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RESEARCH ARTICLE

THE FACTORS WHICH EFFECT MORTALITY AND MORBIDITY RATE IN PATIENTS DURING POSTOPERATIVE PERIOD

***SeldaTekin and Elif Bombaci**

Health Science University, Kartal Lutfi Kirdar Training and Research Hospital, Şemsi Denizer Cad. E5 Karayolu, Cevizli Mevkii, 34890, Kartal, Istanbul, Turkey

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ABSTRACT

Background: Parallel to the advanced surgical techniques, the critically ill postoperative surgical patients are increasing in intensive care units (ICU). Mortality and morbidity of these patients in ICU are multifactorial. However, which of them is most effective is not clearly understood. **Objective:** The aim of this study is to evaluate the factors, which more frequently affect mortality and morbidity of the critically ill patients in postoperative period. **Methods:** Between 2011-2012, 121 patients were included in this study. Postoperative surgical patients, who followed-up in our ICU during one year period, were evaluated in respect of demographic characteristics, "American Society of Anesthesiologists" (ASA) physical status, preexisting co-morbidities, data about surgical procedures, "Acute Physiology and Chronic Health Evaluation" (APACHE) II scores, hemoglobin and hematocrit levels, the amount of transfusion, duration of mechanical ventilation, length of stay in ICU, vasopressor agent requirements and the effects of these parameters on mortality and morbidity of the patients were examined. **Results:** We found that age, gender, ASA physical status, co-morbidities, hemoglobin and hematocrit levels on admission, blood loss in the intraoperative period and operation time were not predictive factors on mortality. However, APACHE II≥25, the amount of transfusion, co-morbidities developed in ICU, mechanical ventilation more than 3 days, length of stay more than 6 days, need of vasopressor agents were risk factors on mortality. Logistic regression analysis showed blood transfusion, co-morbidities developed in ICU and prolonged length of stay were independent risk factors for mortality. **Conclusions:** In conclusion, we want to emphasize the importance of preventive strategies and precision of blood transfusion in critically ill surgical patients because of the deteriorated effects of co-morbidities developed in ICU resulted in prolonged length of stay and mortality.

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INTRODUCTION

The surgical procedures have many perioperative risks closely associated with patients' physical status and the characteristics of the surgical and anesthetic techniques. The most important perioperative complications are usually related with the pulmonary and cardiovascular system resulted in increased morbidity and mortality. These results lead to critical care requirement, prolonged length of stay in the hospital, increased workload and cost (Wiene-Kronish, 2000). The decision of ICU admission in postsurgical high-risk patient is a challenging issue which sometimes results with the unnecessary postponing of the operations.

Corresponding author: **SeldaTekin,**
Health Science University, Kartal Lufi Kirdar Training and Research Hospital, Şemsi Denizer Cad. E5 Karayolu, Cevizli Mevkii, 34890, Kartal, Istanbul, Turkey
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On the other hand, the number of cancellations of pre-booked surgery leads to unavailability of ICU bed for the critically ill patients and suggests a major problem to triage decisions. Although some scoring systems are used to identify the intensive care unit (ICU) admissions in surgical patients, it is usually difficult to determine which patients are at high-risk for complications and critical care (Cavaliere, 2008). It is reported that postoperative ICU care of especially high risk surgical patients reduced the postoperative unexpected events due to early recognition and management of complications on time (Pearse, 2012). In this retrospective study, we aimed to assess the critically ill postoperative surgical patients and to determine the predictive factors of morbidity and mortality in the ICU.

MATERIALS AND METHODS

The study was conducted in mixed medical-surgical tertiary 22-bed-ICU staffing by anesthesiologists available 7/24 between

2011-2012 years.After institutional approval, data were collected in two steps. First, we scanned the admission registry and found the postoperative surgical patients admitted in the ICU and then examined the patients'daily follow-up ICU charts. The hospital electronic database was used to obtain the laboratory parameters. The data included age, gender, "American Society of Anesthesiologists" (ASA) physical status, preexisting co-morbidities, co-morbidities developed after the ICU admission, the type of surgery, duration of operation, the amount of red blood cells (RBCs) and blood products transfusion, hemoglobin (HB) and hematocrit (HCT) levels on the ICU admission, length of mechanical ventilation (LOS), inotropic and vasopressor (VP) agent requirement and mortality."Acute Physiology and Chronic Health Evaluation" (APACHE) II scores and "Predicted Death Rate" (PDR) were also recorded from the patients' first day follow-up charts previously calculated as online with "the Health Quality Standards" (HQS) of The Ministry of Health of Turkey (http://ybs.saglik.gov.tr). Statistical Package for Social Sciences (SPSS) version 13.0 was used in statistical analysis. Descriptive statistics were given as numbers and expressed as a mean± standard deviation. Comparison between two groups was performed with Student's t-test. Numerical variables between more than two independent groups were compared with one–way ANOVA.A p value< 0.05 was considered statistically significant. The study was conducted according to ethical principles outlined in the Helsinki Declaration.

RESULTS

The study group was composed of 121 patients. The relation between mortality rate and demographics and physical status of patients was not statistically significant (Table 1). Patients were divided into 3 groups according to APACHE II scores (≤20, 20-25,≥25). Mortality rate was significantly high in the patients with APACHE II score ≥25 ($p<0.01$). Co-morbidities of the patients on admission were not a predictive factor for mortality ($p=0.49$) but disease developed during ICU stay changed the mortality significantly ($p<0.01$). The amount of blood transmission was significantly high in mortality group ($p<0.01$). HB and HCT levels on admission were divided into 2 groups (≤8.0 g/dL/24.0% or higher) and no difference was found between groups in respect of mortality ($p=0.88$). Length of stay (LOS) of mechanical ventilation in the ICU and requirement of inotropic and vasopressor (VP) agents were significant parameters in mortality group of patients ($p<0.01$) (Table 2). The duration of mechanical ventilation and length of stay in ICU was significantly longer in the patients with APACHE II score>25 ($p<0.01$). According to regression analysis blood transfusion (>4RBCs/2FFP), co-morbidities developed in ICU and LOS more than 6 days are independent risk factors for mortality in postoperative surgical patients (OR>1).

DISCUSSION

The reasons of mortality and morbidity of post-surgical critical care patients are multifactorial. As the population becomes older, many old patients undergo surgical procedures. Hoekstra *et al*. suggested that age itself was not a predictive factor for mortality in cancer patients, the presence of malnutrition and immunodeficiency predicted the outcome (Hoekstra, 2001). In geriatric patients having pulmonary and cardiovascular co-morbidities, the mortality increased 2-fold (Daley, 1997). In our study, the mortality rates of patients 65 years old or older was similar. We agree with Hoekstra *et al*. that the age itself is not a predictive factor for mortality (Hoekstra, 2000). Many preoperative risk assessment scores can help which patients are most likely to need critical care. The best-known ASA classification systemis one of the most useful predictors of postoperative morbidity and mortality of patients (Wolters, 1996). Gregòrio *et al*. suggested that surgical patients in ASA 3-4 physical status were mostly candidatesto ICU admission (Gregòrio, 2011). In our patients, the mortality rate increased 2-fold in patients with ASA 4 physical status but the difference was not statistically significant. This may be due to a small number of patients in each ASA physical status group. APACHE II indexconsists of a score accounting patient's age, chronic health condition and physiological variables including temperature, heart rate, respiratory rate, oxygenation, arterial pH, sodium, potassium, creatinine, hematocrit, white blood cells and "Glosgow Coma Score". It is a widely acceptedmeasure of illness severity classification system applied within 24 hours of admission of the patient to the ICU with a range of 0-71 points. The higher scores correlate with the higher mortality (Wong, 1995). Chiavone *et al*. reported that APACHE II is lacked to estimate the "predicted death rate", so recorded death rate was higher than predicted (Chiavone, 2003). In Turkey, it is used by the Ministry of Health as a criterion for the evaluation of critically ill patients on an electronic database for prediction of illness severity and calculation of predicted death rate. In our study as the high APACHE II scores (≥25) increased the mortality significantly as expected. Blood and blood products transfusionsin surgical patients are complex and challenging issue. In the surgical literature, anemia definition showed variability and the correlation between low hemoglobin levels and survival rates were underestimated (Shander, 2004). It's reported that even mild anemia (<29%HCT≤39% in men, 29%<HCT≤36% in women) increased 30-day mortality rate in critical patients (Musallam, 2011 and Pearse, 2011). The deleterious effect of only one unit of RBCs transfusion had been shown (Bernard, 2009). A lower HCT value is strongly associated with a high risk of acute renal failure, myocardial infarction, higher APACHE II score and "Simplified Acute Physiology Score" (SAPS) II (Lopes, 2017). Transfusion itself is an independent factor for mortality in critically ill patients with ARF (du Cheyron, 2005). In our study, there was a strong relation between RBCs and FFP transfusion and duration of MV, LOS in ICU and mortality. Transfusion was an independent factor for mortality as previously reported in similar studies. Preexisting co-morbidities of surgical patients are usually predictive factor for the assessing the patient suitability to ICU admission but co-morbidity alone has a limited ability to discriminate survivors and non-survivors (Ho, 2007). Despite the inter-observer variability, preexisting diseases change the ASA physical status and decision of ICU admission. The vast majority of post-surgical patients admitted to the ICU are the patients who needed to the follow-up of the severe preexisting diseases (Uzman, 2016). Recently, the necessity of ICU admission of high-risk patients after a surgical procedure has been questioned and no direct association was found between perioperative mortality and ICU utilization (Kahan, 2017). The overuse of ICU resources with inappropriate decisions leadsto increase LOS and cost (Sobol, 2011). Co-morbidities are frequent in our population especially patients older than 65 years of age. Diabetes mellitus, chronic obstructive pulmonary disease, congestive heart failure, hypertension and chronic renal failure are frequently encountered systemic diseases.

Presence of co-morbidities showed no correlation with mortality in our study but the development of additional diseases after admission to the ICU made the patient outcome worse which resulted with the significant increase in mortality. These were the acute renal failure, pulmonary complications, thromboembolic diseases and septic conditions. Inotropic agents and vasopressors are widely used pharmacological treatments in ICUs to increase myocardial contractility and vascular tone. Despite widespread usage, understanding of the clinical effects of these agents was not clearly understood (Bangash, 2012). The mortality rate was significantly high (76%) in inotropic and vasopressor treated patients in our study. There were only 17 patients in the treatment group so detailed evaluation could not be conducted. This is a limitation of this study and may be a subject to another clinical study. Another limitation is that this study was a single-center investigation and reflected only our results. Multi-center analysis will play a role to provide valuable inputs for the predictive factors of mortality in postsurgical critical care patients.

Conclusion

As a conclusion, the results of this study showed that the factors, which determines mortality rate of the postsurgical patients, are not closely related with patients' conditions on admission to the ICU, rather related to the conditions developing at his/her stay in the ICU. Therefore, we want to emphasize the importance of preventive strategies in the critically ill surgical patients because, the deteriorated effects of co-morbidities developed in the ICU, might resulted in prolonged length of stay in the ICU and higher mortality rate.

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