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RESEARCH

POSTOPERATIVE APPROPRIATENESS OF ASSIGNING AN INTENSIVE CARE BED PREOPERATIVELY FOR HIGH-RISK PATIENTS: A RETROSPECTIVE STUDY

ABSTRACT

Introduction: To retrospectively evaluate the correlation between predicted preoperative intensive care unit need and postoperative ICU bed need.

Materials and Method: Adult patients who underwent surgical intervention (except for cardiovascular and intracranial surgeries) between January 2010 and January 2012, and were predicted to need intensive care unit during preoperative evaluation, were included in the study. Patients were divided into those who required intensive care unit support (Group I) and those who did not require intensive care unit support (Group II) in the postoperative period. Demographic data, properties of anesthesia, surgery and mortality were recorded.

Results: Data of 372 patients were reviewed. Of these patients, 195 were in Group I and 177 were in Group II. The number of drugs used, severity of the accompanying disease, operation duration, complexity, emergency status and re-operation, transfusion need, negative events occurring in the perioperative period and mortality were all higher in Group I, while age and regional anesthesia application were higher in Group II. Respiratory and neurological problems, renal disease and active infection rates were also higher in Group I.

Conclusion: Several variables can be utilized in determining the need for postoperative intensive care unit bed. They include: severity of accompanying disease, respiratory and neurological status, renal disease, active infection, number of medications, emergency vs. elective status, complexity and duration of operation, re-operation, need for transfusion and perioperative negative experiences.

Key Words: Intensive Care; Anesthesia Recovery Period; Preoperative Care.

ARAŞTIRMA

YÜKSEK RİSKLİ HASTALAR İÇİN PREOPERATİF YOĞUN BAKIM YATAĞI AYRILMASININ POSTOPERATİF YERİNDELİĞİNİN İNCELENMESİ: RETROSPEKTİF ÇALIŞMA

ÖZ

Giriş: Postoperatif yoğun bakım ihtiyacının preoperative öngörüsü ile postoperative gereksinimi arasındaki ilişkinin retrospektif olarak değerlendirilmesidir.

Gereç ve Yöntem: Çalışmaya Ocak 2010 ve Ocak 2012 yılları arasında kardiyovasküler ve intrakranial cerrahi dışında cerrahi müdahale geçiren, preoperatif değerlendirmede yoğun bakım ihtiyacı olabileceği öngörülen yetişkin hastalar alındı. Hastalar postoperatif dönemde yoğun bakım ihtiyacı olup (Grup I) olmamasına (Grup II) göre iki gruba ayrıldı. Demografik veriler, anestezi ve cerrahinin özellikleri ve mortalite kaydedildi.

Bulgular: Üç yüz yetmiş iki hastanın verilerine ulaşıldı. Bunların 195'i Grup I ve 177'i Grup II idi. Grup I'de kullanılan ilaç sayısı, eşlik eden hastalığın şiddeti, operasyonun süresi, kompleksliği, acil ve reoperasyon olması, transfüzyon ihtiyacı, peroperatif dönemde yaşanan olumsuzluklar ve mortalite daha yüksek iken Grup II'de yaş ve rejyonal anestezi uygulamaları daha fazla bulundu. Solunumsal, nörolojik, renal hastalık ve aktif enfeksiyonu oranı Grup I'de daha fazlaydı.

Sonuç: Eşlik eden hastalığın şiddeti, solunumsal, nörolojik, renal hastalık ve aktif enfeksiyon, ilaç sayısı, operasyonun süresi, komplekliği, acil ve reoperasyon olması, transfüzyon ihtiyacı, peroperatif dönemde yaşanan olumsuzluklar postoperatif yoğun bakım ihtiyacını tespit etmede kullanılabilir.

Anahtar Sözcükler: Yoğun Bakım; Anesteziden Derlenme; Preoperatif Değerlendime.

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Introduction

It is important for patients planning to undergo elective surgery to have a bed reserved in the intensive care unit (ICU) during preoperative evaluation, assuming that they may need postoperative intensive care support for their safety. This way, in a patient requiring postoperative ICU, transfer to another center and accordingly any hindrance to treatment is prevented. Furthermore, an already assigned intensive care bed for a patient not in need of ICU in the postoperative period may prevent another patient from benefitting from care in the ICU. When a bed cannot be reserved in the ICU, elective cases believed to need postoperative ICU may be postponed. Therefore, during the preoperative period, it is important to determine which patients may need ICU beds to assure both patient safety and good IC service. In the clinical literature there are several studies on the ICU needs of patient, involving various patient groups and related parameters (1-5). In general, investigations of effective parameters for predicting the need for postoperative intensive care beds have been conducted by Weismann (6) and Klein (7). In their studies, which separately evaluated preoperative and intraoperative periods, these authors scored all interventions carried out for diagnostic and treatment purposes and demonstrated a significant correlation between high scores on these interventions and the need for intensive care.

Our study aimed to assess patients who were predicted to need intensive care during preoperative evaluation, and also to retrospectively evaluate the correlation between the preoperative prediction of the need for intensive care need and the postoperative actual need for intensive care.

Materials and Method

Before commencing the study, Faculty Ethics Committee approval and Archive Scanning permission were obtained. Then, we examined the records of patients over the age of 18 who underwent surgical intervention (other than cardiovascular and intracranial surgery) between January 2010 and January 2012, and who had been expected to need intensive care during preoperative evaluation, and/or demonstrated a need for intensive care in the postoperative period. Preoperative information on patients was obtained retrospectively from: patient files; preoperative anesthetics assessment and consultation forms; events during anesthesia from anesthetics observation records; treatments, treatment periods and outcomes of patients treated in the intensive care unit from intensive care unit files; and the final condition of the patient from epicrisis forms.

Based on the information obtained from the records, patients were divided into two groups and evaluated.

Group I: Patients who were assigned to an intensive care bed during the preoperative period (ICBP) and required intensive care support in the postoperative period (ICSP),

Group II: Patients who were assigned to an intensive care bed during the preoperative period (ICBP) and who did not require intensive care support in the postoperative period (ICSP).

Age, gender, ASA risk status, alcohol use and smoking, substance abuse, number of drugs used, and type and degree of accompanying diseases of patients were recorded.

Complexity of the operation, emergency/elective operation ratio, presence of re-operation, type of anesthesia, negative events occurring perioperatively, perioperative arrest and perioperative transfusion need were recorded. Duration of hospital and intensive care unit stays, development of mortality, and day and cause of mortality were also recorded.

In patients with accompanying diseases, the severity of pathology in relevant systems was established through clinical and laboratory data on file. Degrees of the accompanying disease were scored as 0: no accompanying disease, 1: mild, 2: moderate, 3: severe, 4: very severe. Negative events that developed during the perioperative period were recorded as OAB<60mmHg (>10 minutes), OAB>100mmHg (>10 minutes), management of difficult airway, arrhythmia, SpO_2<90% (>5min), difficult mechanical ventilation, urination<0.5ml/kg/hour, and pneumothorax.

Complexity of the surgical intervention was recorded by modifying the physiological and operative severity score for the enumeration of mortality and morbidity (POSSUM) scoring system (8): (minor (1): dilation-curettage, tooth extraction, cataract operation, rectal abscess incision and drainage; moderate (2): appendectomy, cholecystectomy, mastectomy, TUR-P, open reduction and internal fixation of hip and long bones; major (3): laparotomy, intestinal resection, cholecystectomy with choledocotomy, major amputation, posterior spinal surgery, abdominal hysterectomy; major plus (4): abdominal–perineal resection, pancreas or liver resection, esophagogastrectomy, craniotomy, anterior–posterior spinal surgery /instrumentation).

Statistical Package for the Social Sciences (SPSS) 12.0 software was used for statistical evaluation. Parametric data were expressed as mean±standard deviation, and were further analysed with one-way ANOVAs; nonparametric data were

Table 1— Demographic Data of the Patients.

	Group I	Group II	p value
Age (year) (mean ± SD)	66.40 ± 15.64	69.61 ± 12.96	**<0.05**
Gender (F/M)	101/94	61/116	**<0.01**
ASA (med (min-max))	4 (3-5)	4 (3-4)	>0.05
Concomitant disease's severity (med (min-max))	4 (2-4)	4 (2-4)	**<0.01**
Drug number (med (min-max))	3 (0-7)	3 (0-6)	**0.01**
Smoking status (use/not use)	18/177	25/152	>0.05
Alcohol use (use/not use)	2/193	2/175	>0.05

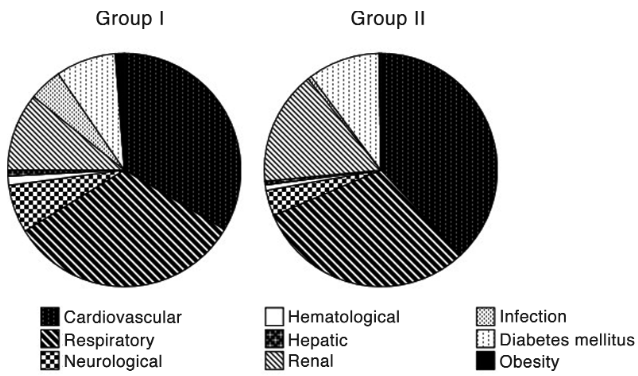

Figure 1— Type of systemic diseases of patients.

analysed with crosstabs and Chi-square tests. Pearson's correlation tests were used to determine the correlations between parameters; p<0.05 was the accepted significance level.

Results

Data of 372 patients who fulfilled the inclusion criteria of the study were analyzed. Of these patients, 195 (52.4%) were found to require ICSP (Group I). The remaining 177 patients (47.6%) were found to not require ICSP (Group II).

Patient age was significantly higher in Group II than in Group I. Rate of females and the number of drugs used was significantly higher in Group I than in Group II. A significant difference was not observed between groups in terms of ASA score, smoking and alcohol use (Table 1).

Severity of the accompanying disease was significantly higher in Group I than in Group II (p<0.05). The most prevalent accompanying diseases in both groups were cardiac, followed by respiratory diseases. While a significant difference was not observed between the two groups in terms of cardiac, hematologic or hepatic diseases, obesity, and the presence of diabetes mellitus, it was established that respiratory, neurological, renal disease and active infection rates were significantly higher in Group I (Figure 1).

A strong correlation was found between the degree of accompanying disease and ASA score in both groups (r=0.407, p<0.001 in Group I; r=0.304, p<0.001 in Group II).

Operation duration, complexity, emergency and re-operation, perioperative transfusion need, and negative events that occurred in the perioperative period were all significantly higher in Group I than in Group II, and regional anesthesia administrations were fewer and cardiac arrest developed in two patients in this period (p<0.05) (Table 2).

The correlation between anesthesia-associated issues and anesthesia periods in Group II was highest for the preoperative period. In Group I this relationship was not limited to the preoperative period; it was also found in the intraoperative and postoperative periods.

A significant difference was not found between the groups in terms of hospital stays. Mortality rate was observed to be higher in Group I than in Group II, and it developed at a later period. The primary causes of mortality were cardiac or respiratory problems in Group I and multi organ failure (MOF) in Group II (Figure 2).

The reasons for transferring patients in Group I to intensive care were: postoperative respiratory distress for 96 patients (PaO_2 in room air below 50 mmHg, PCO_2 above 50 mmHg, 50% FiO_2 and PaO_2 below 60 mmHg, PCO_2 above 60 mmHg, pH below 7.1, clinically cyanosed, intercostal and

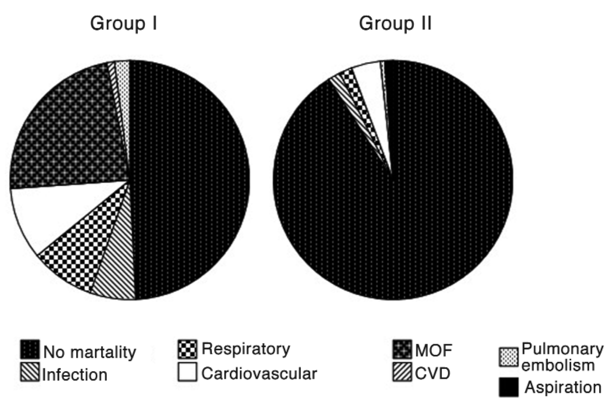

Figure 2— Patients' mortality causes (MOF: multi organ failure, CVD: Cerebrovascular disease)

Table 2— Anesthesia- and Surgery-associated Characteristics of Patients.

	Group I	Group II	p
Complexity of operation (mild/moderate/major/majorplus)	2.55 ± 0.74 18/63/102/12	2.40 ± 0.62 6/101/63/7	**<0.001**
Duration of operation (min)	149.32 ± 121.07	117.38 ± 74.83	**0.01**
Emergency status of operation			
Emerge/Elective (n)	112/83	22/155	**<0.001**
Re-operation (n)	48/195	19/177	**0.001**
Type of anesthesia (n)			
General anesthesia	189	126	
Epidural anesthesia	5	13	
Spinal anesthesia	0	17	
Peripherial block	1	21	
Transfusion (n)	67/195	7/177	**<0.001**
Intraoperative complication (n)	111/195	31/177	**<0.001**
Intraoperative arrest (n)	2/195	0/177	>0.05

diaphragmatic and supraclavicular retraction, presence of respiratory effort pattern, airway obstruction, number of respirations above 35/min or below 8, tidal volume below 3ml/kg and vital capacity below 15 ml/kg, inspiratory strength below 25cmH_2O); intraoperative and postoperative hemodynamic disorder for 55 patients (systolic arterial pressure below 90mmHg, mean arterial pressure below 50 mmHg, noradrenaline, adrenaline and inotropes infused, heart rate above 140/min, intraoperative arrest); diagnosis of sepsis accompanied by hemodynamic disorder for 18 patients; neurological problems (muscular dystrophy, myasthenia gravis, postoperative delirium) for 14 patients; long-duration surgery (>8 hours) for 8 patients; and complications that developed due to disease or intervention (pneumothorax, TURP syndrome, maxillofacial surgery-related severe airway edema) for 4 patients.

Discussion

During preoperative evaluation in our clinic, a fully-equipped bed is assigned in the intensive care unit for patients who we believe will require postoperative intensive care support on the day the operation takes place. When the patient is taken to the operating room, the "surgical safety checklist" recommended by the World Health Organization is filled in (9). A new parameter has been added by our clinic to the "before anesthesia induction" section of this form. This new parameter is whether approval has been given to reserve a bed for patients who, preoperatively, are predicted to have a need for postoperative intensive care. This way any hindrance to the treatment of patients requiring postoperative intensive care support is prevented. However, the fact that the number of well-equipped intensive care beds is limited renders the appropriateness of the preoperative intensive care request important. Absence of the need for postoperative intensive care is invaluable for the patient. Further, keeping an intensive care bed empty for hours may hinder another patient from benefiting from the bed and cause an increase in costs. Considering the fact that the daily cost of a bed is £1000-£2000 (10) and 60% of this is staff expenditures (11), the daily cost of an empty ICU bed is observed to be £600-£1200 and the hourly cost can range from £25-£50.

Among the important indicators of the need for postoperative intensive care support is the age of the patient (1,4,5). In our study, all patients for whom intensive care was indicated in the preoperative period, whether they in fact needed postoperative intensive care or not, were over 65 years of age. However, in patients for whom ICU was predicted in the preoperative period but who did not demonstrate intensive care need in postoperative period, age was observed to be significantly higher. This relates to the fact that postoperative intensive care support is not correlated with age but with the degree of accompanying disease.

One postoperative intensive care need indicator is the ASA risk classification (7,12). De Lima et al. (13) demonstrated that ASA was proportional to care in the recovery room and the duration of stay. The ASA score was significantly correlated with intraoperative blood loss, postoperative ventilation time, time spent in intensive care, postoperative complications, and mortality (12). Although the nature of the ASA score is subjective, it is a beneficial indicator of postoperative morbidity and mortality (14). In our study, ASA scores were high in patients predicted in the preoperative period to need ICU and for whom ICBP was reserved; there was a strong correlation between ASA score and the degree of accompanying disease.

The number of drugs used was actually proportional to the degree and number of accompanying problems. In our study, The group with the highest number of medications used and highest degree of accompanying disease was the group of patients for whom ICBP was reserved and who did require ICSP (Group I). It was found correlation used drugs number and accompanying problems with actual postoperative ICU need.

Although a relationship has been established between smoking and postoperative intensive care need in surgery patients (15), a significant correlation between these two variable was not found in our study. This was attributed to the low rate of smoking in our patient population.

In a study that investigated pulmonary complications, incidence and risk factors in patients who underwent nonthoracic surgery, age, positive cough test, perioperative nasogastric probe and anesthesia time were observed as independent factors related to increased pulmonary complications (4). In another study that evaluated risk factors for prolonged intensive care support following coronary artery bypass grafting surgery, renal dysfunction, unstable angina, low ejection fraction, peripheral venal disease, obesity, advanced age, smoking, diabetes mellitus, hypercholesterolemia, and hypertension were each established to be risk factors (5). In a study that compared postoperative complications and preoperative indicators in patients who underwent Roux-en-Y gastric bypass surgery for morbid obesity, it was demonstrated that the probability of postoperative complication increased in the presence of a body mass index higher than 50kg/m^2, FEV1 lower than 80%, abdominal surgery history, and abnormal ECG (16). Heinonen et al., in their study evaluating intensive care needs of gynecology patients, showed that gynecological malignancy presence and accompanying medical diseases were indicators of the need for ICU (17).

Petrar et al. (18) demonstrated a correlation between postoperative pulmonary complications and prolonged intensive care, hospital stay and increased mortality in patients who underwent head-neck surgery. Silva et al. (19) noted a relationship between preoperative low central venous oxygen saturation and bad prognosis. Wolters et al. (12) showed significant correlations among arterial hypertension, previous myocardial infarction, severe bronchopulmonary disease and postoperative complications, and also between severe bronchopulmonary disease and mortality.

In agreement with the literature, although the severity of accompanying disease was high in all patients in our study predicted to need preoperative intensive care, this was observed to be much higher in patients who actually needed postoperative ICU. While in both groups the most frequent disease group was cardiac-related, respiratory, neurological and renal disease and infection presence were found to be systemic pathologies that created a need for postoperative intensive care.

In their intraoperative scoring system, Klein and Weismann (7) demonstrated apparent significance between a high score and the need for intensive care; their scores were also correlated with ASA and size of surgery. In our study, too, a significant correlation was found between the size of surgery and the need for ICU.

In reports of intraoperative negative incidents (especially the presence of tachycardia), hypotension and hypertension requiring treatment have been found to be correlated with staying in ICU, prolonged hospital stay, and hospital mortality (14, 20-22). In our study, too, intraoperative negative incidents containing the above-mentioned clinical conditions were observed to be higher in patients requiring ICU support.

In a study that retrospectively investigated the effects of hemodynamic monitoring on the intensive care need of patients planning to undergo elective major non-cardiac surgery, fewer cardiovascular system complications were observed in patients with normal preoperative hemodynamic parameters to begin with, or with abnormal parameters that were corrected in the preoperative period, compared to patients with uncorrected abnormal parameters in the preoperative period (3). Weismann and Klein (6) established that the postoperative intensive care need was higher in emergency interventions with patients who had high preoperative therapeutic intensity scores. In our study, too, a significant relationship was found between postoperative ICU need and urgency of the operation. Since sufficient time is not always available to fix the problems in the preoperative period in emergency operations, these patients were believed to have more need of ICU. In addition, we found that the length of surgical intervention and recovering complications from previous operations, or the need for re-operation, were also factors in the need for postoperative ICU.

In a study that evaluated the effects of different anesthesia methods on postoperative ICU need, 88 out of 361 patients who underwent total knee and hip surgery were predicted to need postoperative intensive care support. Of these patients, 45 were administered a neuraxial block, 38 were given general anesthesia, and five patients were administered a combination of the two. In the postoperative period, 11 patients out of 45 who were administered a neuraxial block and 22 out of 38 patients who were given general anesthesia were observed to require ICU support. It has also been shown that anesthesia and surgery times of patients who received general anesthesia were significantly higher than those of patients who were administered a neuraxial block (2). With results similar to this study, we established that regional anesthesia techniques had been administered more often in patients who did not demonstrate any need for ICU.

In our study, bleeding and the associated need for blood transfusion were higher in patients who demonstrated a need for postoperative intensive care because of the size of their surgeries and prolonged operation time.

Sessler et al. (23) showed that low mean arterial pressure during low inhalation anesthetics MAC fraction in the intraoperative period was a strong and quite significant indicator for mortality. More negative events were observed in the intraoperative period in patients who needed postoperative ICU.

While mortality was caused by was cardiovascular or respiratory system failure in patients who received ICSP, it was established that MOF was more likely to occur in patients who did not receive ICSP. This may be related to the protection of other systems through advanced monitoring and support therapy in patients who received ICSP. In a study conducted on patients who underwent non-cardiac surgery, 73% of the patients who died did not go to IC (24). This may be interpreted as indicating that patients requiring ICU in the postoperative period did not undergo such care; however, in our study, mortality was naturally higher in patients who received ICSP.

Altogether, only 52.4% of patients who were preoperatively predicted to need intensive care actually needed postoperative intensive care. Preoperative indicators for needing postoperative ICU were: the number of medications taken, severity of accompanying disease, size and length of operation, emergency and re-operation, intraoperative transfusion need, and issues experienced in the intraoperative period. Regional anesthesia was administered more often in patients who did not require ICU. The most frequently occurring diseases in all groups were cardiac and respiratory system diseases, and there was a significant relationship between the need for postoperative ICU and respiratory, neurological and renal disease and active infection. Therefore, the following parameters can be utilized to determine the need for postoperative ICU: ASA; severity of accompanying disease; respiratory, neurological and renal disease; presence of active infection; number of medications used for systemic diseases; size of the planned operation and its estimated length; emergency and re-operation as assessed in the preoperative evaluation; need for transfusion in the intraoperative period; and negative incidents experienced in the intraoperative period.

The authors report no conflict of interest.

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