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Impact of Surgeon Experience on Clinical Outcomes in Cardiovascular Surgery: A Retrospective Analysis

Kardiyovasküler Cerrahide Cerrah Deneyiminin Klinik Sonuçlar Üzerindeki Etkisi: Retrospektif Bir Analiz

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ABSTRACT

Objective: This study aimed to assess the impact of surgeons' experience (10–20 years vs. over 20 years) on clinical outcomes in coronary artery bypass grafting (CABG) surgeries, considering the multidisciplinary nature of cardiovascular surgery and the critical role of experience in influencing mortality, morbidity, and complications.

Materials and Methods: A retrospective analysis was conducted, including 201 patients who underwent elective or emergency CABG between 2019 and 2024 at a single tertiary center. Patients were grouped based on the experience level of their surgeons. Demographic, intraoperative, and postoperative data were collected from hospital records.

Results: Patients operated on by surgeons with over 20 years of experience had significantly higher rates of hypertension (83% vs. 70.3%; p=0.033) but showed no significant differences in mortality (3% vs. 2%; p=0.170) or complication rates (7% vs. 9.9%; p=0.460). Intraoperative parameters, such as cross-clamp time and cardiopulmonary bypass time, did not differ significantly between the groups (p>0.05). Weak positive correlations were found between cross-clamp time and postoperative ICU stay (r=0.189; p=0.007), as well as cardiopulmonary bypass time and ICU stay (r=0.205; p=0.003).

Conclusions: Surgeons' experience levels influence certain clinical outcomes, particularly in managing high-risk patients. However, mortality and complication rates appear to depend more on multidisciplinary care and standardized protocols than on individual experience. Future studies should explore these dynamics across broader patient populations and different surgical procedures to optimize cardiovascular surgical practices.

Keywords: Clinical outcomes, coronary artery bypass grafting, cardiovascular surgery, retrospective study, surgeon experience

ÖZ

Amaç: Bu çalışmada, kardiyovasküler cerrahinin multidisipliner doğası ve deneyimin mortalite, morbidite ve komplikasyonları etkilemedeki kritik rolü göz önünde bulundurularak, koroner arter bypass greftleme (KABG) ameliyatlarında cerrahların deneyiminin (10-20 yıl ve 20 yıldan fazla) klinik sonuçlar üzerindeki etkisinin değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: Tek bir üçüncü basamak merkezde 2019-2024 yılları arasında elektif veya acil KABG uygulanan 201 hastayı içeren retrospektif bir analiz yapılmıştır. Hastalar, cerrahlarının deneyim düzeyine göre gruplandırıldı. Demografik, intraoperatif ve postoperatif veriler hastane kayıtlarından toplanmıştır.

Bulgular: Yirmi yıldan fazla deneyime sahip cerrahlar tarafından ameliyat edilen hastalarda hipertansiyon oranları anlamlı derecede yüksekti (%83'e karşı %70,3; p=0,033) ancak mortalite (%3'e karşı %2; p=0,170) veya komplikasyon oranlarında (%7'ye karşı %9,9; p=0,460) anlamlı bir fark yoktu. Kros-klemp süresi ve kardiyopulmoner bypass süresi gibi intraoperatif parametreler gruplar arasında anlamlı farklılık göstermemiştir (p>0,05). Kros-klemp süresi ile ameliyat sonrası YBÜ'de kalış süresi (r=0,189; p=0,007) ve kardiyopulmoner baypas süresi ile YBÜ'de kalış süresi (r=0,205; p=0,003) arasında zayıf pozitif korelasyon bulundu.

Sonuç: Cerrahların deneyim düzeyleri, özellikle yüksek riskli hastaların yönetiminde belirli klinik sonuçları etkilemektedir. Bununla birlikte, mortalite ve komplikasyon oranları bireysel deneyimden ziyade multidisipliner bakım ve standartlaştırılmış protokollere bağlı görünmektedir. Gelecekteki çalışmalar, kardiyovasküler cerrahi uygulamalarını optimize etmek için bu dinamikleri daha geniş hasta popülasyonlarında ve farklı cerrahi prosedürlerde araştırmalıdır.

Anahtar Kelimeler: Kardiyovasküler cerrahi, klinik sonuçlar, koroner arter baypas greftleme, retrospektif çalışma, cerrah deneyimi

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INTRODUCTION

Cardiovascular surgery is a field that requires a multidisciplinary approach and attracts attention with its patient characteristics and complexity of surgical applications.[1] In this field, the experience of the surgeon stands out as an important determinant of surgical outcomes and can have significant effects on mortality, morbidity and complication rates.[2,3] The literature reveals that technical skills and clinical decision-making capacity in cardiovascular surgery are closely related to the surgeon's level of experience. In particular, the effect of many years of surgical experience on patient recovery and complication rates has been proven by various studies.[4-6] Surgical experience is not only limited to individual skills but also includes multidimensional factors such as teamwork, patient selection and intraoperative decision-making skills. Experienced surgeons stand out with their ability to prevent complications and make more effective decisions in situations requiring rapid intervention.[7,8] However, the impact of experience on parameters such as operative time, complication rates, and patient recovery remains to be extensively studied. A previous meta-analysis emphasized that an increase in experience level leads to a significant shortening of operation times and a decrease in postoperative complications.[9,10] The impact of differences in experience among cardiovascular surgeons on surgical outcomes, especially in high-risk patient groups, is a critical factor to consider in clinical practice. In another study, surgeons with 20 years or more of experience were reported to have lower mortality rates and shorter hospital stays.[11,12] In addition, the experience level of surgical teams and multidisciplinary approaches are also reported to have important contributions to improving patient outcomes.[13]

This study aims to evaluate the effect of surgeon experience (10-20 years and more than 20 years) on clinical outcomes in cardiovascular surgery. The demographic characteristics of the patients, complications encountered during surgery and differences in the postoperative process were considered in this context and statistically compared. Furthermore, it was discussed how these differences could be optimized with a multidisciplinary team approach.

MATERIALS AND METHODS

Ethics Committee Approval: This study was approved by the Ankara Bilkent City Hospital Medical Research Scientific and Ethical Evaluation Ethics Committee (Date: 17/07/2024, Decision No: TABED-1-24-381). It was conducted in accordance with the principles of the Declaration of Helsinki.

Study Design and Participants: In this study, a retrospective analysis was conducted to evaluate the effects of cardiovascular surgeons' length of experience (10-20 years and over 20 years) on surgical outcomes. A total of 201 patients who underwent cardiovascular surgery between 2019 and 2024 were included in the study. Inclusion criteria were elective or emergency coronary artery bypass grafting (CABG), no missing data, and preoperative ejection fraction (EF) above 20%. Exclusion criteria were defined as patients with a diagnosis of multiple organ failure and patients with a previous history of complex congenital cardiac surgery.

Patients were evaluated according to two different surgical experience groups. The first group consisted of operations performed by surgeons with 10-20 years of experience and included 101 patients. The second group consisted of operations performed by surgeons with 20 years or more experience, and this group included 100 patients.

Data Collection: Demographic and clinical data were collected retrospectively through the hospital's electronic record system. Data collected included age, gender, body mass index (BMI), preoperative risk factors (diabetes, hypertension, COPD, hyperlipidemia, smoking), intraoperative data (number of vessels bypassed, cross-clamp time, cardiopulmonary bypass time), and postoperative outcomes (length of intensive care unit and ward stay, mortality, morbidity and complication rates).

Statistical Analysis: Mean Standard Deviation, Median and Minimum-Maximum values were given in descriptive statistics for continuous data, and number and percentage values were given in discrete data. Kolmogorov Smirnov test was used to examine the suitability of the data for normal distribution. In comparisons of continuous data between groups, Independent Samples t test was used for normally distributed data, and the Mann-Whitney U test was used for data not conforming to normal distribution. Chi-square and Fisher's Exact test were used in group comparisons of nominal variables (cross-tabulations). The relationships between continuous data were analyzed with Spearman's correlation coefficient. IBM SPSS for Windows 20.0 (SPSS Inc. Chicago, IL) program was used in the evaluations, and $p<0.05$ was accepted as the limit of statistical significance.

RESULTS

According to Table 1, the average age of patients was 60.92 ± 8.87 years in the 10-20 years of experience group and 62.64 ± 9.32 years in the >20 years of experience group (p=0.215). The mean body mass index (BMI) was 28.51 ± 4.62 kg/m² in the 10-20 years group and 29.18 ± 4.88 kg/m² in the >20 years group (p=0.342). The gender distribution was 57.4% male and 42.6% female in the 10-20 years group and

58.0% male and 42.0% female in the >20 years group (p=0.942). Hypertension was 70.3% in the 10-20 years group and 83.0% in the >20 years group (p=0.033). Diabetes was 46.5% in the 10-20 years group and 49.0% in the >20 years group (p=0.753). Hyperlipidemia was 36.6% in the 10-20 years group and 42.0% in the >20 years group (p=0.476). COPD was 11.9% in the 10-20 years group and 13.0% in the >20 years group (p=0.810). Smoking was 27.7% in the 10-20 years group and 25.0% in the >20 years group (p=0.675).

According to Table 2, the number of bypass grafts per patient was 3.17 ± 0.90 in the 10-20 years of experience group and 3.32 ± 0.90 in the >20 years of experience group (p=0.238). The cross-clamp time was 73.55 ± 20.92 minutes in the 10-20 years group and 72.57 ± 30.57 minutes in the >20 years group (p=0.360). The cardiopulmonary bypass (CPB) time was 111.50 ± 31.15 minutes in the 10-20 years group and 110.63 ± 43.67 minutes in the >20 years group (p=0.337). Postoperative intensive care unit stay was 2.12 ± 3.00 days in the 10-20 years group and 2.08 ± 3.05 days in the >20 years group (p=0.180). The length of hospital stay was 5.73 ± 4.45 days in the 10-20 years group and 5.87 ± 5.78 days in the >20 years group (p=0.940). Mortality rates were 3.0% in the 10-20 years group and 2.0% in the >20 years group (p=0.170). Complication rates were 9.9% in the 10-20 years group and 7.0% in the >20 years group (p=0.460). Table 2 summarizes intraoperative and postoperative characteristics based on surgeon experience. Parameters such as the number of bypass grafts, cross-clamp time, and CPB time showed no significant differences between the two groups (p>0.05). Mortality and complication rates were also similar.

Table 3 outlines the clinical characteristics of patients based on surgeon experience. Hypertension prevalence was significantly higher in patients treated by surgeons with over 20 years of experience (83% vs. 70.3%; p=0.033). However, no significant differences were observed for other demographic and clinical features (p>0.05).

Table 1. Demographic and clinical characteristics of patients by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Age, (years)	60.92 ± 8.87	62.64 ± 9.32	0.215
BMI, (kg/m²)	28.51 ± 4.62	29.18 ± 4.88	0.342
Gender, (Male/Female)	58 (57.4) / 43 (42.6)	58 (58.0) / 42 (42.0)	0.942
Diabetes, (DM)	47 (46.5)	49 (49.0)	0.753
Hypertension, (HT)	71 (70.3)	83 (83.0)	0.033 *
Hyperlipidemia	37 (36.6)	42 (42.0)	0.476
COPD	12 (11.9)	13 (13.0)	0.810
Smoking	28 (27.7)	25 (25.0)	0.675

Table 2. Intraoperative and postoperative characteristics by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Number of Bypassed Grafts	3.17 ± 0.90	3.32 ± 0.90	0.238
Cross-Clamp Time, (min)	73.55 ± 20.92	72.57 ± 30.57	0.360
CPB Time, (min)	111.50 ± 31.15	110.63 ± 43.67	0.337
Postop ICU Stay, (days)	2.12 ± 3.00	2.08 ± 3.05	0.180
Postop Ward Stay, (days)	5.73 ± 4.45	5.87 ± 5.78	0.940
Mortality, (Ex), n (%)	3 (3.0)	2 (2.0)	0.170
Complications, n (%)	10 (9.9)	7 (7.0)	0.460

Table 3. Clinical characteristics by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Hypertension, (%)	70.3	83	0.033
Mortality, (%)	3.0	2.0	0.170
Complications, (%)	9.9	7.0	0.460

Also, in Table 4, correlation analysis revealed a weak positive correlation between cross-clamp duration and ICU length of stay (r=0.189, p=0.007) and between CPB duration and ICU length of stay (r=0.205, p=0.003). However, no significant correlation was found between cross-clamp duration, CPB duration and length of stay in the ward (p>0.05).

The figüre 1 illustrates the percentages of hypertension, mortality, and complications in patients operated on by surgeons with 10–20 years of experience and those with over 20 years of experience. Hypertension rates were higher in the >20 years group, while mortality and complication rates were similar between the groups.

Table 4. Correlations between cross-clamp and cardiopulmonary bypass times and postoperative intensive care and ward times.

Variable	Duration of Postoperative Intensive Care		Postop Servis süresi	
	r*	p	r*	p
Cross-Clamp Time, (min)	**0.189**	**0.007**	0.065	0.359
Duration of cardiopulmonary bypass, (min)	**0.205**	**0.003**	0.044	0.531

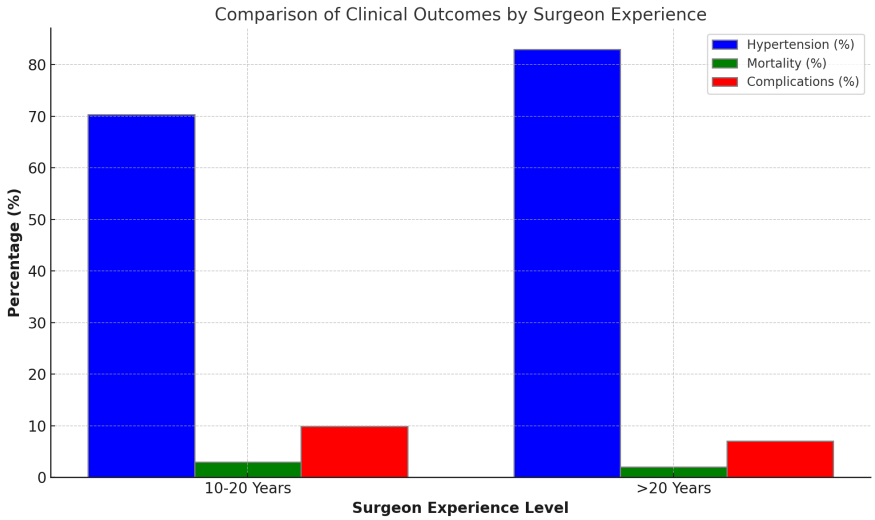

Figure 1. Comparison of clinical outcomes based on surgeon experience.

DISCUSSION AND CONCLUSION

This study retrospectively analyzed the effects of cardiovascular surgeons' length of experience (10-20 years and over 20 years) on clinical and surgical outcomes. Our findings show that the association of surgical experience with risk factors such as hypertension is significant, but its impact on mortality and complication rates is limited. This suggests that surgical outcomes depend not only on individual experience but also on team approach and multidisciplinary care processes. In our study, the rate of hypertension was significantly higher in patients of surgeons with 20 years or more experience (p=0.033). The literature shows that experienced surgeons tend to manage more complex and high-risk patient groups.[14] This may be explained by surgeons relying on their experience in patient selection and undertaking more difficult cases. However, mortality rates did not differ between the two groups, suggesting that experienced teams successfully manage these high-risk patient groups. Especially the role of multidisciplinary teams is critical here.[15,16] No significant difference was found between the two groups in terms of intraoperative parameters such as the number of bypassed vessels, cross clamp time and cardiopulmonary bypass time. While it is emphasized in the literature that more experienced surgeons can shorten the operation times, no significant difference in operation times was observed in this study.[17] This may be due to the fact that all surgeons included in our study were above a certain level of experience. In addition, the fact that the surgical teams worked according to standardized protocols may have limited the effect of individual differences. The postoperative mortality and complication rates of 4% and 8.5%, respectively, indicate that the patient group in our study had generally low complication rates. The fact that there was no significant difference between

the two groups, especially in mortality rates (p=0.170), emphasizes the importance of multidisciplinary care processes regardless of surgical experience.[18,19] In our study, a weak positive correlation was found between cross-clamp duration and cardiopulmonary bypass duration and postoperative intensive care unit duration. This relationship has been reported to be stronger in the literature, but the weak correlation in our study suggests that postoperative processes may be more closely related to other factors such as patient characteristics, team management and complication management.[20,21] The study by Harrison et al. emphasizes that experienced surgeons provide a significant reduction in mortality rates. However, no significant difference was found in mortality rates in our study.[22] This may be attributed to differences in patient populations, the retrospective design of our study, and the generally low mortality rates. Similarly, Brooks et al. reported a correlation between experience level and intraoperative times, whereas no significant difference was observed in this study.[23] This may be attributed to the homogeneous group of surgeons included in our study in terms of experience level. Our findings suggest that surgical outcomes are not only dependent on individual experience but also strongly depend on the contribution of multidisciplinary teams. In cardiovascular surgery, collaboration between units such as the anesthesia team, intensive care staff and nursing services plays a critical role in improving patient outcomes. In addition, standardization of protocols in the postoperative process is considered to be an effective factor in keeping complication rates low.[24] This study shows that the experience level of surgeons is an important factor, especially in high-risk patient groups, but surgical outcomes should be associated with broader teamwork and patient care management. The results emphasize the need to promote multidisciplinary approaches in surgical practices. Furthermore, the low complication rates reveal the importance of standardized surgical protocols. This study has some limitations. First, it may be prone to biases such as missing data and recording errors due to its retrospective design. This limits the evaluation of cause-and-effect relationships. Secondly, the surgeons included in the study were above a certain level of experience, and the results of surgeons with less experience were not analyzed. This limits the generalization of the findings to a large group of surgeons. Third, the fact that the study was conducted in a single center limits the possibility of evaluating the results of variable approaches and surgical procedures in different health centers. Finally, the inclusion of only coronary artery bypass grafting operations led to the exclusion of other types of cardiovascular surgery. This limits the applicability of the findings to different surgical procedures.

In our study, we observed that hypertension prevalence was significantly higher in the group operated on by surgeons with more than 20 years of experience (83% vs. 70.3%, p=0.033). This difference may be attributed to the fact that more experienced surgeons tend to manage higher-risk patients, including those with multiple comorbidities such as hypertension. Although hypertension is a well-known risk factor for cardiovascular complications, in our study, it did not lead to significant differences in mortality (p=0.170) or complication rates (p=0.460) between the groups. This finding suggests that standardized perioperative management and multidisciplinary care play a crucial role in mitigating the adverse effects of hypertension in cardiovascular surgery. Additionally, postoperative parameters such as intensive care unit stay and hospital stay did not differ significantly between groups, indicating that despite a higher prevalence of hypertension, experienced surgical teams effectively managed these patients, ensuring comparable postoperative outcomes.

In conclusion, this study provides valuable retrospective evidence on the impact of cardiovascular surgeons' experience levels on surgical outcomes, emphasizing that while expertise is crucial, particularly in managing complex and high-risk patients, multidisciplinary teamwork and standardized protocols also significantly influence mortality and complication rates. Although cardiovascular surgery requires a five-year specialization period, an additional ten years are estimated to be necessary for surgeons to achieve high proficiency in complex procedures, enabling them to manage high-risk patients more effectively. To further enhance surgical outcomes, fostering multidisciplinary collaboration, integrating advanced technologies, and implementing standardized protocols are essential. Future large-scale, prospective, multi-center studies could provide a more comprehensive evaluation of surgical experience, while research on the contributions of the entire surgical team may offer deeper insights into the benefits of multidisciplinary approaches.

Ethics Committee Approval: The study was reviewed by the Scientific and Ethical Review Board for Medical Research of Ankara Bilkent City Hospital No. 1 and was deemed ethically appropriate. (Date: 17/07/2024, Decision No: TABED-1-24-381). The study was conducted in accordance with the principles of the Declaration of Helsinki, ensuring full protection of patient data confidentiality.

Conflict of Interest: No conflict of interest was declared by the authors.

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