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Comparative Effects of Propofol and Etomidate on Postoperative Outcomes in Off-Pump Coronary Artery Bypass Grafting: A Retrospective Study

Off-Pump Koroner Arter Bypass Greftlemesinde Propofol ve Etomidatın Ameliyat Sonrası Etkilerinin Karşılaştırılması: Retrospektif Çalışma

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ABSTRACT

Aim: Cardiac surgeries often necessitate potent anesthetic agents to optimize perioperative outcomes. This study aimed to evaluate and compare the postoperative effects of propofol and etomidate, two widely used anesthetic agents, following Off-pump Coronary Artery Bypass Grafting (CABG).

Material and Method: Patients who underwent off-pump CABG at Koç University Hospital from January 2018 to December 2021 were retrospectively reviewed and divided into two groups based on the used anesthetic agents. The duration of intensive care unit (ICU) stay, time to extubation, and duration of hospitalization were compared between the groups statistically.

Results: 66 patients' data were examined; during the induction phase of anesthesia, 36 patients received propofol and 30 patients received etomidate. There were no obvious variations in the groups' anthropometric or demographic characteristics. The median duration ICU stay for propofol recipients was 1-day, while etomidate recipients had a median stay of 1.5-days (p=). The time to extubation was 8 hours for propofol and 6 hours for etomidate (p=). Both groups had a similar median hospitalization duration of 6 days (p=). There were no statistically significant differences between groups for any of the outcomes.

Conclusion: The study discovered small variations in the postoperative prognoses of patients who underwent CABG with propofol or etomidate. Both anesthetics demonstrated comparable efficacies concerning duration of ICU stay, extubation time, and hospitalization duration. Further prospective studies with larger cohorts are suggested to consolidate these findings and refine anesthesia strategies in cardiac surgical contexts.

Keywords: Coronary artery bypass, off-pump, propofol, etomidate, hospitalization

ÖZ

Amaç: Kalp ameliyatlarında perioperatif sonuçları optimize etmek için sıklıkla güçlü anestezik ajanlara ihtiyaç duyulur. Bu çalışmada, Off-Pump Koroner Arter Bypass Greftleme (KABG) sonrası yaygın olarak kullanılan iki anestezik ajan olan propofol ve etomidat'ın postoperatif etkilerini değerlendirmeyi ve karşılaştırmayı amaçladık.

Gereç ve Yöntem: Koç Üniversitesi Hastanesi'nde Ocak 2018'den Aralık 2021'e kadar off-pump CABG uygulanan hastaları retrospektif olarak inceledik. Birincil ve ikincil sonuçlar Yoğun Bakım Ünitesinde (YBÜ) kalış süresini, ameliyat sonrası ekstübasyona kadar geçen süreyi ve hastanede kalma süresini içeriyordu. İstatistiksel analizlerde Kolmogorov-Smirnov testi, Bağımsız Örnekler t testi, Ki-kare testi ve Mann-Whitney U testi kullanıldı.

Bulgular: Anestezinin indüksiyonu için 36'sında propofol ve 30'unda Etomidat kullanılan 66 hastanın verileri değerlendirildi. Gruplar arasında anlamlı bir demografik veya antropometrik farklılık yoktu. propofol kullananların yoğun bakımda ortalama kalış süresi 1 gün iken Etomidat kullanılan hastaların ortalama kalış süresi 1,5 gündü. Ameliyat sonrası ekstübasyon süresi propofol için 8 saat, Etomidat için 6 saatti. Her iki grubun ortalama hastanede kalış süreleri 6 gündü. Sonuçların herhangi biri için gruplar arasında istatistiksel olarak anlamlı bir fark yoktu.

Sonuç: Çalışmamız propofol veya etomidat ile anestezi indüksiyonu uygulanan KABG hastalarının postoperatif prognozlarında minimal farklılıklar olduğunu gösterdi. Her iki anestezik ajanda yoğun bakımda kalış süresi, ekstübasyon süresi ve hastanede kalış süresi açısından karşılaştırılabilir etkinlik gösterdi fakat istatistiksel bir fark bulunamadı. Bu bulguları pekiştirmek ve kalp cerrahisi bağlamında anestezi stratejilerini geliştirmek için daha büyük gruplarla ileri prospektif çalışmaların yapılması önerilmektedir.

Anahtar Kelimeler: Off pump koroner arter bypass, propofol, etomidat, hastanede yatış süresi

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INTRODUCTION

Cardiac surgeries, with their inherent complexities, necessitate the use of potent anesthetic agents to ensure hemodynamic stability, swift recovery, and optimal perioperative outcomes. (1) It is known that anesthetic choice influences a range of postoperative variables including time to extubation, duration of intensive care unit (ICU) stays, and overall hospital discharge time, thus affecting hospital resources and patient experience. (2) Two such anesthetic drugs that have been widely used in the postoperative care of cardiac operations are propofol and etomidate. (3) Propofol, known for its rapid onset and short duration of action, is celebrated for its ability to facilitate smooth and swift recovery from anesthesia. But utilizing it can be problematic, particularly for this group of individuals who have hemodynamic instability. (4) Etomidate, on the other hand, boasts a hemodynamic stability profile that makes it a favoured choice for patients with compromised cardiac function. (5) However, there has been a lot of study on the potential effects of etomidate on the adrenal glands and the risk of postoperative infection. (6,7)

Despite their widespread use, comparative studies examining the impact of these anesthetic agents on post-cardiac surgery outcomes have been limited. The necessity to optimize perioperative management and enhance patient outcomes underscores the importance of this research. This study aims to provide an evaluation of the effects of intraoperative use of propofol versus etomidate various postoperative outcomes following cardiac surgery. Through this research, we aspire to guide anesthesiologists in making evidence-based decisions tailored to improving patient care in the context of cardiac surgeries.

MATERIAL AND METHOD

Patient selection

The study was approved by Koç University Ethical Committee (2019.353.IRB2.113). Due to the retrospective design, no informed consent was obtained. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for reporting observational studies was used in writing the article.

Data sources and extraction

The study encompassed a cohort of patients who underwent off-pump coronary artery bypass grafting (CABG) at Koç University Hospital from January 2018 through December 2021. Primary data sources were the records from Koç University Hospital's operating rooms and the logs from the Cardiovascular Surgery Intensive Care Units. We collected data regarding the anesthetic agents, specifically etomidate or propofol, administered during the induction phase of anesthesia.

We excluded patients who required revision surgeries post-CABG or those who, in addition to CABG, had concurrent procedures like valve replacements. The primary outcome of this study was the duration of stay in the ICU. Secondary outcomes were the time required for extubation in the ICU post-surgery and the overall duration of hospitalization.

Statistical analysis

Data were processed and analysed with IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA). The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. In addition to the descriptive statistics, the Independent Samples t-test was employed for comparisons of normally distributed data. For data that didn't adhere to a normal distribution, the Mann-Whitney U test was utilized. Categorical variables were analyzed using Chi-squared test. All analyses were two-tailed, and $p<0.05$ was considered statistically significant.

RESULTS

Demographic and anthropometric data:

Of the 66 patients, propofol was used for induction of anesthesia in 36 patients while etomidate in 30. Patient characteristics were summarized in **Table 1.**

Table 1. Demographic features of the groups

	Propofol (N:36)	Etomidate (N:30)	p value
Age (mean(sd))	65.1(7.2)	65.9(7.4)	0.660
Sex (F/M)	20/16	12/18	0.228
ASA (I/II/III/IV)	0/12/14/10	0/12/9/9	0.741
BMI (mean(sd))	28.2(5.5)	27.7(5.9)	0.727

The age and BMI values are given as mean(sd). The age and BMI between the two groups were evaluated using independent samples t-tests. The Chi-squared test was utilized to assess the ASA and Sex variables. P<0.05: statistically significant. (sd: standard deviation, F: Female, M: Male, ASA: American Society of anesthesiologists, BMI: Body Mass Index)

The age and BMI between the two groups were evaluated using independent samples t-tests. There were no significant differences between the groups regarding these variables. For age, the test yielded a t-value of -0.442 with an associated p-value of 0.660. Similarly, for BMI, the derived t-value was 0.350, accompanied by a p-value of 0.727. The Chi-squared test was utilized to assess the ASA and Sex variables. The analysis revealed no significant differences with p-values of 0.741 for ASA and 0.228 for Sex, respectively.

Duration of ICU stay

The median ICU stay for the Propofol group was 1 day, with interquartile ranges spanning from 1 day (25th percentile) to 2.25 days (75th percentile). In contrast, the Etomidate group had a median stay of 1.5 days, with the 25th and 75th percentiles being 1 and 2 days, respectively.

A non-parametric Mann-Whitney U test was utilized to compare the two groups due to the non-normal distribution of the data. The mean rank of ICU stay for the Propofol group was 33.44 with a sum of ranks totalling 1204.00. In contrast, the Etomidate group had a mean rank of 33.57 and a sum of ranks of 1007.00.

Statistical analysis via the Mann-Whitney U test produced a value of U=538.000, and the Wilcoxon W was calculated as 1204.000. The computed Z-score was -0.028. The associated two-tailed p-value for this test was a remarkably high 0.978.

Time to extubation

The Propofol group had a median extubation time post-surgery of 8 hours, ranging between 6 hours (25th percentile) and 12 hours (75th percentile). On the other hand, the Etomidate group's median extubation time stood at 6 hours, with interquartile values of 4 hours and 9.5 hours.

The data for extubation time was not normally distributed and therefore a non-parametric test, the Mann-Whitney U test, was employed. The mean rank for extubation time was 37.61 for the Propofol group, with a sum of ranks totalling 1354.00, while the Etomidate group had a mean rank of 28.57 with a sum of ranks of 857.00. The Mann-Whitney U test yielded a value of U=392.000 and Wilcoxon W was found to be 857.000. The Z-score for the test was -1.931. The associated p-value for this test was 0.054.

Duration of hospitalization

Post-surgery, the Propofol group's median hospitalization duration was 6 days, with a range from 5 days (25th percentile) to 8.25 days (75th percentile). Meanwhile, the Etomidate group had a median duration of 6 days, with interquartile values of 5 days and 6.75 days.

Mann-Whitney U test was applied to compare the two groups due to the data's non-normal distribution. The Propofol group had a mean rank for time to discharge of 35.39 and a sum of ranks amounting to 1274.00. In comparison, the Etomidate group presented with a mean rank of 31.23 and a sum of ranks standing at 937.00.

The Mann-Whitney U test provided a U value of 472.000, and the Wilcoxon W was established as 937.000. The resultant Z-score from the test was -0.892. The corresponding p-value for the analysis was 0.372.

DISCUSSION

In the evolving field of cardiac surgery, the choice of anesthetic agents plays an integral role in influencing postoperative outcomes. (8-10) This retrospective study examined the effects of two widely-used anesthetics – Propofol and Etomidate – on postoperative parameters such as duration of ICU stay, extubation time, and hospitalization duration, following Off-pump Coronary Artery Bypass Grafting (CABG). Our findings offer insights that could influence clinical decisions and potentially shape future perioperative management in cardiac surgeries.

The demographic and anthropometric data from our cohort revealed no significant differences between the two groups in terms of age, BMI, ASA, or sex. This homogeneity establishes a foundation for a more balanced comparison of postoperative outcomes associated with the two anesthetic agents.

Regarding duration of ICU stay – a primary outcome of our study – we observed that the median stay for patients in the Propofol group was slightly shorter than that of the Etomidate group, although the difference was not statistically significant. We thought that this might be because clinicians prefer etomidate rather than propofol in patients with hemodynamic instability. However, it does not seem right to attribute this situation only to hemodynamic instability. Because there are many publications that found different results on the side effects of etomidate, such as propensity for sepsis and suppression of the adrenal cortex. (6-8,11-17) In addition, there are numerous studies showing that a single dose of etomidate used in induction does not impair adrenal functions. (18-20)

The time to extubation, a crucial secondary outcome, showed a trend towards a longer median time for the Propofol group compared to the Etomidate group. Although the p-value approached significance, it did not meet the conventional threshold. This observation aligns with Etomidate's known hemodynamic stability, which may expedite readiness for extubation. (9,10,21) Nevertheless, the difference was marginal, and clinical implications may be limited.

Finally, the duration of hospitalization, another secondary outcome, indicated comparable stays for both groups. Similarly, our findings in the literature despite the pharmacological differences between Propofol and Etomidate, their impact on overall recovery trajectories, in terms of hospitalization duration, appears similar in the context of CABG. (20,22-24)

While our study provides valuable insights, certain limitations must be acknowledged. The retrospective nature of the study could introduce biases inherent to chart reviews. Additionally, we focused exclusively on CABG patients at a single institution, which may limit the generalizability of our findings.

CONCLUSION

Our investigation into the effects of Propofol and Etomidate on post-CABG outcomes found minimal differences in ICU stay, extubation time, and overall hospitalization duration. Both agents demonstrated efficacious profiles, reaffirming their utility in cardiac surgeries. Future prospective studies with larger sample sizes could further elucidate these findings, helping refine anesthesia strategies in cardiac surgical settings.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was approved by Koç University Ethical Committee (2019.353.IRB2.113).

Informed Consent: Informed consent form did not obtained from the participants due to the nature of the study.

Referee Evaluation Process: Externally peer-reviewed.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Grant MC, Isada T, Ruzankin P, et al. Opioid-Sparing Cardiac Anesthesia: Secondary Analysis of an Enhanced Recovery Program for Cardiac Surgery. Anesth Analg. 2020;131(6):1852-61.
2. Landoni G, Lomivorotov VV, Nigro Neto C, et al. Volatile Anesthetics versus Total Intravenous Anesthesia for Cardiac Surgery. N Engl J Med. 2019;380(13):1214-25.
3. Wagner CE, Bick JS, Johnson D, et al. Etomidate use and postoperative outcomes among cardiac surgery patients. Anesthesiology. 2014;120(3):579-89.
4. Krzych LJ, Szurlej D, Bochenek A. Rationale for propofol use in cardiac surgery. J Cardiothorac Vasc Anesth. 2009;23(6):878-885.
5. Malhotra AK. Con: etomidate--the ideal induction agent for a cardiac anesthetic?. J Cardiothorac Vasc Anesth. 2013;27(1):178-9.
6. Wagner RL, White PF. Etomidate inhibits adrenocortical function in surgical patients. Anesthesiology. 1984;61(6):647-51.
7. Chan CM, Mitchell AL, Shorr AF. Etomidate is associated with mortality and adrenal insufficiency in sepsis: a meta-analysis*. Crit Care Med. 2012;40(11):2945-53.
8. Hidalgo DC, Amin V, Hukku A, Kutlu K, Rech MA. Etomidate Use for Rapid Sequence Intubation Is Not Associated With Nosocomial Infection. J Pharm Pract. 2022;35(3):383-7.
9. Hannam JA, Mitchell SJ, Cumin D, et al. Haemodynamic profiles of etomidate vs propofol for induction of anaesthesia: a randomised controlled trial in patients undergoing cardiac surgery. Br J Anaesth. 2019;122(2):198-205.
10. Aggarwal S, Goyal VK, Chaturvedi SK, Mathur V, Baj B, Kumar A. A comparative study between propofol and etomidate in patients under general anesthesia. Braz J Anesthesiol. 2016;66(3):237-41.
11. Paternoster G, Guarracino F. Sepsis After Cardiac Surgery: From Pathophysiology to Management. J Cardiothorac Vasc Anesth. 2016;30(3):773-80.
12. Ailawadi G, Chang HL, O'Gara PT, et al. Pneumonia after cardiac surgery: Experience of the National Institutes of Health/Canadian Institutes of Health Research Cardiothoracic Surgical Trials Network. J Thorac Cardiovasc Surg. 2017;153(6):1384-91.
13. Howitt SH, Herring M, Malagon I, McCollum CN, Grant SW. Incidence and outcomes of sepsis after cardiac surgery as defined by the Sepsis-3 guidelines. Br J Anaesth. 2018;120(3):509-16.
14. Weiss B, Schiefenhövel F, Grunow JJ, et al. Infectious Complications after Etomidate vs. Propofol for Induction of General Anesthesia in Cardiac Surgery-Results of a Retrospective, before-after Study. J Clin Med. 2021;10(13):2908.
15. Sunshine JE, Deem S, Weiss NS, et al. Etomidate, adrenal function, and mortality in critically ill patients. Respir Care. 2013;58(4):639-46.
16. Asehnoune K, Mahe PJ, Seguin P, et al. Etomidate increases susceptibility to pneumonia in trauma patients. Intensive Care Med. 2012;38(10):1673-82.
17. Albert SG, Ariyan S, Rather A. The effect of etomidate on adrenal function in critical illness: a systematic review. Intensive Care Med. 2011;37(6):901-10.
18. Morel J, Salard M, Castelain C, et al. Haemodynamic consequences of etomidate administration in elective cardiac surgery: a randomized double-blinded study. Br J Anaesth. 2011;107(4):503-9.
19. Basciani RM, Rindlisbacher A, Begert E, et al. Anaesthetic induction with etomidate in cardiac surgery: A randomised controlled trial. Eur J Anaesthesiol. 2016;33(6):417-424.
20. Bruder EA, Ball IM, Ridi S, Pickett W, Hohl C. Single induction dose of etomidate versus other induction agents for endotracheal intubation in critically ill patients. Cochrane Database Syst Rev. 2015;1(1):CD010225.
21. Kaushal RP, Vatal A, Pathak R. Effect of etomidate and propofol induction on hemodynamic and endocrine response in patients undergoing coronary artery bypass grafting/mitral valve and aortic valve replacement surgery on cardiopulmonary bypass. Ann Card Anaesth. 2015;18(2):172-8.
22. Vinclair M, Broux C, Faure P, et al. Duration of adrenal inhibition following a single dose of etomidate in critically ill patients. Intensive Care Med. 2008;34(4):714-9.
23. McPhee LC, Badawi O, Fraser GL, et al. Single-dose etomidate is not associated with increased mortality in ICU patients with sepsis: analysis of a large electronic ICU database. Crit Care Med. 2013;41(3):774-83.
24. Heinrich S, Schmidt J, Ackermann A, Moritz A, Harig F, Castellanos I. Comparison of clinical outcome variables in patients with and without etomidate-facilitated anesthesia induction ahead of major cardiac surgery: a retrospective analysis. Crit Care. 2014;18(4):R150.