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BETA-BLOCKER MEDICATION: BETWEEN CARDIOVASCULAR BENEFITS AND FUNCTIONAL LIMITATIONS IN MEDICAL REHABILITATION

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ABSTRACT

Introduction: With multiple indications in both cardiovascular and non-cardiovascular diseases, beta-blockers exert complex effects on the cardiovascular system and energy metabolism, potentially impacting functional performance in medical rehabilitation programs. While their efficacy in controlling cardiac function is well-documented, the literature reports inconsistent results regarding the effects of this drug class on metabolic parameters and exercise tolerance. In the context of medical rehabilitation, these aspects justify the evaluation of the potential impact of beta-blockers on functional response.

Materials and Methods: The study had a prospective design and included 320 patients hospitalized between January and December 2025 at the Techirghiol Balneary and Rehabilitation Sanatorium. The antihypertensive medication used was analyzed, with patients grouped based on the administration of beta-blockers or other classes of antihypertensive drugs. Clinical observations regarding exercise tolerance were noted according to the timing of beta-blocker medication administration. Body Mass Index (BMI) was calculated to compare the weight status between groups. Functional evaluation was performed at the beginning and at the end of the rehabilitation program using the Visual Analog Scale (VAS) and the Six-Minute Walk Test (6MWT).

Results: Of the included patients, 179 were under treatment with beta-blockers, with metoprolol being the predominantly used active substance. In this group, 72% had BMI values above 25 kg/m², with a gender distribution of 59.7% females and 40.3% males. Comparative analysis revealed higher average BMI values in women treated with beta-blockers compared to those receiving other classes of antihypertensive drugs. Dynamic evaluation indicated a more limited functional improvement in the group of patients treated with beta-blockers.

Conclusion: Differences were observed between patients treated with beta-blockers and those treated with other classes of antihypertensive drugs regarding metabolic and functional parameters. These findings highlight the importance of considering antihypertensive therapy and monitoring exercise tolerance in the context of medical rehabilitation programs.

Keywords: Adrenergic beta-Antagonists, Rehabilitation, Exercise Tolerance, Body Mass Index

Introduction

Beta-blockers are frequently used in clinical practice by patients with cardiovascular diseases, being extensively evaluated as therapeutic options in the treatment of hypertension and heart failure (1) (1,2). In the current clinical context, this drug class is commonly found in the baseline therapeutic regimen of elderly patients admitted to medical rehabilitation services.

Through their effects on the adrenergic system, beta-blockers influence cardiovascular function, impacting heart rate and hemodynamic response to exercise (3). While their benefits in controlling cardiac function are well-documented, the literature reports inconsistent results regarding the effects of this drug class on metabolic parameters and exercise tolerance (3,4).

Some studies have reported possible

associations between beta-blocker use and changes in metabolic parameters, including body weight and energy metabolism, with these effects being variable depending on the type of substance used and the individual characteristics of the patient (3,4). Regarding exercise tolerance and functional performance, available data are inconclusive, with both limitations in exercise capacity and context-dependent effects described, depending on the clinical setting and study population (5,6).

In medical rehabilitation programs, optimizing exercise tolerance and functional response are essential therapeutic objectives (6). The frequent use of beta-blockers among patients included in rehabilitation programs, alongside inconclusive data regarding their impact on functional response, supports the need for evaluating rehabilitation response differences depending on the type of antihypertensive therapy. In this regard, a clinical study showed that, in patients treated with beta-blockers, the physiological response to exercise is altered, and prescribing exercise intensity based solely on heart rate may lead to undertraining in cardiac rehabilitation programs (7). In this context, the present study aims to evaluate the functional response to medical rehabilitation therapies in patients treated with beta-blockers, compared to those treated with other classes of antihypertensive drugs.

Materials and Methods

The study included 320 patients admitted to the Techirghiol Balneary and Rehabilitation Sanatorium between January and December 2025.

The study was conducted with the approval of the ethics and research committee of the Techirghiol Balneary and Rehabilitation Sanatorium, in accordance with local regulations. All patients signed informed consent for the use of medical data for research purposes.

Patient selection was performed from the current clinical practice, without randomization. Adult patients admitted for medical rehabilitation treatment, with documented antihypertensive medication at the time of admission, were included.

Inclusion criteria were: a diagnosis of arterial hypertension, cardiovascular and pulmonary stability, and eligibility for the balneary-physical-kinetic rehabilitation program.

Exclusion criteria were: cardiovascular instability or decompensation, severe pulmonary or neurological conditions, medical contraindications for physical effort, as well as associated conditions that could limit functional assessment.

The study was prospective in design, conducted as part of a complex balneary-physical-kinetic medical rehabilitation program. The main objective of the study was to evaluate the functional response to medical rehabilitation therapies based on the presence or absence of beta-blocker treatment in the antihypertensive regimen. Secondary objectives included assessing weight status, expressed by body mass index (BMI), as well as analyzing functional capacity and pain, using the six-minute walk test (6MWT) and the visual analog scale (VAS), depending on the presence of beta-blockers in the antihypertensive regimen.

Depending on the existing antihypertensive therapeutic regimen, patients were divided into two groups: those whose therapeutic regimen included beta-blockers and those whose antihypertensive regimen did not include beta-blockers. Antihypertensive medication was not initiated or modified within the study, as it had been prescribed prior to hospitalization by the patients' attending cardiologist.

BMI was calculated for all patients based on the weight and height recorded upon admission, in order to compare weight status between patients with and without beta-blockers in the antihypertensive regimen.

The data obtained were analyzed descriptively. Clinical, anthropometric, and functional variables were synthesized to describe the cohort characteristics and patient progression during the rehabilitation program, as well as the differences observed between patients with and without beta-blockers in the antihypertensive regimen. Pain was assessed using the VAS, a standardized subjective instrument, applied at admission and at the end of the rehabilitation program. Exercise tolerance was assessed using the 6MWT, a tool commonly used in clinical

practice to assess functional capacity, applied at admission and at the end of the rehabilitation program.

Results

A total of 320 patients receiving antihypertensive treatment were included in the study. The ages ranged from 45 to 80 years. Among these, 179 patients had beta-blockers included in their antihypertensive regimen, while 141 patients did not. In the group of patients whose antihypertensive regimen included beta-blockers, 72% had a BMI ≥25 kg/m², indicating overweight or obesity. Among the patients treated with beta-blockers and a BMI ≥25 kg/m², the majority were women.

BMI values are detailed only for the group treated with beta-blockers, as the primary interest of the analysis was to descriptively assess whether beta-blocker therapy was associated with a higher prevalence of overweight and obesity (BMI ≥25 kg/m²), in accordance with previously reported metabolic effects of this drug class.

The general characteristics of the study cohort are presented in Table 1. BMI values are reported only for patients treated with beta-blockers.

The most frequently used beta-blockers were metoprolol (68%), bisoprolol (20%), and carvedilol (12%), as shown in Figure 1. In addition, both patients receiving beta-blockers and those without beta-blockers also used other classes of antihypertensive drugs for blood pressure control, reflecting a combined therapeutic approach. Angiotensin-converting enzyme inhibitors were used in approximately 40% of cases, sartans in 30%, and calcium channel blockers in 25%.

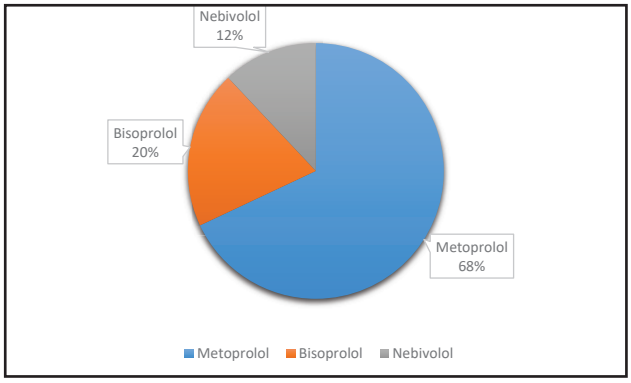


Figure 1. Distribution of beta-blocker substances used in the study cohort. Metoprolol was the predominantly used active substance, followed by bisoprolol and carvedilol.

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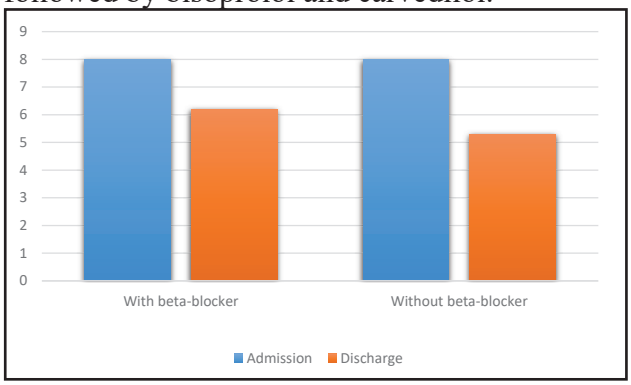


Figure 2. Evolution of the average pain scores assessed by the VAS at admission and discharge in patients with and without beta-blockers in the antihypertensive regimen.

Table 1. General characteristics of the study cohort, as well as the distribution of BMI in the group of patients treated with beta-blockers.

Categories	Patient subgroup	Absolute frequency	Relative frequency (%)
Number of Patients	Total number of patients	320	
	With beta-blocker	179	56%
	Without beta-blocker	141	44%
Gender	Male	128	40%
	Female	192	60%
BMI <25 kg/m² (normal weight), with beta-blocker	Total	50	28%
BMI ≥25 kg/m² (overweight/obese), with beta-blocker	Total	129	72%
Gender	Male	52	40,3%
	Female	77	59,7%

At admission, the average VAS score was 8 in both groups, while at discharge, the mean values were 6.2 for patients treated with beta-blockers and 5.3 for patients without beta-blockers.

Exercise tolerance was assessed at admission and discharge using the 6MWT, and the results are illustrated in Table 2.

Table 2. Evolution of the distance covered (in meters) in the 6MWT at admission and discharge in patients with and without beta-blockers in the antihypertensive regimen. Values are expressed as means.

Group	Admission	Discharge
With beta-blocker	312m ± 78	338m ± 75
Without beta-blocker	348 m± 82	378m ± 80

At admission, patients treated with beta-blockers covered shorter average distances in the 6MWT compared to patients without beta-blockers. At discharge, both groups showed increases in the distance covered; however, the mean values remained lower in the group of patients treated with beta-blockers.

The data obtained in this study describe the evolution of functional parameters and pain perception based on the presence of beta-blockers in the antihypertensive regimen.

Discussion

The results of this study highlight significant differences in functional response and exercise tolerance perception among patients included in medical rehabilitation programs, depending on the presence of beta-blocker treatment in the antihypertensive regimen. Although both groups benefited from balneary-physical-kinetic interventions, patients treated with beta-blockers showed a lower exercise tolerance, reflected by higher VAS scores at discharge and shorter distances covered in 6MWT.

The wide age range of patients included (45–80 years) is relevant for the interpretation of the results, given that the prevalence and severity of hypertension increase significantly with age, especially after 60 years (8,9). This suggests that the data obtained may reflect different stages of disease progression and distinct pathophysiological mechanisms specific to each age group, influencing the observed therapeutic profile.

An important aspect observed was the increased prevalence of overweight and obesity among patients treated with beta-blockers, with over 70% of them having a BMI ≥25 kg/m², as well as the predominance of females in this group. This descriptive observation suggests the need for further investigations to evaluate potential differences in metabolic response according to sex.

The higher VAS score observed in patients with beta-blockers may reflect a reduced functional comfort during the rehabilitation program, possibly due to limited exercise tolerance. It is important to emphasize that the VAS score represents the subjective perception of pain and does not allow for the establishment of a direct causal relationship. Similarly, the more modest performance in the 6MWT may be interpreted as a manifestation of reduced functional tolerance, in line with the effects of beta-blockers on chronotropic and hemodynamic responses to exercise (3).

From a clinical perspective, these findings underscore the importance of individualizing medical rehabilitation programs according to the patient's therapeutic profile. In patients treated with beta-blockers, adjusting exercise progression, training intensity, and recovery periods may help optimize functional tolerance and increase adherence to the rehabilitation program, without requiring changes to the underlying pharmacological treatment.

In the study cohort, metoprolol was the most frequently used beta-blocker, a trend supported by the literature, which shows that metoprolol is often the first choice in clinical practice for hypertensive patients and those with cardiovascular diseases (10).

The combined use of 6MWT and VAS allowed for an integrated assessment of functional response and subjective symptom perception. The walking test provides objective information on exercise tolerance, while the VAS reflects the level of discomfort experienced. Differences between groups can be explained by chronotropic response limitation, muscle fatigue, and increased body weight, mechanisms that indirectly contribute to the more pronounced

perception of effort (3,11).

The literature supports these observations. Beta-blockers can reduce total energy expenditure and thermogenesis, influencing protein oxidation and sustaining long-term weight gain (11,12). At the same time, the limitation of the chronotropic and hemodynamic response to exercise reduces muscle perfusion and oxygen delivery to active muscles, affecting exercise tolerance (3). Thus, the increased VAS scores in patients with beta-blockers may reflect both functional limitations and drug effects on the cardiovascular system and pain modulation.

Another aspect that deserves consideration is the timing of beta-blocker administration in relation to physiotherapy sessions. Given the pharmacokinetic profile of these medications, morning administration may sustain their negative chronotropic effects during the early part of the day, a time when rehabilitation programs are frequently conducted. Although this study did not directly assess this relationship, clinical observations suggest that the timing of administration could influence perceived exertion and functional performance, representing a potentially relevant factor in the organization of rehabilitation activities.

Previous studies suggest that patients with mild hypertension do not show significant changes in functional capacity measured by 6MWT, but significant reductions occur in advanced stages or in the presence of comorbidities. Additionally, 6MWT has been shown to be sensitive to improvements induced by physical rehabilitation programs, supporting its use in assessing functional progress (13). Regarding pain perception, hypertension may be associated with reduced pain sensitivity (hypoalgesia), mediated by changes in the autonomic nervous system and baroreflex, influencing the scores obtained through VAS (14).

Furthermore, the use of beta-blockers in combination with other antihypertensives does not allow for the isolated evaluation of the effects of this drug class, given that guidelines often recommend combining beta-blockers with other antihypertensive medications, such as angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers, to optimize blood pressure control (15).

Moreover, the chronotropic limitation induced by beta-blockers may reduce the reliability of exercise intensity prescription based solely on heart rate (7). In this context, the use of subjective tools, such as the Borg Rating of Perceived Exertion (RPE) scale, could be considered in future studies as a complementary method for monitoring and individualizing exercise intensity in patients receiving beta-blocker therapy.

This study has some limitations. The wide age range (45–80 years) may introduce heterogeneity, and the subjective assessment of exercise tolerance was not standardized. The analysis of weight status in patients without beta-blockers was limited, and the pharmacokinetic profile of the medications was not evaluated, which could influence exercise tolerance and the optimal timing for physical therapy.

Thus, these observations highlight the need for individualized rehabilitation programs, taking into account antihypertensive medication, body weight status, and subjective exercise response, in order to maximize functional benefits and patient comfort.

Conclusions

The results of this study suggest that chronic beta-blocker treatment may influence exercise tolerance and subjective pain perception, potentially impacting the response to medical rehabilitation programs. These findings emphasize the importance of a personalized and multidisciplinary approach in the recovery of patients with cardiovascular pathology, as well as the need for careful monitoring of metabolic status and functional capacity in the context of antihypertensive therapy.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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