

Introduction

Tachycardia is a critical issue in septic shock, as it increases myocardial oxygen demand and worsens cardiovascular function. This elevated heart rate, driven by excessive sympathetic activation, persists despite addressing underlying causes and is associated with increased catecholamine levels, myocardial dysfunction, and vascular hyporeactivity. Prolonged exposure to high catecholamine levels can lead to detrimental effects, including myocardial damage, insulin resistance, thrombogenicity, immune suppression, and bacterial growth. β -Adrenergic blockers have emerged as a potential therapy to manage heart rate and counteract these harmful effects by offering neurohormonal protection. Preclinical studies show that β -blockers, particularly when administered before sepsis onset, improve outcomes. Although concerns exist about cardiovascular collapse with β -blockers in septic shock, research supports their safety, especially with oral metoprolol and intravenous esmolol.

Aim of the Work

This study aims to evaluate whether intravenous β -blockers, particularly metoprolol, can reduce 28-day mortality in septic shock patients by effectively lowering heart rates and improving hemodynamics and organ function.

Patients and Methods

Patients: One hundred patients with septic shock due to ventilator associated pneumonia
Methods: A single-center, open-label, phase 2 trial. Patients with septic shock requiring norepinephrine to maintain a MAP of ≥ 65 mmHg and with a heart rate ≥ 100 bpm were enrolled, following informed consent. The study monitored hemodynamic and laboratory parameters, including heart rate, MAP, serum lactate, inflammatory markers, and acid-base balance. Patients were randomized into two groups: one received conventional care plus metoprolol, and the other received standard care. Metoprolol was administered to maintain a heart rate of 70-80bpm. The primary outcome was to assess 28-day mortality.

Results

Table 1: Shows the total dose of metoprolol needed to achieve target HR along with total IV fluids and total Norepinephrine given [All data presented in median (IQR)]

	Control group	Metoprolol group	P
Total dose of metoprolol (mg)	-	15 (12.5- 20)	-
Duration of metoprolol therapy (Days)	-	(2-5)	-
Total fluids (Liter)	16.7 (16- 18)	12.8 (11- 14.4)	< 0.001
Total Nor-epinephrine dose (mg)	126.5 (112.7- 149.5)	88.63 (83.05- 97.5)	< 0.001

Table 2: Outcomes of the study

	Control group	Metoprolol group	P
Table (7.A): Primary outcome			
28-day mortality	17 (34%)	10 (20%)	0.013
Table (7.b): Secondary outcomes			
ICU Mortality	13 (26%)	7 (14%)	0.016
ICU length of stay (days)	19 (17- 21)	16 (14- 16.2)	<0.001
Ventilator-free days	15 (9.7- 16)	18 (16- 19)	<0.001

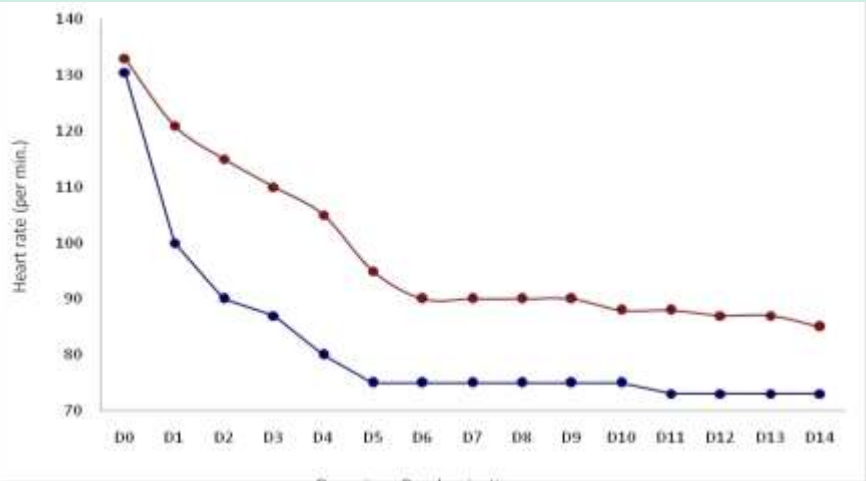


Figure 1:
Line graph for the changes of heart rate over time in both groups

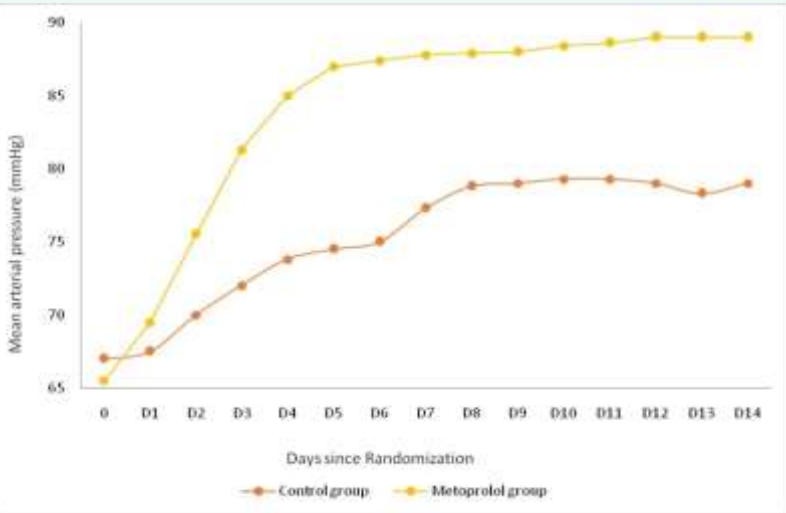


Figure 2:
Line graph for the changes of mean arterial pressure over time in both groups

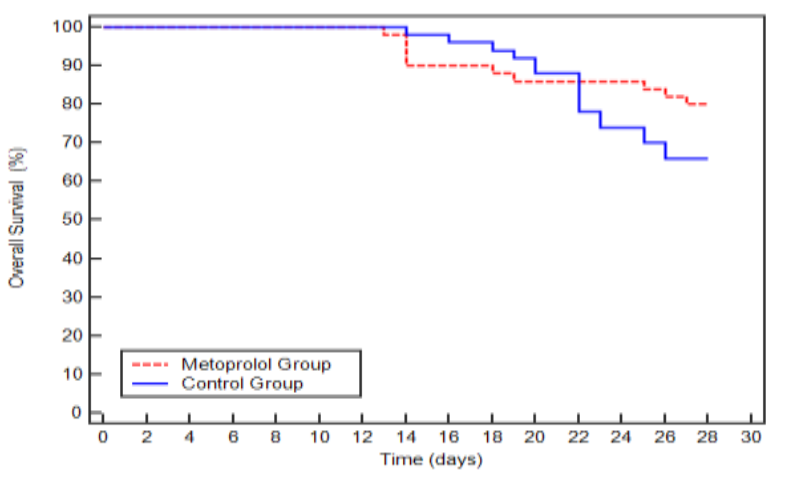


Figure 3:
Kaplan-Meier Overall survival curve for total sample

Conclusion

In septic shock patients, metoprolol effectively reduced 28-day mortality, ICU stay, and ventilation days without increasing adverse events compared to standard treatment. It may also positively influence the inflammatory response and acid-base balance.