

Comparative Study of Hemodynamic Response to Etomidate Versus Ketofol Anesthetic Induction in Patients with Reduced Ejection Fraction Undergoing Coronary artery bypass grafting (CABG)

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ABSTRACT

Background: Coronary artery bypass grafting surgery is the commonest surgery done in patients with various cardiovascular diseases. Doing the CABG surgery in patients with reduced ejection fraction is associated with mortality. Anesthesia used in the CABG surgery in patients with reduced ejection fraction plays major role in surgical outcome. The present study aimed to evaluate the hemodynamic response to etomidate versus ketofol anesthetic induction in patients with reduced ejection fraction undergoing CABG surgery. **Materials and Methods:** This study was conducted in a total of 70 patients selected in the based on the inclusion and exclusion criteria. Patients were divided in to two groups, group-I received Etomidate and group-II Ketofol respectively. For all the patients demographic data , systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate were recorded at different time periods (at baseline, after 1 min of induction , before laryngoscopy (BL) , after laryngoscopy(AL) , 2min following lscopy)and the data was enter in excel sheet used for analysis. Statistical Package for Social Sciences (SPSS 20.0) version used for analysis. **Results:** Maximum number of patients had age between 51-60 years in both groups. Comparison of mean between the groups not showed any significant difference. Group-I and II had similar gender distribution. Mean weight between the group-I and II not showed any significant difference. Comparison of mean systolic blood pressure at baseline, After Laryngoscopy (AL) and 2 min following laryngoscopy not showed significant difference, but at 1 min and Before Laryngoscopy (BL) values showed significant difference. Baseline, 1 min, BL and AL diastolic blood pressure showed significant difference compared between group-I and II not at 2 min. Mean arterial pressure showed significant difference compared between group-I and II at 1 min and BL and no other time periods. Comparison of heart rate between the groups at baseline and 1 min showed significant difference with p value 0.05. **Conclusion:** These study observations concluded that patients received etomidate showed better hemodynamic stability at all the time periods compared to ketofol in patients undergoing CABG surgery with reduction ejection fraction.

Keywords: Ketofol, Etomidate, CABG surgery, reduction ejection fraction, heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure.

INTRODUCTION

CABG surgery for patients with low ejection fraction carries a high pre-operative and operative risk but it is associated with long term survival and quality of life benefits compared to medical management alone^[1,2] . Patients with severely reduced ejection fraction will

have a higher incidence of perioperative complications like renal failure, prolonged ventilation, bleeding, respiratory distress and hypotension. Preoperative planning and anesthetic management plays major role to reduce these complications.^[3] Because the margin for hemodynamic instability is low, patients need experienced intervention cardiology and surgical team.

Preoperative testing is the most important step to make sure surgery to go smooth and reduce the complications. Assessing the heart as an affected tissue whether it is permanently scarred or can be regenerate by increasing blood flow is primary important step before instituting a surgical step.^[4-6] Check for heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, cardiac output and functions of heart chambers to ensure the patient can withstand the surgery. Selection of on pump and off pump CABG surgery also plays major role on surgery output. Selection of anesthetic is the very important for patients undergoing CABG surgery with low ejection fraction.^[7] The agent should not affect the hemodynamic parameters which can leads to development of complications and mortality.^[8] In the present study we aimed to compare the hemodynamic response to etomidate versus ketofol anesthetic induction in patients with reduced ejection fraction undergoing CABG surgery.

MATERIALS AND METHODS

Study Type: Comparative study

Study Settings: This study was conducted

Study Period: One year April 2025- may 2026

Inclusion Criteria

- Both gender
- Patients undergoing CABG surgery
- Patients with reduced ejection fraction (EF <50%)

Exclusion Criteria

- Pregnant women
- Already underwent heart surgery

RESULTS

Comparison of age distribution between the groups not showed any significant difference. Maximum number of patients are having age between 51-60 years in group-II. On group-I similar number of patients had age between 40-50 and 51-60 years. 2 patients in group-I had age between 71-80 years. Comparison of mean age between the groups not showed any significant difference with p value more than 0.05. This gender distribution is similar in both groups. Comparison of mean weight between the groups not showed any significant difference due to similar mean age 65 years. (Table-1)

Table: 1. Comparison of Demographic Data between the Groups

Groups	Group 1 (Etomidate) (Mean±SD)	Group 2 (Ketofol) (Mean±SD)
Age (Years)		
40-50	12	11
51-60	12	13
61-70	9	11
71-80	2	0
Age (Mean±SD)	55.83±9.17	55.46±7.74
Gender		
Male	28	28
Female	7	7
Weight (KG)	65.46±13.89	65.43±11.13

Systolic blood pressure was compared between the groups at different time periods. Baseline, AL and 2 min systolic blood pressure comparison not showed any significant difference. At 1 min and BL group-II showed high systolic

- Tuberculosis
- Drug allergy
- Psychiatric patients

Groups

Group: 1. Etomidate (n=35) Group: 2. Ketofol (n=35)

Procedure

The study was conducted in 70 subjects undergoing CABG surgery with reduced ejection fraction, divided into two groups each of 35 patients. Both groups were explained about study procedure and informed consent was obtained. Patients were divided according to sealed envelope technique , patients belong to group I were induced with 1 % etomidate and group II were induced with ketofol (prepared by mixing 4.5 ml of 1 % propofol and 25 mg of ketamine making to total of 5ml) other drugs were standardised to their body weight .All the patients demographic and clinical data were collected for analysis. Cardiovascular parameters like systolic blood pressure, diastolic blood pressure, mean atrial pressure and heart rate were recorded at different time periods (at baseline, after 1 min of induction , before laryngoscopy (BL) , after laryngoscopy(AL) , 2min following lscopy). The collected data was entered in excel sheet and used for analysis.

Statistical Analysis

The study was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 20.0) Version used for analysis. Unpaired t test applied to find the statistical significant between the groups. p value less than 0.05 consider statistically significant at 95% confidence interval.

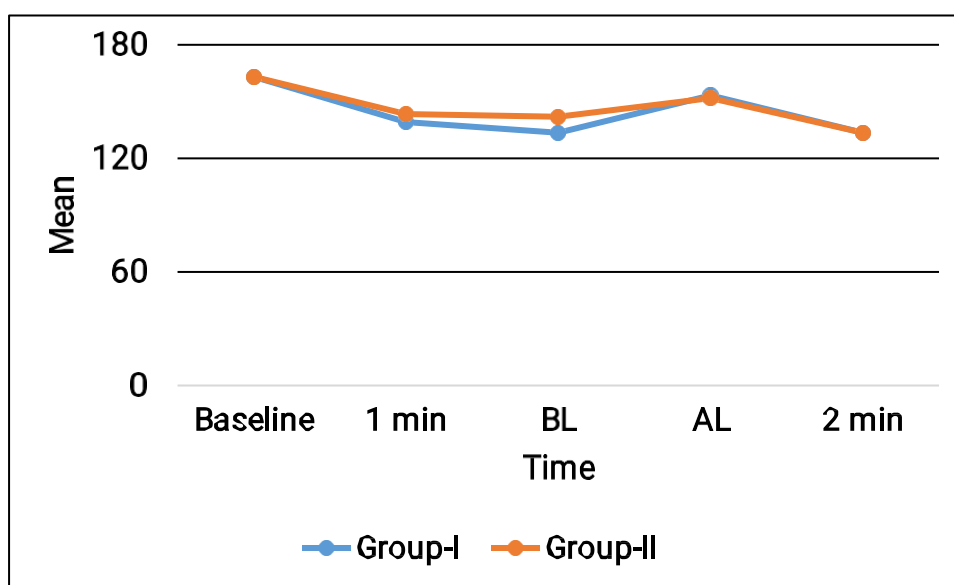
blood pressure compared to group-I. This difference is statistically significant with p value less than 0.05. (Table-2)

Table: 2. Comparison of Systolic blood Pressure between the Groups at Different time Periods

Systolic blood Pressure	Group 1 (Etomidate) (Mean±SD)	Group 2 (Ketofol) (Mean±SD)
Baseline	163.06±34.95	162.71±23.69
1 Min	138.54±24.16	143.20±26.24*
BL	132.20±29.55	141.94±25.73*
AL	152.26±32.43	150.60±28.89
2 Min	133.17±24.73	132.54±19.36

*P<0.05 Significant

Graph: 1. Comparison of Systolic blood Pressure between the Groups at Different time Periods



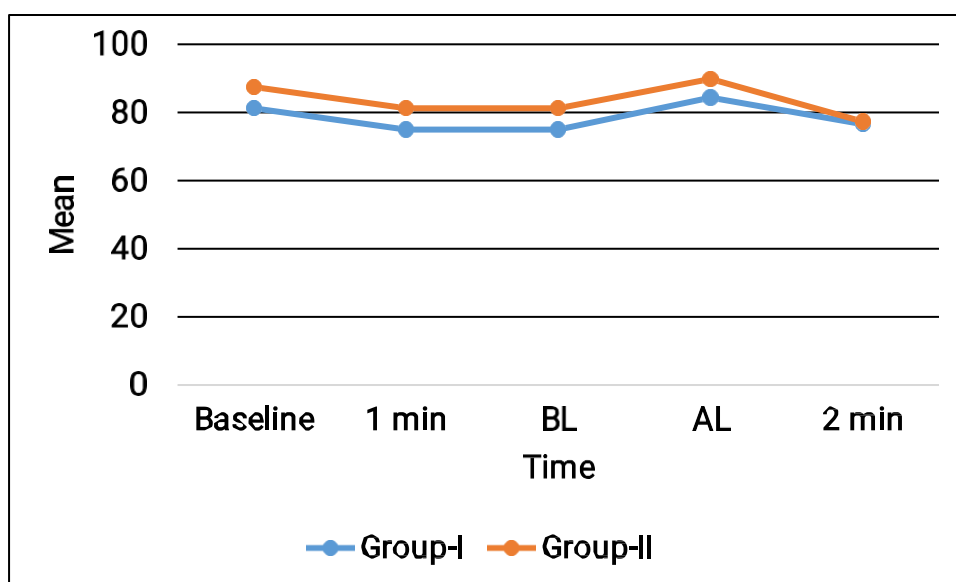
(Graph-1) Comparison of diastolic blood pressure at baseline, 1 min, BL and AL showed significant difference between group-I and II with p value less than 0.05. Group-II showed high diastolic blood pressure than group-I at all time periods. Comparison of diastolic blood pressure at 2 min not showed any significant difference between the groups. Group-I showed better diastolic blood pressure stability compared to group-II. (Table-3)(Graph-2)

Table: 3. Comparison of Diastolic blood Pressure between the Groups at Different time Periods

Diastolic Blood Pressure	Group 1 (Etomidate) (Mean±SD)	Group 2 (Ketofol) (Mean±SD)
Baseline	80.46±13.75	86.77±18.03*
1 Min	74.97±15.45	81.20±15.42*
BL	74.51±14.47	81.06±17.60*
AL	83.83±18.83	89.17±20.79*
2 Min	75.83±13.78	76.63±12.68

*P<0.05 Significant

Graph: 2. Comparison of Diastolic blood Pressure between the Groups at Different time Periods



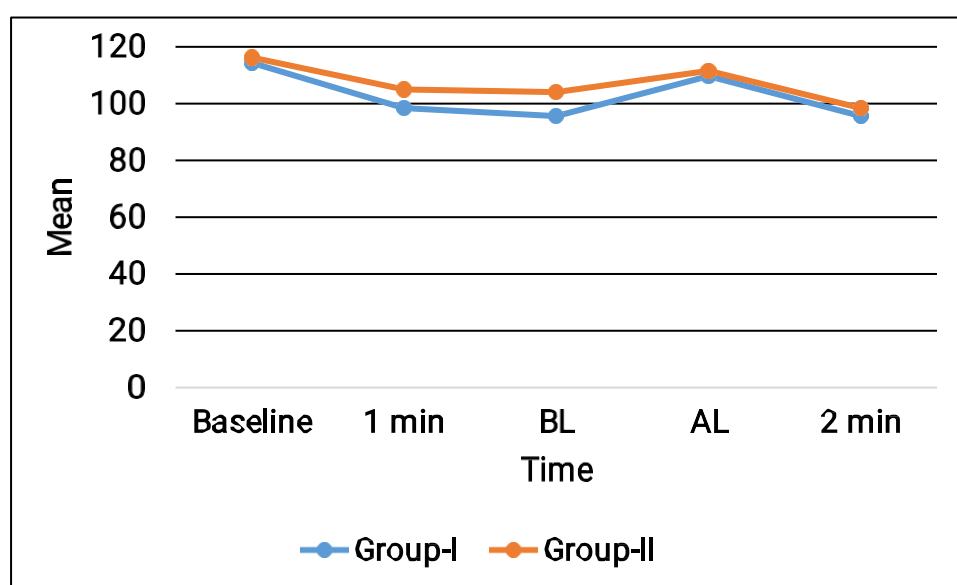
Comparison of mean arterial pressure between the group-I and II at AL and 2 min not showed any significant difference. 1 min, BL and AL at this time periods comparison mean arterial pressure between the group-I and II showed significant difference with p value less than 0.05 (Graph-3). Mean arterial pressure maintained high in group-II compared group-I. (Table-4).

Table: 4. Comparison of Mean Arterial Pressure between the Groups at Different Time Periods

Mean Arterial Pressure	Group 1 (Etomidate) (Mean±SD)	Group 2 (Ketofol) (Mean±SD)
Baseline	113.86±21.75	115.66±19.41
1 Min	98.29±16.40	104.20±17.41*
BL	95.06±17.76	103.31±21.26*
AL	109.11±24.28	110.91±23.38
2 Min	94.83±18.82	98.34±13.97

*P<0.05 Significant

Graph: 3. Comparison of Mean Arterial Pressure between the Groups at Different Time Periods

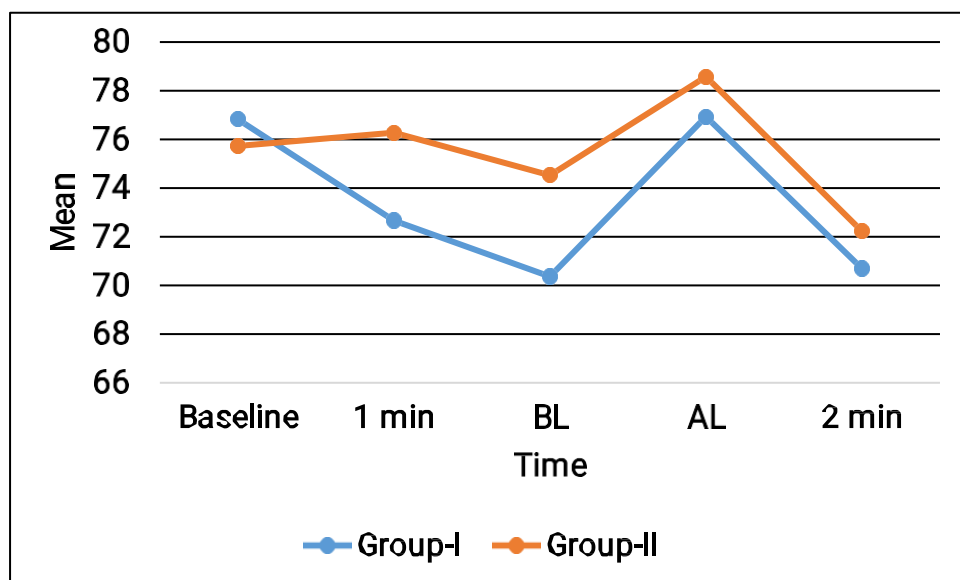


Heart rate was compared between the groups at BL, AL and 2 min not showed any significant difference with p value more than 0.05. Both groups showed similar heart rate at above time periods. At 1 min mean heart rate showed significant difference compared between group-I and II. Group-I showed low heart rate compared group-II. (Table-5) (Graph-4)

Table: 5. Comparison of Mean Heart Rate between the Groups at Different Time Periods

Heart Rate	Group 1 (Etomidate) (Mean±SD)	Group 2 (Ketofol) (Mean±SD)
Baseline	76.77±13.87	75.71±13.09
1 Min	72.63±11.63	76.20±12.06*
BL	70.31±12.33	74.46±12.03
AL	76.86±14.25	78.49±14.90
2 Min	70.66±11.96	72.17±10.92

*P<0.05 Significant

Graph: 4. Comparison of Mean Heart Rate between the Groups at Different Time Periods

DISCUSSION

This study conducted to evaluate the hemodynamic changes due to administration of ketofol and etomidate in patients undergoing CABG surgery with low ejection fraction. The major findings of this study was that the difference in hemodynamic responses to etomidate versus ketofol for anesthetic induction in these patients was statistically significant at different time periods. Hemodynamic changes due to anesthesia in CABG surgery patients with low ejection fraction have become a great concern to anesthesiologists and associated team members.^[9,10] The evidence show that changes in hemodynamic parameters increased or decreased independently are associated with complications in patients.^[11] Nahid A et.al study showed hemodynamic response was similar in the two groups for all variables over the time interval.^[12] It was concluded that both anesthetic agents were acceptable for induction in patients with coronary disease. Afshin et.al study observed there is a decreased in all hemodynamic parameters from induction and increased as time increase in ketofol group than in the etomidate group.^[13] In our study also similar results were observed. Aghdaii et.al evaluated the effect of etomidate midazolam versus propofol ketamine combination during induction of anesthesia on hemodynamic responses in patients undergoing CABG.^[14] The present study showed that there is

increase in hemodynamic parameters at 1 min and decreased after 2 min in the both groups. Pandey et.al found that etomidate provides more stable hemodynamic values when used for anesthesia induction compared with other anesthetic agent.^[15] It was observed that in the present study also showed similar results. Etomidate and ketofol showed changes in hemodynamic changes patients undergoing CABG surgery with reduced ejection fraction. Etomidate showed better hemodynamic stability than ketofol.

Strengths of the Study

1. The study directly compared two commonly used anesthetic induction strategies, etomidate and ketofol, in patients with reduced ejection fraction undergoing CABG surgery.
2. Both groups consisted of patients with reduced ejection fraction, providing a clinically relevant population in which maintenance of hemodynamic stability is particularly important.
3. The study included equal numbers of patients in both groups (35 patients each), allowing a balanced comparison between the two induction regimens.
4. Hemodynamic parameters including systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate were assessed at multiple clinically relevant time points during induction and

laryngoscopy.

5. The use of a standardized induction protocol and sealed-envelope allocation helped provide a structured comparison between the two groups.
6. The study provides clinically relevant comparative data that may contribute to the selection of an appropriate induction agent in patients with reduced ejection fraction undergoing CABG.

Limitations of the Study

1. The study included a relatively small sample size of 70 patients, which may limit the statistical power and generalizability of the findings.
2. The study was conducted at a single center, which may limit the applicability of the findings to other institutions and patient populations.
3. Hemodynamic parameters were assessed only during the immediate peri-induction period and up to 2 minutes after laryngoscopy; therefore, longer-term hemodynamic effects were not evaluated.
4. The study primarily evaluated hemodynamic parameters and did not assess important postoperative outcomes such as duration of mechanical ventilation, intensive care unit stay, hospital stay, postoperative complications, or mortality.
5. Although the study used sealed-envelope allocation, details regarding concealment and blinding were not reported sufficiently to completely exclude the possibility of allocation or assessment bias.
6. Potential confounding factors such as severity of left ventricular dysfunction, comorbidities, concomitant medications, and other perioperative clinical factors may have influenced hemodynamic responses.
7. The findings are specific to patients undergoing CABG with reduced ejection fraction and should therefore be interpreted cautiously when applying them to other surgical populations.

Future Directions

Future studies should include larger, multicenter patient populations to improve the generalizability and statistical power of the findings. Randomized controlled trials with clearly described allocation concealment and blinding procedures would provide stronger evidence regarding the comparative hemodynamic effects of etomidate and ketofol. Further research should also evaluate postoperative outcomes, including duration of mechanical ventilation, intensive care unit and hospital stay, postoperative cardiovascular complications, recovery, and mortality. Studies with longer hemodynamic monitoring and subgroup analysis according to the severity of left ventricular dysfunction may further clarify the clinical role of these induction agents in patients undergoing CABG with reduced ejection fraction.

CONCLUSION

Patients undergoing CABG surgery with reduced ejection fraction always have risk of cardiovascular collapse. Anesthetic agents play a major role on recovery of patients after surgery. Etomidate showed better hemodynamic stability compared to ketofol in patients undergoing CABG surgery with reduced ejection fraction. There is a requirement of further studies to establish selection of anesthetic agent in patients undergoing CABG surgery with reduced ejection fraction for better patient safety and output.

DECLARATIONS

Ethics Approval and Consent to Participate

The study was conducted in accordance with the ethical principles applicable to research involving human participants. Ethical approval was obtained from the appropriate institutional ethics committee. Written informed consent was obtained from all participants before enrollment in the study.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

All authors contributed to the conception and design of the study, data collection, analysis and interpretation of the results, preparation and critical revision of the manuscript, and approved the final version for publication.

Data Availability

The data generated and/or analyzed during the present study are available from the corresponding author on reasonable request, subject to applicable institutional and ethical restrictions.

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AI Use Disclosure

The authors declare that no generative artificial intelligence tools were used to generate or substantially modify the scientific content of this manuscript.

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