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Research Article

Predicting Preoperative Risks Factors for Improved Outcome in Major Limb Amputations: In the Perspective of Anesthesiologists

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Abstract

Objective: Patients undergoing major limb amputations are often elderly, debilitated patients with comorbidities that increase their operative risks and postoperative morbidity and mortality rates. We, as anesthesiologists, aimed to underline the factors that are important in decision-making for the well-being of these patients in the preoperative period.

Method: After Ethical Committee approval, data was collected retrospectively from files of patients who underwent major limb amputation surgeries in our hospital from January 2014 to March 2016. Patient characteristics, indications for amputation, anesthetic techniques and surgical procedures performed, perioperative complications, requirement of intensive care unit admissions, length of stay in intensive care unit (LOS in ICU) and hospital together with mortality rates were recorded. The results were represented as numbers and percentage.

Results: A total of 126 patients were evaluated in the study. The mean age was 68.1 ± 15.9 years. ASA IV patients made up 46% of all. 87.3% had emergency surgeries. The median waiting time before operation was 1 day (0 - 29). Mortality rate at 30-day was 9.5%. The median length of stay in ICU and hospital was 3 (1 - 135) and 12 (1 - 135) days, respectively. The length of time a patient waited after admission to hospital prior to the operation and LOS in ICU and hospital were found to have significantly adverse effects on survival. The re-amputated patients were the ones who had significantly longer preoperative waiting times and more postoperative complications.

Conclusion: We herein documented the data of patients undergoing major limb amputation including preoperative care and perioperative complications. We tried to draw attention to the appropriate perioperative preparation of these patients and its effects on the outcomes.

Keywords: *Amputation; Major Limb; Waiting Time; Outcome*

Introduction

Major limb amputations are commonly performed operations with a high mortality rate [1,2]. Previous studies have shown that a range of factors are related to postoperative mortality after amputation. This patient population is getting increasingly older with a greater number of significant medical comorbidities. Age, diabetes, increased ASA grade, female sex, heart failure, systemic sepsis are among the factors associated with worse perioperative outcomes [1,3,4].

Despite improvements in coordinated efforts among the disciplines, management of these patients perioperatively continues to be challenging for anesthesiologists. The physical status of the patient at the time of operation and anesthetic preferences have been also a matter of question in the medical care [5]. When the operation isn't urgent, risk factors may be modified with attention to appropriate patient selection, risk stratification, and preoperative patient optimization [6]. However; the heterogeneity of the surgical population makes preoperative patient optimization difficult. Nevertheless, the length of time a patient waits after admission to hospital prior to the operation has been demonstrated to have negative effects on outcome [4]. Thus, preoperative optimization should be prompt and rapid as well as making a decision for either limb salvage or primary amputation.

Purpose of the Study

The purpose of this study was to examine and identify the patient and anesthetic factors that are important in perioperative optimization of the patients who underwent major limb amputation at our hospital within a 2-year period.

Materials and Methods

Between January 2014 - March 2016, major limb amputations were performed in 126 (one hundred and twenty six) patients at Atatürk Training and Research Hospital. We analyzed the data of these patients with regard to anesthetic issues, retrospectively. The ethics committee approved the study and informed consent had been obtained from all patients before the operation.

Patient characteristics, indications for amputation, time for preoperative optimization, types of anesthesia and operations performed, perioperative complications, requirement for intensive care unit admission, length of stay in intensive care unit and hospital up to discharge, together with 30-day mortality rates were recorded.

Statistical analysis

Data analysis was performed in SPSS for Windows 15.0 packet programmed. It was investigated by Smirnow Test whether the distribution of numerical variables were conformed to normal distribution. Descriptive statistics were shown as mean ± standard deviation or median (minimum-maximum) for numeric variables and as the number of cases and (%) for categorical variables. One- Way ANOVA test was used in determination of numeric data conforming normal distribution in independent groups. In case of differences occur between groups, Tukey test was used as Post-Hoc test in order to determine from which group differences occurred. Kruskal-Wallis test was used for not normally distributed data. Bonferroni correction and Mann-Whitney U test in groups were performed in case differences occur between groups. Categorical variables were assessed by Chi-Square. Results were considered statistically significant for $p < 0.05$.

Results

A total of 126 major limb amputation patients were evaluated in this study (55 females, 71 males). Patient's demographic data are shown in table 1. The mean age of the patients was 68.1 ± 15.9. ASA III and IV class made majority of the patients (35.7% and 58% respectively). 92.1% of the patients had at least one co-morbidity. Major co-morbidities were diabetes mellitus, hypertension, coronary and peripheral artery diseases (64.3%, 55.6%, 54%, 50%), respectively. One hundred and two patients had at least one abnormal laboratory parameter preoperatively. 87.3 % of the cases were emergency ones. The main indication for amputation was peripheral arterial disease (48.4%), followed by diabetes (42.9%). 57.1% underwent below knee amputations, while 23% underwent above knee amputations. The patients who had amputations because of trauma were 7 (5.5%) (Table 1). General anesthesia was preferred in 50.7% of patients due to impaired sensorium, being on anticoagulation therapy or having a bleeding diathesis. The median anesthesia duration of all was 75 minutes (30 - 240), while median operative duration was 70 minutes (20 - 230). The median waiting time before operation was 1 day (0 - 29). No intraoperative arrest was detected. Fifty-one patients required postoperative intensive care unit (ICU) admission.

The median length of stay (LOS) in ICU and hospital was 3 (1 - 135) and 12 (1 - 135) days (Table 2). Twelve patients died at a median time of 8 days (1 - 33) due to postoperative complications of cardiac, renal or septic origin. Of all, 21.4% had amputation in two stages due to wound infection. In 5 patients blood culture was positive. There was a significant difference between the survivors and non-survivors in the aspect of age, waiting time for the operation, development of any complication, LOS in ICU and hospital and positive blood culture ($p < 0.05$) (Table 3). We found no association with choice of anesthesia type (general or spinal anesthesia) and 30 day mortality rate.

Variable	All (n = 126) (Mean ± standard deviation) (%)
Age	68.1 ± 15.9
Gender	
Male	71 (56.3)
Female	55 (43.7)
ASA score	
I	6 (4.8)
II	15 (11.9)
III	45 (35.7)
IV	58 (46.0)
V	2 (1.6)
Existence of at least 1 comorbidity	116 (92.1)
Amputation due to	
Peripheral artery disease	61 (48.4)
Diabetes mellitus	54 (42.9)
Infection	4 (3.2)
Gunshot Injury	2 (1.6)
Trauma	2 (1.6)
Accident at work	1 (0.8)
Traffic accident	1 (0.8)
Infection+Trauma	1 (0.8)
Amputation level	
Below knee	72 (57.1)
Above knee	29 (23.0)
Foot	21 (16.7)
Hip	4 (3.2)
Surgery	
Emergency	110 (87.3)
Elective	16 (12.7)

Table 1: *Demographic data and clinical characteristics of patients.*

Characteristics	Number (%)
Waiting time for the amputation (days)	3.3 ± 5.6* 1 (0-29) β
Anesthesia duration (min)	82.9 ± 30.0* 75 (30 - 140) β
Operation duration (min)	75.9 ± 29.3* 70 (20 - 230) β
Stay	
(+) in ICU	52 (41.3)
(-) in ICU	74 (58.7)
Length of stay in ICU (days)	14.5 ± 32.1* 3 (1 - 135)β
Length of stay in hospital (days)	12.8 ± 22.5* 6 (1 - 135)β

Table 2: *Operative characteristics of the patients.*

*ICU: Intensive Care Unit; ***:** Mean ± Standard Deviation, β: Median (Min-Max).*

Characteristics	Number (%)		
Mortality at 30 day	12 (9.5)		
Time spent until death (days)	9.8 ± 9.6		
	Mortality (+)	**Mortality (-)**	**p value**
Time spent between hospitalization and operation (days)	5.5 (0 - 29) β	1 (0 - 23) β	0.004
Length of stay in ICU (days)	13.5 (1 - 63) β	2.5 (1 - 135) β	0.029
Length of stay in hospital (days)	14.5 (2 - 63) β	6 (1 - 135) β	0.004
Blood culture (+)	3 (25)*	2 (1.8)*	0.006

Table 3: *Mortality of patients and factors related to mortality.*

β: *Median (Min-Max); *: Number (%).*

Discussion

In this study, we didn't intend to define preoperative predictors of mortality in major limb amputations, because the study population size is small. Rather; we wanted to call attention to the importance of perioperative optimization and management of this complex patient group amongst the anesthetic, surgical and other clinical teams.

In the literature, in-hospital mortality rates were reported to be between 4 - 22% after major limb amputations. Netten., *et al*. reported that the older patients had a higher mortality risk [5]. Scott., *et al.* confirmed that both 30-day and long-term mortality were associated with increased age [7]. Similar with the other studies, within our patient population, the deceased ones were also older (mean age: 75.5 years); indicating an apparent association between increased age and increased mortality.

In most of the studies, diabetes which was found in 39 - 89% of the population as an underlying disease had been linked to high mortality [8-10]. The incidence of diabetes was 64.3% in our patients. 62.7% of all had overlooked blood glucose levels. However, this didn't make a significance in the mortality rates. We realized that all the deceased patients had at least one comorbidity. Although we couldn't show a significant association between pre-amputation morbidity and post-amputation mortality, we observed that ASA (The American Society of Anaesthesiologists) physical status ≥ 3 made majority (83.3%) of our population. The other authors also showed a significant association between dependent functional status and worse long-term outcome after amputation [7,9].

At this point, the practice of patient-centered, multidisciplinary, and integrated medical care of these high-risk amputee patients is required. A recent report found that although "high-risk patients" only comprised 10% of the overall inpatient surgical workload, they accounted for 80% of deaths after surgery [11]. This relation is more emphasized in patients with higher ASA as in our study population.

Even any comorbidity the patient had, influenced the survival rates negatively. The available time ahead of operation for optimum medical management of comorbidities is important in decision making with the patient [12]. When we stratified the waiting times before operation, we found that; longer waiting times were associated with significantly poor survival outcomes. In one study, the authors declared that they had operated as promptly and rapidly as they could, in order to reduce surgical invasiveness and unnecessary blood loss [13]. Time spent in correcting poor condition of these patients is of vital importance [14].

The non-standardized preoperative treatment in our hospital is also reflected in the low survival rates in the patients having amputations under emergent conditions (87,3 % of all). This means that preoperative preparation didn't routinely involve a consultant clinician from the most frequent consultation required clinics such as -cardiology, endocrinology and infectious diseases- clinics and also a consultant orthopedist. This is not true for us, since both a senior and a consultant anesthesiologist are routinely involved for every operation in our hospital during 24 hours' time. Thus, we observed that most of the procedures were performed by senior surgeons on patients prepared by senior clinicians and on out of operating lists. Scott., *et al.* recommended that 75% of amputations should be performed within routine working hours [7]. This is actually necessary for improved perioperative outcomes. However; he also confessed that 20% of their cases were between 16.00 - 08.00. We also had 87.3% of all amputations as emergency cases, meaning that preoperative optimization was not at the desired levels. Thus, we need to implement a multidisciplinary and optimized perioperative regime for these patients. Besides, a special attention should be taken for surgical decision making and frailty in this patient population [15].

Mann., *et al*. compared the effect of technique of anesthesia on mortality and morbidity of patients undergoing major lower limb amputation and couldn't show any difference [16]. Although other small-sized studies showed similar results, recently, Khan., *et al*. reported a significant higher 30-day mortality in patients undergoing major lower limb amputation under general anesthesia [17-21]. We also couldn't show any favorable effect of any anesthesia technique on the outcomes, but we believe longer follow-up times for these patients are required to have actual results.

Our study has several limitations. First of all, it was a retrospective study collecting data over a relatively long period of time. Neither the evaluation of the patients, nor the care given to the patients were uniform. Besides the sample size was small to study.

Conclusion

We believe the choice of anesthetic technique is not much more important than the preoperative preparation and consultation of the patient. Further studies might explain the importance of multi-disciplinary, therapeutic approaches in altering the mortality and morbidity rates in these high-risk patient population.

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