: (1) to evaluate ICU and hospital outcomes of patients readmitted to the medical ICU (MICU); (2) to identify the risk factors of survival and mortality in these patients; and (3) to determine the difference between geriatric and young readmitted patients.

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2. Materials and methods

The MacKay Memorial Hospital Tamsui Branch is a tertiary hospital with 950 beds that mainly serves the northern part of New Taipei City. There are two MICU in the hospital that comprise 28 beds for adult intensive care, including an eight-bed coronary care unit.

After getting approval from the Institutional Review Board of MacKay Memorial Hospital with waving for informed consent, data were collected retrospectively for all patients readmitted to the MICU from January 1, 2011 to December 31, 2013. The Patients with planned readmission due to cardiac catheterization or planned operations were excluded from the study. In addition, patients who were mandatorily transferred to a step-down respiratory care center (RCC) based on the regulations of the National Health Insurance were also excluded. For patients who had multiple readmissions during the same hospital stay, data for analysis were obtained from the first readmission. Basic demographic characteristics, including gender, age, type of admission, length of hospital stay, length of ICU stay during the first admission, and ICU readmission were analyzed. The reasons for admission were classified into eight major categories: cardiovascular, respiratory, gastrointestinal, sepsis, and so on. Comparison of disease severity scores based on APACHE II was performed while these patients were discharged for the first time and readmitted. And the change between these two scores was calculated to reflect the change in disease severity. The impact of a previously healthy status was analyzed using modified Charlson comorbidity score (CCI).

2.1. Statistical analysis

Categorical variables in each group were expressed as frequency and percentage, whereas continuous data were expressed as mean ± SD. All data were analyzed by Graphpad Prism 5.0 for Windows (Graphpad Software, Inc., La Jolla, CA, USA). Unpaired t-test and one way ANOVA analysis of variance were used to compare groups. A p value < 0.05 was considered statistically significant.

3. Results

During the study period, there were 4327 ICU admissions, including 211 readmissions. After excluding readmissions due to scheduled operations (n = 28), cardiovascular procedures (n = 31), request for hospice care after readmission (n = 16), and transfer to RCC (n = 19), 117 were included in the analysis (Fig. 1).

The mean age of the study population was 69.2 years and the average CCI was 7.2. The average duration in the ward before readmission was 12.3 days, and 16 patients were on regular hemodialysis. There were 91 patients who developed respiratory failure while readmitted, 89 patients who received invasive mechanical ventilation (MV) and 2 patients who received non-invasive ventilation. Sixty-two patients developed shock while readmitted in the ICU. The most common cause for readmission was respiratory disease (49 patients, 41.9%), including chronic obstructive pulmonary disease and pneumonia. The average duration of readmission was 10.1 days. After readmission, 74 patients survived and 43 died, with a mortality rate of 36.8%.

The survivors and non-survivors were similar in disease severity, CCI, duration of first ICU admission, and duration upon leaving the ICU after the first admission (Table 1). However, in the non-survivors, the APACHE II score at readmission was significantly higher (32.2 vs. 26.6, p < 0.05). In addition, non-survivors had worse indices of liver function (GOT 885.7 vs. 38.2 IU/L), hematocrit (24.3 vs. 27%), and coma score (7.1 vs. 9.3). (Table 2, all p < 0.05).

Among the 74 survivors, only 50 patients were discharged from the hospital and 24 patients died afterwards in the hospital. The overall hospital mortality rate was 57.3%, with an average hospital stay of 51.5 days. The patients who survived the hospital course were younger (64.1 vs. 75.6 years, p < 0.01), had higher coma score (10.2 vs. 7.5, p = 0.02), lower CCI (6.4 vs. 8.6, p = 0.03), and readmitted APACHE II score (24.4 vs. 31.3, p < 0.01) compared with patients who survived the readmission but died later in the hospital (Table 3). However, there was no difference in the duration of hospital stay between the two groups.

Compared with older readmitted patients, younger patients had significantly lower APACHE II score (24.9 vs. 31.2, p < 0.01); lower CCI (5.4 vs. 8.3, p < 0.01); and less possibility of receiving MV (61% vs. 86.8%, p < 0.01) (Table 4), but had higher possibility of uremia (31.7% vs. 3.9%, p < 0.05) and shock (68.3% vs. 44.7%, p < 0.05). Although there was no difference between the geriatric and young patients in duration of ward stay, duration of ICU readmission, and outcome, the younger patients had better chance of hospital survival (61% vs 35.2%, Table 4, p < 0.01).

4. Discussion

Readmission has been a major quality index for ICUs. Unfortunately, 8%–10% of patients were reported to be readmitted to the ICU.[1–3,7] In our study, 4.9% were readmitted after 12.1 days' stay at the ward. The most common cause for readmission was acute respiratory failure. ICU readmission mortality rate was 36.8% and hospital mortality rate was 57.3%. These data were similar to the results of a previous study by Tam, who demonstrated an ICU readmission rate of 5.1% due to respiratory problems in the majority.[7] Likewise, Chan showed that respiratory complications were the most common etiology of surgical ICU readmission with a mortality rate of 40%.[5] A systematic review proved that the most common reason for ICU readmission was respiratory problems, followed by other diseases in the cardiac and gastrointestinal systems.[8]

On the other hand, data from the National Health Insurance in Taiwan showed an ICU readmission rate of 13.3%, with ischemic heart disease as the most common reason.[2] That study included health insurance data and did not determine whether the readmissions were scheduled or unplanned. In contrast, our study excluded 31 patients who were scheduled for cardiovascular procedures.

Lee suggested that the APACHE II score at discharge might be a good indicator of ICU readmission and post- ICU mortality.[9] However, their patients were readmitted within 48 h, whereas most of our patients stayed for more than one week before readmission. Some authors implied that creation of a model based on the risk factors for predicting death or readmission was not possible.[10] However, old age, prolonged hospitalization, high dependence, and high APACHE II score were risk factors for ICU readmission.[1,4,12] Our study population comprised 65% geriatric patients who spent a mean duration of 12.3 days at ward before ICU readmission and had high CCI (7.2) and APACHE (25) scores. These placed them at high risk for ICU readmission.

Notably, disease severity was worse in patients who died during ICU readmission. The main contributing factor was probably multiple organ failure, as reflected by worse liver function and lower hematocrit levels. Our findings might be compatible with other previous studies, which reported that worsened severity score and multiple organ failure were good indicators of survival from ICU readmission.[7,10–14] For example, Li reported increased disease severity and worsened coma scale in their surgical patients who did not survive after ICU readmission.[14]

In our study, the overall hospital mortality rate was 57.3%; moreover, 32.4% of the patients did not survive the subsequent hospital course. Several studies have reported high hospital