

Mini Review

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# Evaluating Beta Blocker use in Acute Pericarditis Beyond Anti-Inflammatories: A Retrospective Cohort Study

Aarushi Kalra<sup>1\*</sup>, Henry L. Colorado<sup>1</sup>, Fardeen Faiz<sup>2</sup>, Ioannis Parastatidis<sup>2</sup>

<sup>1</sup>Northeast Georgia Medical Center, Gainesville, GA, USA

<sup>2</sup>Georgia Heart Institute, Gainesville, GA, USA

## Article Info

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### \*Correspondence:

Dr. Aarushi Kalra, Northeast Georgia Medical Center, Gainesville, GA, USA; Email: akalra.med@gmail.com

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## Abstract

**Background:** Pericarditis accounts for approximately 5% of chest pain visits in the emergency department. Standard therapy includes NSAIDs, colchicine, and corticosteroids; however, recurrence and readmissions remain common despite treatment. Few European studies suggest that beta blockers may decrease symptoms and arrhythmia burden; however, the role of beta blockers in acute pericarditis outcomes is limited.

**Objective:** We sought to examine whether beta blockers influence the clinical outcomes of acute pericarditis.

**Methods:** We performed a retrospective cohort chart review which analyzed adult patients in the Northeast Georgia Health System diagnosed with pericarditis between 2018 and 2024. A total of 435 patients were included: 155 were not on beta blockers (no BB) and 280 were on beta blockers (BB). Primary outcomes included length of stay (LOS), 365-day cardiovascular and all-cause hospital and emergency department readmissions.

**Results:** Based on the results, mean length of stay did not differ between the BB group and the no BB group (4.0 vs 3.0 days,  $p=0.228$ ). At 1-year, cardiovascular readmissions occurred in 35/280 (12.5%) for the BB group versus 16/155 (10.3%) for the no-BB group ( $p=0.69$ ). Similar nonsignificant differences were observed for all-cause hospital and ED readmissions. Since arrhythmia events were infrequent, no formal statistical analysis was performed.

**Conclusions:** In our cohort, beta-blocker use in acute pericarditis was not significantly associated with reduction in LOS or readmission rates. While European data suggests potential benefits, our results do not confirm a clear advantage. Further trials are necessary to define whether beta blockers have a role in pericarditis management.

## Abbreviations

BB = Beta Blocker

No BB = No Beta Blocker

LOS = Length of Stay

CV = Cardiovascular

## Introduction

Pericarditis is classified as the inflammation of the pericardial layers which usually manifests itself as chest pain and shortness of breath. Around five percent of emergency department visits for chest pain are attributed to acute pericarditis<sup>1</sup>. Etiologies of pericarditis vary, but the three most common causes include infectious, non-infectious, and idiopathic<sup>2</sup>. Common complications for pericarditis include pericardial effusion, tamponade, recurrence of pericarditis, atrial fibrillation, and constrictive pericarditis<sup>2</sup>.

The mainstay of treatment is centered around anti-inflammatory therapy with medications such as NSAIDs and Colchicine<sup>3</sup>. NSAIDs are used based on clinical experience, with no randomized clinical trial showing efficacy in acute pericarditis<sup>3</sup>. Colchicine blocks tubulin polymerization with consequent impaired microtubule assembly, thus inhibiting the formation of inflammatory molecules which has demonstrated benefit in reducing recurrence. Systemic corticosteroids are typically seen as a third-line agent; however, studies have shown that patients have higher recurrence rates of pericarditis when receiving steroids<sup>3</sup>. IL-1 receptor antagonists have shown benefit only in recurrent pericarditis, with ongoing trials to assess its usefulness in acute pericarditis<sup>3</sup>.

The current recommendation is for patients to refrain from intense cardiac activity for three months with a heart rate goal of less than 100 bpm<sup>3</sup>. It is thought that the exercise-induced tachycardia and shear stress on the pericardium cause inflammation-related increased blood flow which favors oxidative stress<sup>6</sup>. Despite this recommendation, there has been minimal research on beta-blocker therapy for acute pericarditis. Beta blockers reduce heart rate, and thus, it has been proposed that it can reduce pain associated with pericarditis<sup>5</sup>.

An observational study performed in Italy demonstrated that beta-blockers with anti-inflammatory therapy resulted in better symptom control<sup>6</sup>. Hence, beta-blocker therapy may also have benefits in hospital readmissions, decreased length of hospitalization, and decreased risk of arrhythmias. The purpose of this study is to determine whether beta blockers should be added to the treatment regimen for pericarditis in addition to current therapy of NSAID's and steroids. Beta blockers could reduce the recurrence/readmissions of pericarditis, hospitalization stay, rate of arrhythmia occurrence along with earlier resolution of symptoms. This is important because it can prevent life threatening conditions such as constrictive pericarditis/cardiac tamponade in those who are at higher risk of developing pericarditis despite current treatment guidelines.

## Methods

In this study, we performed a retrospective observational cohort study of patients greater than 18 years of age who were admitted with an acute pericarditis diagnosis at Northeast Georgia Medical Center between 2018 and 2024. The diagnosis was based on clinical symptoms, C-reactive protein abnormality, and troponin elevation criteria consistent with the guidelines.

435 patients were divided into two groups; the beta blocker group where patients were discharged on beta blocker versus the non-beta blocker group, those who were not discharged on the adjunctive therapy. Cardiovascular

diseases where beta blockers are used such as underlying heart failure, myocardial infarctions, and arrhythmias were not controlled in this study.

To reduce confounding due to non-random treatment assignments, a propensity score matching analysis was completed using a logistic regression model. This estimated the probability of beta blockers based on age, sex, race, abnormal troponin, CRP, and history of arrhythmias. Patients were matched 1:1 using a caliper of 0.2 and the balance between the groups with the covariables was assessed using standardized mean differences.

The primary outcomes that were studied included length of stay, 1-year cardiovascular readmission rates, and 1-year all cause readmission rates. Cardiovascular readmissions were defined as hospitalizations due to recurrent pericarditis, heart failure exacerbation, arrhythmias or other primary cardiovascular diagnoses. Secondary outcomes included emergency department readmissions and in-hospital arrhythmias. Since there was an outlier of one patient with a 232-day hospital stay, that was excluded from the length of stay data collection and analysis to reduce skewed data.

Statistical analysis: A negative binomial regression model was used to infer the difference in length of stay between groups. Whether the patient was on beta blockers during or at the time of initial admission was included in the model to adjust for potential confounding. If the adjusted beta coefficient for beta blocker group at discharge possesses  $P < .05$ , the null hypothesis of no group difference was rejected. The adjusted beta coefficient was converted to an odds ratio (aOR) for easier interpretation.

For each type of readmission, a logistic regression model was used to infer the difference in readmission between groups. Whether the patient was on beta blockers during or at the time of initial admission was included in the model to adjust for potential confounding. If the adjusted beta coefficient for beta blocker group at discharge possesses  $P < .05$ , the null hypothesis of no group difference was rejected. The adjusted beta coefficient was converted to an odds ratio (aOR) for easier interpretation.

## Results

A total of 435 patients were included in this study. Baseline characteristics of the study population are presented in Table 1. Following propensity score matching, 155 matched pairs were included in the matched cohort. Baseline characteristics between the two groups were well balanced after matching with standard mean differences less than 0.1. The percentages between pre- and post-match were less than 0.5 percentage wise.

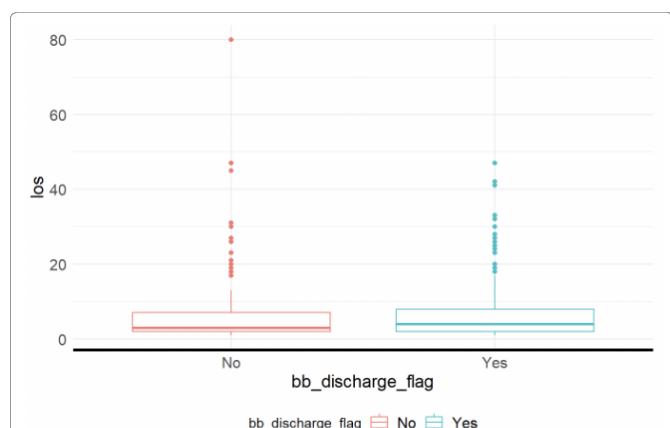
Table 2 shows the age, race, ethnicity, clinical lab values along with primary and secondary outcomes characteristics

**Table 1:** Characteristics of the 435-patient sample population

| Characteristics                       | N = 435          |
|---------------------------------------|------------------|
| <b>Sex</b>                            |                  |
| Female                                | 157 (36%)        |
| Male                                  | 278 (64%)        |
| <b>Race</b>                           |                  |
| White                                 | 352 (81%)        |
| Black/African American                | 51 (12%)         |
| Hispanic/Latino(a)                    | 30 (6.9%)        |
| Other                                 | 2 (0.5%)         |
| <b>Ethnicity</b>                      |                  |
| Not Hispanic/Latino(a)                | 406 (94%)        |
| Hispanic/Latino(a)                    | 28 (6.5%)        |
| Missing                               | 1                |
| <b>Beta-blocker at admission</b>      | 40 (9.2%)        |
| <b>Beta-blocker during stay</b>       | 305 (70%)        |
| <b>Beta-blocker at discharge</b>      | 280 (64%)        |
| <b>Length of stay, median (Q1–Q3)</b> | 4 (2–8)          |
| <b>Arrhythmia</b>                     | <b>14 (3.2%)</b> |
| SVT                                   | 26 (6%)          |
| Ventricular tachycardia               | 33 (7.6%)        |
| Atrial fibrillation                   | 142 (33%)        |
| Ventricular fibrillation              | 7 (1.6%)         |
| Torsades                              | 0                |
| <b>Abnormal troponin</b>              | 122 (28%)        |
| <b>Abnormal CRP</b>                   | 144 (33%)        |
| <b>CV hospital readmission</b>        | 51 (12%)         |
| <b>All-cause hospital readmission</b> | 126 (29%)        |
| <b>CV ED readmission</b>              | 122 (28%)        |
| <b>All-cause ED readmission</b>       | 211 (49%)        |
| <b>Mortality</b>                      | 10 (2.3%)        |
| <b>COVID-19 infection</b>             | NA               |
| <b>COVID-19 vaccination</b>           | NA               |

**Table 2:** Characteristics of Sample Distributed Between No Beta blocker versus Beta blocker group

| Variable                              | No Beta Blocker (n=155) | Beta Blocker (n=280) |
|---------------------------------------|-------------------------|----------------------|
| <b>Age, median (Q1–Q3)</b>            | 52 (39–68)              | 61 (51–71)           |
| <b>Female, n (%)</b>                  | 53 (34%)                | 104 (37%)            |
| <b>Male, n (%)</b>                    | 102 (66%)               | 176 (63%)            |
| <b>Race</b>                           |                         |                      |
| White                                 | 116 (75%)               | 236 (84%)            |
| Black/African American                | 26 (17%)                | 25 (8.9%)            |
| Hispanic/Latino(a)                    | 13 (8.4%)               | 17 (6.1%)            |
| Other                                 | 0                       | 2 (0.7%)             |
| <b>Ethnicity</b>                      |                         |                      |
| Not Hispanic/Latino(a)                | 142 (92%)               | 264 (95%)            |
| Hispanic/Latino(a)                    | 13 (8.4%)               | 15 (5.4%)            |
| Missing                               | 0                       | 1                    |
| <b>Beta-blocker at admission</b>      | 4 (2.6%)                | 36 (13%)             |
| <b>Beta-blocker during stay</b>       | 44 (28%)                | 261 (93%)            |
| <b>Length of stay, median (Q1–Q3)</b> | 3 (2–8)                 | 4 (2–8)              |
| <b>Arrhythmia</b>                     | 3 (1.9%)                | 11 (3.9%)            |
| SVT                                   | 9 (5.8%)                | 17 (6.1%)            |
| Ventricular tachycardia               | 6 (3.9%)                | 27 (9.6%)            |
| Atrial fibrillation                   | 34 (22%)                | 108 (39%)            |
| Ventricular fibrillation              | 0                       | 7 (2.5%)             |
| Torsades                              | 0                       | 0                    |
| <b>Abnormal troponin</b>              | 35 (23%)                | 87 (31%)             |
| <b>Abnormal CRP</b>                   | 57 (37%)                | 87 (31%)             |
| <b>CV hospital readmission</b>        | 16 (10%)                | 35 (13%)             |
| <b>All-cause hospital readmission</b> | 40 (26%)                | 86 (31%)             |
| <b>CV ED readmission</b>              | 38 (25%)                | 84 (30%)             |
| <b>All-cause ED readmission</b>       | 73 (47%)                | 138 (49%)            |
| <b>Mortality</b>                      | 2 (1.3%)                | 8 (2.9%)             |
| <b>COVID-19 Infection</b>             | NA                      | NA                   |
| <b>COVID-19 vaccination</b>           | NA                      | NA                   |



**Figure 1:** Visual Difference between Length of Stay between Beta blocker and No-Beta Blocker Groups Without Outlier

and percentages between the 155 patients in the no beta blocker group versus the 280 patients that were in the beta blocker group.

**Table 3:** Length of Stay Odds Ratio Statistics between Beta blocker and No-beta blocker Groups

|                                   | Odds Ratio <sup>1</sup> | 95% Confidence Interval | P-value |
|-----------------------------------|-------------------------|-------------------------|---------|
| <b>Beta blockers at discharge</b> | 0.856                   | 0.664, 1.102            | 0.228   |

<sup>1</sup>Odds ratio adjusted for beta blocker use at admission and during visit

As supported by Table 3 and illustrated in Figure 1, there was insufficient evidence to support a difference between the two groups for the average length of stay (OR 0.856 [0.664, 1.102], P = .228).

There was no evidence to support a difference between the beta blocker and no beta blocker groups regarding readmission rate outcomes. The distribution of readmission outcomes is presented in Table 4. As shown in Table 5, there was no statistical significance amongst the cardiovascular (CV) hospital readmissions or Emergency Department readmissions. Similar results were noticed amongst all hospital readmissions and ED visits as well.

**Table 4:** 365-Day Cardiovascular Disease and All-Cause Hospital Readmission Outcomes by Beta Blocker Use at Discharge

| Outcome                        | BB at Discharge | No Readmission, n (%) | Readmission, n (%) | Total, n (%) |
|--------------------------------|-----------------|-----------------------|--------------------|--------------|
| CV Hospital Readmission        | No              | 139 (89.7)            | 16 (10.3)          | 155 (100.0)  |
|                                | Yes             | 245 (87.5)            | 35 (12.5)          | 280 (100.0)  |
|                                | <b>Total</b>    | 384 (88.3)            | 51 (11.7)          | 435 (100.0)  |
| All-Cause Hospital Readmission | No              | 115 (74.2)            | 40 (25.8)          | 155 (100.0)  |
|                                | Yes             | 194 (69.3)            | 86 (30.7)          | 280 (100.0)  |
|                                | <b>Total</b>    | 309 (71.0)            | 126 (29.0)         | 435 (100.0)  |
| CV ED Readmission              | No              | 117 (75.5)            | 38 (24.5)          | 155 (100.0)  |
|                                | Yes             | 196 (70.0)            | 84 (30.0)          | 280 (100.0)  |
|                                | <b>Total</b>    | 313 (72.0)            | 122 (28.0)         | 435 (100.0)  |
| All-Cause ED Readmission       | No              | 82 (52.9)             | 73 (47.1)          | 155 (100.0)  |
|                                | Yes             | 142 (50.7)            | 138 (49.3)         | 280 (100.0)  |
|                                | <b>Total</b>    | 224 (51.5)            | 211 (48.5)         | 435 (100.0)  |

**Table 5:** Statistical Analysis results for Hospital and Emergency Department (ED) Readmission Outcomes

| Outcome                  | Odds Ratio (OR) | 95% Confidence Interval | P value |
|--------------------------|-----------------|-------------------------|---------|
| CV hospital readmission  | 1.130           | 0.626–2.037             | 0.685   |
| Any hospital readmission | 1.128           | 0.62–2.053              | 0.694   |
| CV ED visit              | 1.793           | 0.95–3.381              | 0.071   |
| Any ED visit             | 1.137           | 0.661–1.956             | 0.641   |

## Discussion

Based on the results from this retrospective study, when the beta blocker group and no beta blocker group were compared, there was no significant difference in the mean length of stay, cardiovascular readmissions, and all-cause hospital readmissions. Cardiovascular readmissions included those with recurrent pericarditis, heart failure exacerbation, and arrhythmias. In terms of the mean length of stay, those who are in the beta-blocker group had an average of 4 days of hospital stay versus the no beta-blocker group having an average of 3 days' length of stay. There was a single outlier length of stay up to 232 days which did not change the data and was removed to acquire less biased estimates. Given the P value was >0.05 and there was a very minor difference between the two groups, this data suggested no significance. Especially, the consistency of findings before and after propensity score matching strengthens these conclusions that there is no significant difference in outcomes.

When comparing the cardiovascular hospital readmission rates at 365 days, out of the 280 beta blocker patients, 35 of those were readmitted for cardiovascular reasons. When compared to the 155 patients who did not have any beta-blocker, the data showed only 16 were readmitted for cardiovascular concerns. The p value being 0.69 showed no significance again. Similar results were seen for cardiovascular ED readmission rates where 84 out

of 280 beta blocker patients were readmitted while 38 out of 155 non beta blocker patients were readmitted.

Additionally, all cause hospital and ED readmission rates were assessed between both groups, and the following findings as mentioned in the results section showed no major significant difference. Based on the evidence, all cause readmissions were most likely heavily influenced non cardiac comorbidities and restricting to pericarditis was limited. Standard therapies such as NSAID's, colchicine, and corticosteroids were not included in the analysis since they were not available in our dataset. The distribution of these therapies between groups was not available which represents a potential source of confounding variable given their impact on clinical outcomes and recurrence rates. Future research investigations should consider incorporating these variables to adjust the results.

For our study, since arrhythmia events were infrequent during data collection, we did not perform formal statistical analysis on arrhythmia incidence due to the low event rate which was previously highlighted in European studies.

Of note, this study period overlaps with the COVID-19 pandemic where cardiology practice was heavily influenced especially in the consideration of pericarditis. Both the SARS-CoV-2 infection and vaccination have been associated with rare cases of pericarditis particularly among younger patients as previously describe in literature (Mead et al., 2025). These presentations may also include those with concomitant arrhythmias such as atrial fibrillation which could change the practice of beta blocker initiation. However, in our study, data regarding COVID-19 infection and vaccination were not available to interpret. We were unable to account for the impact of this disease on pericarditis outcomes. Necessity for further studies to interpret this period of medicine will allow us to further define whether beta blockers may have an impact on pericarditis management.

## Conclusions

In our cohort, beta-blocker use in acute pericarditis was not significantly associated with reduction in length of stay or 1-year readmission rates, including the emergency department and hospital admissions. Despite the European observational data stating that there seems to be a benefit in symptoms and recurrence with adjunctive beta-blockade treatment, our results do not confirm a clear advantage in real-world practice. After adjusting for the limited covariates with propensity scoring, there was still no association observed, but confounding variables based on comorbidities cannot be excluded. However, further observations would need to be performed for a more cohesive decision on beta blocker usage.

## Limitations

Some limitations of our study could include that our sample size was only 435 patients and only collected from one medical record system, which may not be an accurate representation of the U.S. population. Also, there are many confounding variables that can skew the data such as inaccurate diagnoses charted, some laboratory values missing to correctly classify pericarditis, and multifactorial admission and length of stay reasons that may not specifically correlate with pericarditis. Apart from that, arrhythmias were not analyzed due to infrequent events so due to a lack of power, we were unable to address this secondary outcome. Cardiovascular diseases where beta blockers are used such as underlying heart

failure, myocardial infarctions, and arrhythmias were not controlled in this study and not included in the propensity model as well which may result in confounding outcomes.

## Perspectives

Prospective, randomized trials are necessary to define whether beta blockers have a role in pericarditis management. Even obtaining a larger sample size with multiple hospitals may be beneficial to further study if there are any benefits for beta blockers.

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