Emergency surgery in geriatrics: A retrospective evaluation in a single center

Özlem Sezen, M.D., Banu Çevik, M.D.

Department of Anesthesiology and Reanimation, University of Health Sciences, Kartal Dr. Lütfi Kırdar Training
and Research Hospital, İstanbul-Turkey

ABSTRACT

BACKGROUND: As life expectancy increases in humans, surgical procedures applied to the elderly people are also increasing in parallel with the developments in surgery and postoperative care. A significant number of studies investigating the morbidity-mortality of geriatric patients are related to patients who are undergoing emergency operations. The present study aims to investigate the factors affecting mortality and morbidity after emergency surgery in elderly people.

METHODS: The data of 200 patients aged 65 years and over who were operated under emergency conditions in the University of Health Sciences Kartal Dr. Lütfi Kırdar Training and Research Hospital between January and December 2018 were evaluated retrospectively.

RESULTS: Patient's demographic information, including age, gender, ASA physical status, comorbidities, functional dependency or non-dependency of patients, types of operation, anesthesia technique, duration of operation, intraoperative blood transfusion, the changes of hematocrit levels (during the perioperative period), the outcome after surgery (intensive care admission or ward transfer), were recorded. The risk prediction of short-term mortality has been estimated using CCI and APACHE II scoring systems.

CONCLUSION: The mean age of the patients was 74.8±6.7 and the number of females (n=134, 67%) outweighed the males. Higher ASA physical status scores, dependent living conditions, long operation time, general anesthesia, intraoperative blood transfusion, low Htc values (<25%), high APACHE II scores and lower scores of 10-years survival by CCI were the factors that affected the acceptance into ICU.

Keywords: Elderly; emergency; geriatric surgery; intensive care unit.

INTRODUCTION

The proportion of elderly people is gradually increasing in the global population and the number of people aged over 60 years is expected to reach a number between 900 million to 2 billion by 2050.[1] The aged patients usually have many complex health problems, so during their long-life period, they often require immediate care or surgical interventions due to the developing complications as a consequence of the multiple underlying diseases. In parallel to the advances in modern surgery in all age groups, the number of elderly patients undergoing surgical interventions rises gradually. Concerning emergency surgeries, these patients are usually under-evaluated before the procedure because of the limited time for preoperative assessment. This may result in a worse outcome compared to the elective surgical procedures employed in the same age group.[2]

Due to the lack of universally accepted risk prediction scores, the risk estimation in these patients is usually problematic. In a comparative study, the prevalence of mortality has been demonstrated in a wide range of 52–85% by six different screening instruments. The Vulnerable Elderly Survey (VES-13) has been reported as the most accurate tool for risk assessment.[3] Acute Physiology and Chronic Health Evaluation [APACHE II] had a sensitivity of 96% in postoperative

mortality prediction, but it has been suggested that this tool was time-sparing during daily practice and usually used for the clinical researches.[4] Charlson Comorbidity Index (CCI) has been used for the prediction of preoperative outcomes after surgical procedures.[5] A modified version of the Canadian Study of Health and Aging Clinical Frailty Scale has been constructed to investigate the effects of frailty on infection outcomes and mortality for emergency patients aged 60 and older.[6] Although many other scoring systems have been introduced by the clinicians in different countries, these tools have limited specificity in the geriatric population.[7] The anesthesia consultation is mainly based on the American Society of Anesthesiologists (ASA) physical status classification, which is an easy tool for risk prediction in surgical patients. The estimated rate of mortality in patients aged 70 and older with ASA IV physical status has been reported up to 56.8%.[8] However, these results may show variations between the observers as a result of the subjective characteristics.

Our hospital is one of the main referral university-affiliated training hospitals, so a large proportion of the patients are admitted to the hospital for many advanced surgical procedures. In this study, we aimed to describe the clinical properties of the patients over 65 years old who underwent an emergency surgical intervention and discussed the factors affecting the postoperative outcomes in an anesthetic perspective.

MATERIALS AND METHODS

This 680-bed-hospital is a tertiary health care center having two emergency operation rooms (OR) and a 32-bed-tertiary intensive care unit (ICU) working for 24 uninterrupted hours under the Department of Anesthesiology and Reanimation. After obtaining institutional Ethics Committee approval [2018/514/144/4] and informed consent from all patients, patients ≥65 years old that underwent an emergency surgical intervention between January and December 2018 were recruited in this study. This study was conducted according to the ethical principles outlined in the Declaration of Helsinki and guideline for the Good Clinical Practice (GCP).

Data Collection

First, we reviewed the registry records of the operation rooms for finding the patients ≥65 years old. After that, the patient's characteristics were extracted from the clinical registry in the hospital electronic database. Perioperative anesthetic management was recorded from the anesthesia charts of each patient. Patient's demographics, including age, gender, ASA physical status, comorbidities, functional dependency or non-dependency of patients, types of operation, anesthesia technique, duration of operation, intraoperative blood transfusion, the changes of hematocrit levels (during the perioperative period), the outcome after surgery (intensive care admission or ward transfer), were recorded. The risk prediction of short-term mortality using CCI and APACHE II scoring system was estimated. The

main goal of this study was to evaluate these data and determine the factors affecting the outcome of the patients.

Statistical Analyses

Data were analyzed using GraphPad Prism 7. In the study data, descriptive statistical parameters (mean, standard deviation, minimum and maximum value) were compared in binary groups using Student's t-test, and in multiple comparisons, one-way ANOVA and Tukey post-test were used. The statistical significance levels were considered as ns: not significant, *$p<0.05$, **$p<0.01$, ***$p<0.001$, and ****$p<0.0001$.

RESULTS

A total of 200 patients [134 females (67%), 66 males (33%) (9% of overall emergency surgical procedures] were included in this study. The patients were between 65–92 years (mean age, 74.8±6.7 years).

Patients' Characteristics

Patients were divided into three groups as 65≤years<75 (Group 1), 75≤years<85 (Group 2), and over 85 years (Group 3).The ICU admission after surgical procedure was significantly higher in patients over 85 years old ($p=0.005$). The rate of female and male patients admitted to ICU was similar to 40.3 and 37.9%, respectively ($p=0.743$). The mortality rates in patients were 14.8, 18.8, 35.7% in Groups 1,2, and 3, respectively ($p=0.142$). Age alone was not a significant factor in mortality. The mortality rates were also similar in both genders (17.9% in female, 16.7% in male; $p=0.828$). A higher ASA physical status was associated with a significant increase in ICU admission ($p=0.003$) and a higher mortality rate ($p=0.019$) (Fig. 1).

The majority of the patients had more than one systemic comorbidity and parallel to the increase of additional systemic problems, ICU admission and mortality rates were gradually increased (Table 1). The living condition was expressed as an important factor affecting the outcome of elderly patients. Forty patients were nursing home patients who represented a significantly high percentage of ICU admission ($p<0.001$) and mortality rate ($p<0.0001$).
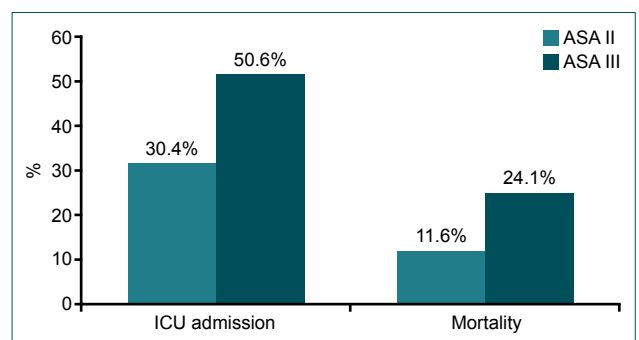

Figure 1. The ASA, ICU admission and mortality relationship. ICU: Intensive care unit; ASA: American Society of Anesthesiologists.

Table 1. The distribution of the data related to the number of systemic diseases and the outcome of the patients

Variables	0–1	2	3	4	p
Number of the patients, n (%)	40 (20)	110 (55)	43 (21.5)	7 (3.5)	–
ICU admission*	7.5±4.2	40.0±4.7	60.5±7.5	85.7±14.3	<0.0001**
Mortality rate*	0.0±0.0	12. 7±3.2	34.9±7.4	85.7±14.3	<0.0001**

*Data are expressed as mean percentage ± SEM, **statistically highly significant. ICU: Intensive care unit.

Table 2. The ICU admission and mortality rates according to the duration of operation

Variables	DO ≤60 min	60<DO≤120 min	120<DO≤180 min	180 min<DO	p
The number of patients, n (%)	71 (35.5)	61 (30.5)	48 (24)	20 (10)	–
ICU admission*	11.3±3.8	34.4±6.1	68.8±6.7	85.0±8.2	<0.0001**
Mortality*	4.2±2.4	13.1±4.4	30.0±10.5	37.5±7.1	<0.0001

*Data are expressed as mean percentage ± SEM, **statistically highly significant. ICU: Intensive care unit; DO: Duration of operation.

Surgical Characteristics and the Types of Anesthesia

The distribution of surgical interventions was as follows; general surgery (110 patients; 55%), neurosurgical procedures (51 patients; 25.5%), orthopedic surgeries (30 patients; 15%) and urologic interventions (nine patients; 4.5%). The duration of operation (DO) was evaluated in four groups as DO≤60 minutes (min), 60 min<DO≤120 min, 120min <DO≤180 min, 180 min<DO. Longer surgical durations were found to be associated with higher ICU admission and mortality rates (Table 2).

The types of anesthesia administered were general anesthesia (74%), regional (15%) and sedo-analgesia (11%) and the patients employing general anesthesia was indicated a high significance for admission to ICU in the postoperative period (<0.0001). Elderly patients undergoing general anesthesia mostly required critical care management (Fig. 2). The mortality rate was found significantly high in patients undergoing general anesthesia (21.2%) compared to regional (3.3%) and sedo-analgesia (7.1%) techniques (p=<0.0357).

Blood and Blood Products Transfusion

Out of 200 patients, 113 (56.5%) patients received a blood transfusion. Of these patients, 71.3% were admitted to ICU after surgery. The amount of transfusion was also significantly associated with the number of patients admitted to ICU (p<0.0001) (Table 3).

As the amount of transfusion increased, the mortality rates of patients were significantly increased (<0.0001). In non-transfused patients, the mortality rate was 5.3%±2.1% but it gradually increased in patients who were transfused with 0<packs≤2 (20.5%±6.6%), 3 packs (33.3%±9.2%) and 4≤packs (57.1%±11.1%) of blood.

Hematocrit Measurements

The hematocrit (Htc) levels of the patients were divided into three groups as patients with Htc<25%, 25%≤Htc<38% and 38%≤Htc. The patients with an Htc level lower than 25% were admitted to ICU more frequently than the other patients and mortality rates of these patients were significantly higher when compared to the patients with higher levels of the Htc (Table 4).

APACHE II and CCI as Outcome Predictors

The patients were divided into three groups based on their APACHE II scores as APACHE II ≤10 (n=30), 10<APACHE
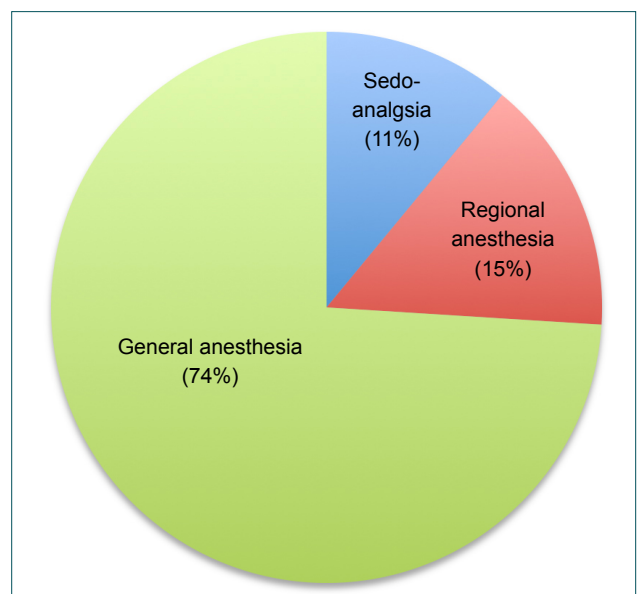

Figure 2. The distribution of the types of anesthesia in patients admitted to intensive care unit.

Table 3. The number of blood and blood products transfusion-ICU admission relationship

Number of patients	The package of blood and blood products	ICU admission (%)	SEM (±)	p
113	0	15.0	3.4	<0.0001[*]
39	0<packs≤2	64.1	7.8	
27	3 packs	74.1	8.6	
21	4≤packs	80.9	8.8	

SEM: Standard error of the mean; [*]Statistically highly significant. ICU: Intensive care unit.

Table 4. The relation of the hematocrit levels with ICU admission and mortality rate

Variables	Htc<25%	25%<Htc<38%	38%≤Htc	p
The number of patients (%)	12 (6)	145(72.5)	43(21.5)	–
ICU admission[*]	58.3±14.9	45.5±4.2	14.0±5.4	0.0003[**]
Mortality rate[*]	41.7±14.9	18.8±3.3	7.0±3.9	0.0156[***]

[*]Data are expressed as mean percentage ± SEM; [**]p<0.001, statistically highly significant; [***]p<0.05, statistically significant. ICU: Intensive care unit.

Table 5. Data related to the CCI scores

Variables	A	B	C	D	E	p
Number of patients	41	38	60	34	27	
ICU admission[*]	82.9±6.0	47.4±8.2	38.3±6.3	8.8±4.9	3.7±3.7	<0.0001[**]
Mortality[*]	63.4±7.6	15.8±6.0	3.3±2.3	2.9±2.9	0.0±0.0	<0.0001[**]

[*]Data are expressed as mean percentage ± SEM; [**]statistically highly significant. ICU: Intensive care unit; CCI: Charlson Comorbidity Index.

II≤20 (n=135) and 20<APACHE II (n=35). The statistical analysis of ICU admission of patients and APACHE II scores revealed that higher APACHE II scores were associated with higher rates of ICU admittance with a ratio of 10.0±5.6%, 32.6±4.1% and 91.2±4.9, respectively (p<0.0001). The mortality rates increased up to 70.6±7.9 % in patients with APACHE II scores higher than 20 (p<0.0001). In the analysis of CCI scores, patients were divided into five groups as CCI=0% (A), 0%<CCI≤10% (B), 10%<CCI≤25% (C), 25%<CCI≤75% (D), and 75%<CCI (E) (Table 5). In Pearson correlation analysis, APACHE II and CCI showed a moderate positive correlation (p=0.569, R^2=0.324) with a prediction power of 32.4%.

DISCUSSION

We presented a retrospective evaluation of the patients aged 65 years and older who underwent emergency surgery and described the short-term outcomes of these patients. Our results showed that advanced age was a predictive factor for ICU admission, but concerning mortality, the results were insignificant. High ASA physical status scores, having more than one systemic comorbidity, dependent living condition, prolonged operation duration, general anesthe-sia administration, intraoperative blood transfusion, lower HTC levels (<25%), higher APACHE II scores and the low estimated 10-years survival by CCI scores were the factors affecting the ICU admission in patients over 65 years after an emergency surgical intervention. APACHE II and CCI scores showed a moderate correlation with the prediction of 32.4% for elderly patients.

A recent study concerning a 15-year retrospective analysis of elderly people who underwent an emergency surgical procedure revealed that the complexity of surgical interventions has increased during the time and seemed to be a challenge in the future.[9] The ratio of emergency surgery shows variability between countries according to the characteristics of a healthcare institution, the clinicians trained in the subspecialty areas, the population density, and the geographic differences. Previously, the overall emergency general surgery rate has been reported as 8–26%.[10] The emergent interventions were accompanied by higher rates of mortality than elective procedures due to pre-existing systemic diseases and age-related physiological changes rather than the surgical procedure itself.[11] A recent study

has indicated that older patients had a ten-fold higher mortality rate after major emergency surgery when compared to younger patients.[12] The ratio of the geriatric surgical emergency intervention was 9% in our hospital, and the overall mortality was 18%.

Age itself is an important risk factor for postoperative morbidity and mortality; the risk-adjusted surgical mortality rates have been increased almost by 2-folds in patients older than 75 years.[13] In a 30-day outcome study, the morbidity and the mortality rates of the patients older than 80 years have been reported as 51 and 7%, respectively.[14] In our study, admission to ICU was significantly higher in patients with advanced age (over 85 years), but mortality did not differ when compared to the other elderly critically ill surgical patients.

It is important to investigate patient's physiological condition, the severity of the pre-existing disease, nutritional status, the presence of dehydration, depression, and the evaluation of cognitive functions play important roles in the pre-anesthetic assessment process. General anesthesia may impair the pulmonary functions, increase the myocardial depression, induce hypothermia and worsen the cognitive functions. On the other hand, regional anesthesia has potential difficulties because of the anatomical changes in advanced ages.[15] Our results showed that the number of systemic comorbidities (means higher ASA physical status), prolonged duration of the operation and the general anesthesia technique significantly affected the ICU admission after emergency surgery in geriatric patients.

Frailty has been discussed since the 1990s and many tools for prediction of the outcome have been introduced.[16] Functional dependency is a practical assessment of frailty in elderly patients and usually indicates an advanced symptom of frailty.[17] When a surgical intervention was scheduled for an elderly patient, long-term hospitalization, dependency, home care requirement, institutionalization and even death are the possible outcomes.[18] A previous report indicated that patients with functional dependency have higher 30-day mortality rates than independent patients after major general and vascular surgery.[19] The dependency of the patients was also found to be a significant factor on the ICU admission in our study.

Anemia is a common symptom in the elderly population and when the surgical interventions become in question, anemia has a negative impact on postoperative outcome and mortality. The assessment and the treatment of underlying causes may require intravenous iron therapy, nutritional support or preoperative blood transfusion.[20] Our study indicated that the ICU admission increased by 4-folds (15.0 vs. 64.1%) approximately in patients who were treated with one to two packs of blood transfusion during the intraoperative period.

Although APACHE II is a widely used tool to measure the severity of diseases in patients admitted to ICU, it is recommended for risk stratification before emergency surgical interventions.[21] APACHE II scoring consists of the physiological variables, age and chronic health evaluation points together. Thus, high scores before the surgery may reflect the postoperative outcome and prediction of ICU admission. Our results indicated that the majority of patients have APACHE II scores between 10 and 20 (n=135) or more than 20 (n=35), resulting in significantly high ICU admission and mortality rates.

The Charlson comorbidity index has been validated in medical settings, critically ill patients, trauma patients and the elective surgical patients and predicts ten-year mortality based on 22 conditions, including age, medical, infection, and oncologic history of the patient and the end-organ dysfunction along with age, and increased CCI has been shown to be correlated with the increased mortality in advanced ages.[22] In a recent study, CCI has been reported as an effective component of preoperative risk assessment and provided useful information about the outcomes of elderly patients having laparoscopic surgery for colon cancer.[23] On the other hand, the efficacy of this score in the emergency surgical settings has remained limited in the literature. Despite the lack of sufficient data, some studies suggested that CCI might be used to estimate the morbidity and mortality in emergency surgical patients.[24] According to our results, patients with a 10-year survival rate of less than 25% admitted to ICU more than the others and the mortality rates were significantly higher in this group of patients.

Geriatric patients need special care and must be separated from other patient groups. Concerning emergency situations, this issue becomes even more important.[25]

Our results represented the data of a well-equipped single university-affiliated tertiary hospital in which many advanced surgical procedures have been conducted. Thus, these results cannot be applied to the entire population in our country. Also, hospital variability may result in different outcomes. Data were obtained retrospectively, which might cause a bias in data. The distribution of age groups was not similar, so the results may not be used in a similar aged-specified patient population. Our data did not include all postoperative complications, which might extend the duration of stay in the hospital. However, this was not the point of the study; we only focused on the outcomes after surgery and the early ICU mortality. The patients were not evaluated according to the degree of dependency, preoperative cognitive function and nutritional status. These issues may be the subjects of further clinical trials.

Elderly patients requiring an emergency surgical operation is a double-edged sword in need of a special medical approach. Age itself is not a risk factor for the outcomes after surgery,

but the general physical status of the patients and accompanying systemic dysfunctions have become more important for these patients. The lack of worldwide risk assessment scores and recommendations in this population arise necessities for further clinical trials in larger elderly populations. One of the more important points of the medical approach in these patients is to avoid futile treatments, and patient-centered care must be focused.

Ethics Committee Approval: Approved by the local ethics committee.

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Authorship Contributions: Concept: Ö.S., B.Ç.; Design: Ö.S., B.Ç.; Supervision: Ö.S., B.Ç.; Fundings: Ö.S., B.Ç.; Materials: Ö.S.; Data: Ö.S.; Analysis: Ö.S., B.Ç.; Literature search: Ö.S., B.Ç.; Writing: Ö.S., B.Ç.; Critical revision: Ö.S., B.Ç.

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Geriatrik hastada acil cerrahi: Tek merkezde geriye dönük değerlendirme

Dr. Özlem Sezen, Dr. Banu Çevik

Sağlık Bilimleri Üniversitesi Kartal Dr. Lütfi Kırdar Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, İstanbul

AMAÇ: İnsanlarda yaşam beklentisi arttıkça, yaşlı insanlara uygulanan cerrahi prosedürler cerrahi ve ameliyat sonrası bakımdaki gelişmelere paralel olarak artmaktadır. Geriatrik hastaların morbidite-mortalitesini araştıran önemli sayıda çalışma acil ameliyat geçirenlerle ilgilidir. Bu çalışmanın amacı yaşlılarda acil cerrahi sonrası mortalite ve morbiditeyi etkileyen faktörleri araştırmaktır.

GEREÇ VE YÖNTEM: Ocak–Aralık 2018 tarihleri arasında Sağlık Bilimleri Üniversitesi Kartal Dr. Lütfi Kırdar Eğitim ve Araştırma Hastanesi'nde acil şartlarda ameliyat edilen 65 yaş ve üstü 200 hastanın verileri geriye dönük olarak değerlendirildi.

BULGULAR: Hastaların demografik özellikleri yaş, cinsiyet, ASA fiziksel durumları, komorbiditeleri, fonksiyonel olarak bağımlı olup olmadıkları, ameliyat tipleri, anestezi tekniği, ameliyat süresi, intraoperatif kan transfüzyonu, hematokrit düzeyindeki değişiklikler (perioperatif dönemde) cerrahi sonrası sonuç (yoğun bakım ya da servise transfer) kaydedildi. Kısa vadeli ölümlerin risk tahmini, Charlson Comorbidity İndeks (CCİ) ve APACHE II puanlama sistemleri kullanılarak tahmin edildi.

TARTIŞMA: Hastaların yaş ortalaması 74.8±6.7 idi ve kadın sayısı (n=134, %67) erkeklerden daha yüksekti. Yüksek ASA fiziksel durum skorları, bağımlı yaşam koşulları, uzun ameliyat süresi, genel anestezi, intraoperatif kan transfüzyonu, düşük Htc değerleri (<%25), yüksek APACHE II skorları ve 10 yıllık sağ kalım skorlarının CCİ'ye göre daha düşük olması yoğun bakım ünitesine kabulü etkileyen faktörlerdir.

Anahtar sözcükler: Acil; geriatrik cerrahi; yaşlı hasta; yoğun bakım ünitesi.