

Metoprolol versus Bisoprolol in Patients with Coronary Artery Disease: A Prospective Comparative Study

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Abstract

Background: Beta-blockers are the most commonly prescribed class of drugs in coronary artery disease (CAD). This study directly compared the effects of on metoprolol and bisoprolol in patients with CAD.

Methods: This prospective comparative study included 60 patients with CAD, with 30 receiving metoprolol and 30 receiving bisoprolol. Clinical parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), left ventricular ejection fraction (LVEF), regional wall motion abnormalities (RWMA), and quality of life (QoL) scores were measured before and after treatment. Statistical analysis included both paired and independent t tests for continuous variables, and performed McNemar test for paired RWMA data.

Results: Both groups showed significant reductions in SBP and HR while DBP declined significantly only in the bisoprolol group. Between group differences revealed significant for changes in SBP, DBP, and HR ($p = 0.041$, <0.001 , and 0.028 , respectively). LVEF improved in both cohorts rising from 44.87% to 51.96% with metoprolol and from 40.57% to 44.80% with bisoprolol. QoL scores increased in both groups, without a significant difference ($p = 0.70$).

Conclusion: Metoprolol and bisoprolol both produced significant improvements in BP, HR, LVEF and QoL scores while RWMA remained unchanged across both treatment groups.

1. INTRODUCTION

Coronary Artery Disease is the foremost global health issue which leads to higher rates of morbidity and mortality. In the year 2021, cardiovascular diseases (CVDs) impacted over half a billion individuals and took 20.5 million lives, with a rising trend that is alarming. India has a disproportionate share of this global health burden, with nearly 20% of the CAD related deaths occurring in the world. The age-adjusted mortality rate from CVD in India (272 per 100,000 individuals) is considerably higher than the global average (235 per 100,000 individuals), with the age of disease onset being a decade earlier than in western populations. This premature onset is frequently accompanied by accelerated disease progression and poorer outcomes [1-3].

Beta-blockers are the most commonly prescribed class of drugs which can include cardio-selective agents such as metoprolol and bisoprolol for the long-term management of coronary artery disease. These agents decrease myocardial oxygen demand through the reduction of heart rate & myocardial contractility, also enhancing the left ventricular ejection fraction (LVEF) which is an excellent measure of cardiac function and prognostic marker of CAD [4]. Although metoprolol and bisoprolol are commonly preferred drugs in the management of CAD, yet direct comparative evidence of their therapeutic effectiveness (e.g., enhancing LVEF) and differential effects on quality of life are inadequate. The quality of life depends on the physical symptoms (e.g., angina, dyspnea), psychological distress (e.g., anxiety, depression) and social impairment which remains an important predictor of long-term prognosis and treatment compliance in CAD patients [5-6]. Duration of treatment and side effects caused by the medication can also impact the quality of life of the patient. So, therapeutic assessment is necessary for the effective management of coronary artery disease and overall wellbeing of the CAD patients [7]. Hence, this study was conducted to compare the effects of metoprolol and bisoprolol on SBP, DBP, HR,

LVEF, RWMA, and quality of life vitals in patients with coronary artery disease.

2. MATERIALS AND METHODS

This was a prospective comparative study conducted over a period of 6 months with 60 study participants at KIMS Hospital, Rajahmundry, East Godavari District after obtaining the Ethics Committee approval (GSPRJY-IEC/ Pharm D/2024/05). The data was collected from the enrolled patients by strictly adhering to the inclusion and the exclusion criteria in a suitably designed data collection pro-forma, by using the relevant resources such as case files and WHOQOL-BREF questionnaire. Patients of both the genders of age above 18 years, who were diagnosed with coronary artery disease (CAD) were included in this study after taking their consent. Patients with a history of hypersensitivity or contraindications to beta-blockers, pregnant & lactating women, patients with severe comorbid conditions such as advanced renal disease or severe respiratory disorders that could confound the study outcomes were excluded.

The patients recruited in this study were categorised into two groups such as Group A, which includes 30 study participants prescribed with the drug metoprolol and Group B, which includes 30 study participants prescribed with the drug bisoprolol. At baseline, demographic data and measurements of left ventricular ejection fraction (LVEF) and regional wall motion abnormalities (RWMA) were recorded from all participants. These parameters were reassessed after treatment to evaluate changes from baseline. Additionally, the vitals such as Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Heart Rate (HR) were recorded before and after the treatment. The data related to WHOQOL-BREF questionnaire was also collected by directly asking questions to the patients for assessing their quality of life.

2.1 Tools used for assessing the Quality of Life

WHOQOL-BREF is a 26 items questionnaire which includes four health domains such as physical health, psychological health, social relationship and environment. The quality-of-life changes were measured by the WHOQOL-BREF scores and were analysed from baseline to review both groups. The analysis was carried out by measuring the score of each question in the form of a Likert scale. For each participant, raw domain scores were calculated and transformed to a 0–100 scale according to the WHOQOL-BREF scoring procedure, with higher scores indicating better quality of life. For the present analysis, the overall quality-of-life score was used to compare changes from baseline to follow-up between the two groups.

2.2 Statistical analysis

Data were analysed using GraphPad Prism 10 statistical software. Continuous variables were expressed as mean $\pm$ standard deviation (SD).

Paired t-test was used for within-group comparisons of pre-treatment and post-treatment values, while independent t-test was used for between-group comparisons of changes from baseline. For paired categorical variables such as RWMA status, the exact McNemar test was used. A p-value <0.05 was considered statistically significant.

3. RESULT

Among the 60 study participants, 38 (63.3%) were males and 22 (36.7%) were females. Table 1 represents the age wise categorisation of the study participants. The mean age of the overall study participants was found to be 56.50 ($\pm$ 12.54) years.

Table 1: Age-wise categorisation of the study participants

Age (years)	Male n (%)	Female n (%)	Total n (%)
31 – 40	3 (7.9)	1 (4.5)	4 (6.7)
41 – 50	14 (36.8)	2 (9.1)	16 (26.7)
51 – 60	9 (23.7)	8 (36.4)	17 (28.3)
61 – 70	8 (21.1)	7 (31.8)	15 (25.0)
71 – 80	4 (10.5)	4 (18.2)	8 (13.3)
Total	38 (100)	22 (100)	60 (100)

Table 2 represents the comparison of the mean values of vitals before and after the treatment between Group A (Metoprolol) and Group B (Bisoprolol). Significant within-group reductions were observed in SBP and HR in both

groups, while DBP showed a significant reduction only in Group B. The between-group comparison of mean changes showed statistically significant differences in SBP, DBP and HR.

Table 2: Comparison of vitals before and after the treatment in Group A (Metoprolol) and Group B (Bisoprolol)

Vitals	Group A			Group B			p-value		
	Before treatment	After treatment	Mean Difference	Before treatment	After treatment	Mean Difference	Within Group A	Within Group B	Between Groups A and B
SBP	123.3 ($\pm$ 12.41)	118.8 ($\pm$ 5.31)	4.5	128.7 ($\pm$ 19.07)	116.6 ($\pm$ 6.59)	12.1	0.030	<0.001	0.041
DBP	78.33 ($\pm$ 7.46)	78 ($\pm$ 5.81)	0.33	83 ($\pm$ 9.87)	73.97 ($\pm$ 7.89)	9.03	0.792	<0.001	<0.001
HR	90.63 ($\pm$ 14.94)	75.47 ($\pm$ 8.22)	15.16	89.53 ($\pm$ 13.02)	77.57 ($\pm$ 3.61)	11.96	<0.001	<0.001	0.028

Table 3 presents the comparison of regional wall motion abnormality (RWMA) status before and after treatment in both groups. A reduction in the

proportion of participants with RWMA was observed in Group A, whereas no change was observed in Group B. However, the within-group changes were not statistically significant.

Table 3: Comparison of RWMA status before and after the treatment in Group A (Metoprolol) and Group B (Bisoprolol)

RWMA status	Group A		Group B	
	Before Treatment (%)	After treatment (%)	Before Treatment (%)	After treatment (%)
Present	26 (86.7)	23 (76.7)	27 (90.0)	27 (90.0)
Absent	4 (13.3)	7 (23.3)	3 (10.0)	3 (10.0)

[Note. Within-group comparisons were performed using the exact McNemar test. Group A: $p = 0.250$; Group B: $p = 1.000$.]

Table 4 represents the comparison of the mean values of Left Ventricular Ejection Fraction (LVEF) before and after the treatment between Group A and Group B. A statistically significant within-

group improvement in LVEF was observed in both groups. However, the difference in mean change between the two groups was not statistically significant.

Table 4: Comparison of the mean values of Left Ventricular Ejection Fraction (LVEF) before and after the treatment between Group A and Group B

LVEF (%)	Before treatment	After treatment	Mean difference	p-value (within group)	p-value (between groups)
Group A	44.87 (± 8.56)	51.96 (± 7.24)	7.09	<0.001	0.20
Group B	40.57 (± 11.40)	44.80 (± 10.81)	4.23	0.030	

Table 5 represents the comparison of the mean and standard deviation based on overall Quality of Life scores between Group A & Group B. A statistically significant improvement in quality-of-life

scores was observed in both groups from before to after treatment. However, the difference in mean improvement between the two groups was not statistically significant.

Table 5: Comparison of the mean and standard deviation based on overall Quality of Life scores between Group A & Group B

Groups	Quality of Life		Mean Difference	p-value (within group)	p-value (between groups)
	Before treatment	After treatment			
Group A	64.09 (± 9.45)	73.57 (± 6.07)	9.48	<0.001	0.70
Group B	60.37 (± 8.65)	69.25 (± 6.36)	8.88	<0.001	

4. DISCUSSION

This study evaluated the effects of metoprolol and bisoprolol on systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), left ventricular ejection fraction (LVEF), regional wall motion abnormalities (RWMA), and quality of life in patients with coronary artery disease (CAD). Both groups showed improvements in several of these measured outcomes during the study period. A significant reduction in SBP and HR was observed in both groups, while DBP decreased significantly only in the bisoprolol group. Whereas, significant differences were observed in SBP, DBP, and HR between both the groups. These study findings are in line with prior comparative studies of metoprolol and bisoprolol. BISOMET had shown reductions in exercise blood pressure and heart rate with both drugs, while bisoprolol showing a more sustained effect at 24 hours [8]. The CREATIVE study also reported a greater reduction in heart rate with bisoprolol compared with metoprolol CR/ZOK in patients with hypertension [9]. In patients with CAD, both bisoprolol and metoprolol have also been associated with improved resting heart-rate control in clinical practice [10].

LVEF improved in both treatment groups, rising from 44.87% to 51.96% with metoprolol and from 40.57% to 44.80% with bisoprolol. Although the

numerical gain was larger with metoprolol, the difference between groups was not statistically significant. This suggests that both drugs may enhance ventricular function through β -blockade, though the role of concurrent therapies and baseline disease status can't be excluded. RWMA showed a slight decrease in the metoprolol group and no change with bisoprolol; however, neither finding reached statistical significance ($p = 0.250$ and $p = 1.000$).

Quality-of-life scores improved in both groups, yet the degree of improvement did not differ significantly between treatments. The WHOQOL-BREF, a validated 26-item tool covering physical, psychological, social, and environmental domains, was used to assess these outcomes [11]. Prior studies have indicated that β -blockers can influence functional recovery and quality of life after myocardial infarction, though such outcomes are often shaped by symptoms and other clinical variables [12,13].

The study sample was relatively small, treatment allocation was non-randomized, and differences in baseline characteristics, concomitant medications, and disease severity may have influenced the findings. The single-centre design and relatively short follow-up may also limit

generalizability. Nevertheless, the prospective assessment of blood pressure, heart rate, LVEF, RWMA, and patient-reported quality of life provides useful comparative information regarding these commonly used β -blockers. Both metoprolol and bisoprolol were associated with improvements in blood pressure, heart rate, left ventricular ejection fraction, and patient-reported quality of life. Regional wall motion remained largely unchanged in either group. When the two agents were compared directly, differences appeared in blood pressure and heart rate responses, whereas ventricular function and quality-of-life outcomes were broadly similar. To strengthen these observations, future work should draw on larger patient samples, apply consistent treatment protocols, and extend follow-up to determine whether clinically important distinctions exist between the therapies in coronary artery disease. Future research should involve larger cohorts, standardized treatment protocols, and extended follow-up to clarify whether clinically relevant distinctions exist between these therapies in patients with coronary artery disease.

5. CONCLUSION

This prospective comparative study demonstrated that both metoprolol and bisoprolol were associated with reductions in SBP and HR, while DBP decreased significantly only with bisoprolol. LVEF improved significantly in both groups, whereas RWMA did not show a statistically significant within-group change. Between the two treatment groups, differences were evident in the changes observed for systolic and diastolic blood pressure as well as heart rate. In contrast, measures of left ventricular ejection fraction and quality-of-life scores showed broadly similar outcomes. To clarify these findings and determine whether subtle distinctions exist, larger studies with standardized regimens and extended follow-up will be important.

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