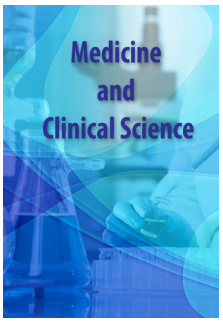
Medicine & Clinical Science

Original Article



Pain As A Potential Impact Factor In Cardiac Rehabilitation: Literature Review

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- Received Date: 18 Jun 2023
- Accepted Date: 22 Jun 2023
- Publication Date: 24 Jun 2023

Keywords

Pain, Chronic pain, Cardiovascular Disease, Cardiac Rehabilitation.

Abstract

Introduction: *Cardiovascular diseases are responsible for substantial damage to the health system, being the main cause of mortality in the world, just as pain is the main cause of disability in the world. It is common for individuals diagnosed with both pathologies as well as other comorbidities, to be associated with a high risk of mortality. The study of pain in this specific population can bring us greater clarity on the impact it has on cardiac rehabilitation.*

Objective: *To identify studies that researched the impact of pain in patients with cardiovascular disease, and to analyze the impact of pain on the rehabilitation of these individuals.*

Methods: *We performed an integrative literature review in the PUBMED database based on clinical practice, selecting studies that evaluated pain, functional capacity, quality of life, and treatment adherence, the studies were analyzed according to criteria of practice based on scientific evidence.*

Results: *A total of 380 studies using the search strategy, where 55 studies were selected after reading the title and abstract, and after analysis 23 studies were included according to the inclusion criteria. Despite the high relevance of the subject in the literature, there are still few studies with a high level of scientific evidence, which address the impact of pain in individuals with cardiovascular disease, but primary studies have shown a direct correlation between the two pathologies, being associated with clinical worsening of these individuals, highlighting the importance of a better approach to pain.*

Conclusion: *Pain is a common pathology among individuals with cardiovascular disease, decreasing functional capacity, and treatment adherence, and triggering changes in the autonomic nervous system, which can negatively impact cardiac rehabilitation.*

İntroduction

Currently, cardiovascular diseases are the leading cause of death in the world, being responsible for substantial damage to the health system, so scientific development for the clinical improvement of these individuals is a priority [1].

There are several pathologies that are associated with the weakening of the heart, leading to heart failure, and it is estimated that approximately 37.7 million people worldwide are diagnosed with chronic heart failure [1].

Chronic pain is one of the main causes of disability in the world, reducing the quality of life and is responsible for increasing the risk of mortality in the population [2].

It is characterized by a picture of persistent pain for more than three months, is associated with functional disability, and is pointed out by some studies as a risk factor for the development or clinical worsening of cardiovascular disease [2].

The study of pain has been developing a lot in recent years, where its pathophysiology is already well defined and its treatment follows international guidelines, developed by specialists, enabling a better approach and treatment [2].

It is commonly possible to observe people who have these two pathologies, as well as other comorbidities such as obesity, diabetes, smoking, sedentary lifestyle associated with poor diet [2].

The treatment for both pathologies consists of changing habits, including the practice of physical activities, and multidisciplinary follow-up to obtain a better prognosis and clinical evolution [3,4].

It is known that psycho-emotional, socioeconomic, education level and sleep disturbance factors significantly interfere in the worsening of symptoms and predisposition of these pathologies, being modifiable factors for prevention and for a better clinical evolution of these individuals [3].

Studies show that individuals with cardiac dysfunctions may suffer from associated acute pain (angina) or acute myocardial infarction,

Citation: da Silva JRR, de Oliveira M. Pain As A Potential Impact Factor In Cardiac Rehabilitation: Literature Review. Med Clin Sci. 2023;5(5):1-8.

postoperative pain, and chronic pain, which can be localized or generalized, these types of pain have different characteristics and pathophysiology, where treatment must be specified according to the guidelines already established by specialists [2,5].

Musculoskeletal pain is also a frequent pathology in these individuals, which can hinder the practice of physical exercises that are the basis for good rehabilitation and can reduce adherence to treatment [4,6-8].

Health professionals who work with cardiac rehabilitation follow clinical guidelines with a scientific basis and good prognosis for the improvement of cardiac dysfunction [4].

However, several studies demonstrate that a better approach and treatment of pain in these individuals is necessary [9,10].

The study of pain in this specific population can bring us greater clarity of the impact it has, directing us to more precise and effective treatments, improving the quality of life, and reducing mortality in the population [9,10].

Objective

To identify studies that researched the impact of pain in patients with cardiovascular disease, and to analyze the impact of pain in the rehabilitation of these individuals.

Methods

This study was carried out by means of an integrative review, with the collection of secondary data, which allows us to carry out a bibliographical survey based on the experience lived by the authors, with the aim of aggregating and disseminating the knowledge that already exists in the literature and is used in a way effective in clinical practice.

During consultations in clinical practice at a rehabilitation and training center specializing in pain, we observed a high incidence of chronic patients diagnosed with cardiovascular disease reporting the loss of functional capacity as well as a sedentary lifestyle due to Pain, which led us to the following question:

WHAT IS THE IMPACT OF PAIN IN INDIVIDUALS WITH CARDIOVASCULAR DISEASE AS COMPARED TO INDIVIDUALS WITHOUT PAIN? SHOULD WE INCLUDE SPECIFIC PAIN TREATMENTS IN CARDIAC REHABILITATION PROTOCOLS, IMPROVING TREATMENT ADHERENCE AND THE QUALITY OF LIFE OF THESE INDIVIDUALS?

To prepare for this clinical questioning, we used the PICO strategy:

P (patients with cardiovascular disease and pain), I (evaluation of pain, quality of life, adherence to treatment and cardiac rehabilitation protocols), C (individuals without pain), O (low adherence to treatment, decreased quality of life, and increased risk of mortality in individuals with cardiovascular disease).

The focus for the elaboration of the search was the target audience, allowing a greater number of studies that correlated the two pathologies.

The database selected to carry out the research was PUBMED, which was carried out on February 26, 2023.

After a detailed search in the DeCS/MESH database (science and health descriptors) we used the following keywords: Heart failure, Pain, cardiac disease, cardiovascular disease, angina, myocardial ischemic, coronary-heart-disease, Pain; Pulmonary arterial hypertension.

And for a more accurate search, we searched for the terms most recognized by the PUBMED database, the following MESHs: Coronary Disease, Heart Diseases, Rheumatic Heart Disease, Myocardial Ischemia, Heart failure, cardiac disease, cardiovascular disease, Chronic Pain, Musculoskeletal Pain, Low Back Pain.

The search strategy in which we obtained a greater number of studies related to the theme proposed by the work was: ("Chronic Pain" OR "Musculoskeletal Pain" OR "Low Back Pain") AND ("Coronary Disease" OR "Heart Diseases" OR " Rheumatic Heart Disease" OR "Myocardial Ischemia" OR "Heart failure" OR "cardiac disease" OR "cardiovascular disease").

Studies that analyzed the effects of the association between individuals with pain and cardiac dysfunction, published until February 26, 2023, were included.

Studies that did not assess the quality of life, pain, or adherence to treatment in individuals with cardiovascular disease were excluded.

After selecting the studies, a methodological analysis of each study was carried out using evidence-based practice as a reference, for a better critical and scientific analysis of the content of this review.

Results

We observed a total of 380 studies using the search strategy, where 55 studies were selected after reading the title and abstract.

After the complete reading of the studies, one study was excluded due to duplication [11] and another thirty studies were excluded due to the exclusion criteria, where there was no association between the two pathologies, or because they were not relevant to the subject of the study [12-42], and one study for not able to get read access [43].

The final sample for carrying out this review consisted of twenty-three studies selected by the inclusion criteria, which will be presented in chronological order below in Table 1.

The selected studies originated in thirteen countries, namely: Scotland, Sweden, England, USA, South Korea, Spain, France, Brazil, Iran, Palestine, Australia, Japan, and China.

The total sample of participants in this review consisted of approximately 594,397 individuals of both male and female genders, four studies did not present the number of participants clearly, the age ranged between 18 and 94 years, and only one study was carried out with children over 4 years old.

The methods for assessing cardiac dysfunction were the anamnesis form, blood pressure, blood test, Framingham score, and Artery flow-mediated dilation (FMD).

The pain was assessed using self-administered questionnaires such as the Sf-36, Pain Grade, Brief Pain, Inventory (BPI), Numerical Rating Scale (NRS), Graduated Chronic Pain Scale (GCPS), Survey on Chronic Pain in Europe, Pain Index Score (PIS), Nordic Musculoskeletal Questionnaire.

Physical capacity by physical and anthropometric assessment, International Physical Activity Questionnaire, and transcutaneous exercise oximetry (ex-tcPO 2).

Table 1. *Baseline characteristics and laboratory parameters of the study groups.*

Article	Author, Country and Year	Kind of study	Participants	Assessment Methods	Results	Level of Evidence
Cardiovascular risk factors associated with the metabolic syndrome are more prevalent in people reporting chronic pain: Results from a cross-sectional general population study44.	Nicola J. Goodson, Scotland, 2013	Randomized controlled clinical trial.	24,000 individuals of both sexes with an average age between 35 and 65 years.	Clinical examination, blood test, blood pressure numerical enological scale for pain intensity.	The authors found a hypothesis that there is an association between the increased risk for cardiovascular diseases in individuals with chronic pain, noting that the greater the intensity of pain, the greater the risk for cardiovascular diseases.	Level II
An investigation of association between chronic musculoskeletal pain and cardiovascular disease in the Health Survey for England (2008) [45].	C.G. Ryan, England, 2013	Observational cross-sectional study.	5354 individuals of both genders, 3332 middle-aged and 2022 of the best age.	A face-to-face questionnaire was applied, containing questions related to the risks of cardiovascular diseases and pain assessment.	The authors found a direct relationship with the increased incidence of cardiovascular diseases in patients with chronic musculoskeletal pain. But they were unable to prove that decreased levels of physical activity and sedentary behavior were the causal factors. However, it was concluded that chronic musculoskeletal pain is a potential modifiable factor to decrease the incidence of cardiovascular diseases in these individuals.	Level V
The association between the history of cardiovascular diseases and chronic low back pain in South Koreans: a cross-sectional study [46].	In-Hyuk Ha, South Korea, 2014	Observational cross-sectional study.	13,841 individuals of both genders aged between 20 and 89 years.	The Framingham score was used to define the risk of cardiac dysfunction and the report of persistent pain for more than three months by clinical examination.	The authors found a strong relationship between individuals with cardiovascular disease and chronic low back pain, raising the hypothesis that low back pain may come from a disorder caused by lumbar arteriosclerosis.	Level V
Self-reported pain severity is associated with a history of coronary heart disease [47].	S Parsons, England, 2015	Observational cross-sectional study.	15,288 individuals of both genders.	A self-administered questionnaire was sent to the mailbox of the research participants, pain was evaluated using the Pain Grade scale.	Risks for cardiovascular diseases were associated with increased pain intensity. Independent of factors such as age, gender, comorbidities, and lifestyle factors measured in this study.	Level V
Chronic pain, body mass index and cardiovascular disease risk factors: Tests of moderation, unique and shared relationships in the Study of Women's Health Across the Nation (SWAN) [48].	John W. Burns, USA, 2015	Cohort study, randomized and controlled clinical trial.	3,302 female individuals aged between 42 and 52 years.	Medical clinical assessment performed annually, SF-36 pain and Dysfunction questionnaire, blood test.	A relationship was observed between the increase in the intensity of Pain over a period of three years and an increase in the body mass index of these individuals, leading to a high risk for cardiovascular diseases.	Level II
Musculoskeletal complaints in cardiac rehabilitation: Prevalence and impact on cardiovascular risk factor profile and functional and psychosocial status [49].	José Afonso Rocha, Portugal, 2015	Observational cross-sectional study.	119 individuals of both genders diagnosed with coronary heart disease submitted to the hospital cardiac rehabilitation sector.	Physical and anthropometric assessment, International Physical Activity Questionnaire, Nordic Musculoskeletal Questionnaire, Hospital Anxiety and Depression Scale, SF-36.	27% of individuals had musculoskeletal pain, with the lower limbs being more affected, being associated with lower levels of physical activity and quality of life, which resulted in a worse prognosis for cardiac rehabilitation of these individuals.	Level V
Variations in patient-reported physical health between cardiac and musculoskeletal diseases: systematic review and meta-analysis of population-based studies50.	James A. Prior, England, 2015	Systematic review and meta-analysis.	43,840 individuals of both genders aged over 18 years.	SF-12 or SF-36.	The authors observed that osteoarthritis, rheumatoid arthritis and cardiac disorders are pathologies that affect the physical capacity of individuals, equivalent to their degree of severity.	Level I

Assessing the relationship between chronic pain and cardiovascular disease: A systematic review and meta-analysis [9].	Alan Fayaz, England, 2016	Systematic review and meta-analysis.	Individuals of both genders with a history of chronic pain and cardiac dysfunction.	Was not presented.	The authors noted the possibility of a dose response related to the incidence of chronic pain and cardiovascular disease. Demonstrating in their results that the alteration of the autonomic nervous system, being the increase of excitability of the sympathetic nervous system a probable cause for the increased risk for cardiac dysfunctions.	Level I
Chronic pain in chronic heart failure: A review article [51].	Mohammad Javad Alemzadeh-Ansari, Iran, 2017	Literature review.	Individuals of both genders with a history of chronic pain and cardiac dysfunction.	Was not presented.	The authors found that cardiac pain is common in patients with heart failure, but difficult to diagnose and treat.	Level V
The characteristics of pain in patients diagnosed with depression and heart failure [52].	Christine Haedtke, USA, 2017	Randomized controlled clinical trial.	62 individuals of both sexes over 55 years old, with a history of non-cardiac pain in the last 24 hours.	Brief Pain Inventory, Beck Depression Inventory, and Rand-36.	The authors will observe a high prevalence of moderate to severe non-cardiac pain in individuals, with the lumbar region being the most affected, only 5% of individuals underwent non-pharmacological treatment, and most who underwent pharmacological treatment did not improve.	Level II
The Relationship Between Spinal Pain and Comorbidity: A Cross-sectional Analysis of 579 Community-Dwelling, Older Australian Women [53].	Katie E de Luca, Australia, 2017	Observational cross-sectional study.	579 Australian women aged between 60 and 66 years.	Item Short Form Survey (SF-36) and Health Assessment Questionnaire (HAQ)	A relationship was observed between low back pain and cardiovascular disease, among other comorbidities such as diabetes and overweight.	Level V
The Effect of Chronic Musculoskeletal Pain on Sexual Function and Quality of Life of Cardiac Rehabilitation Patients [54].	Pricilla Geraldine Wittkopf, Brazil, 2018	Observational cross-sectional study.	105 individuals of both sexes who were undergoing cardiac rehabilitation.	The Short-Form Health Survey (SF-36).	It was observed that more than half of the patients who were in the cardiac rehabilitation program had musculoskeletal pain, which reduced the quality of life and functional capacity of these individuals.	Level V
Post-surgical chronic pain and quality of life in children operated for congenital heart disease [55].	Megumi Matsuda, Japan, 2019	Observational cross-sectional study.	141 individuals of both genders aged 4 years or older undergoing cardiac surgery.	Pediatric quality of life inventory 4.0 (PedsQL)	17% of individuals had pain for more than three months, which is associated with worse quality of life.	Level V
Chronic pain, cardiovascular health and related medication use in ageing African Americans with osteoarthritis [56].	Staja Q Booker, EUA, 2019	Observational cross-sectional study.	110 African American individuals of both genders aged 50 to 94 years.	The Brief Pain Inventory- Short Form (BPI-SF), Pain Index Score (PIS).	The authors observed that individuals with cardiovascular diseases have higher levels of pain.	Level V
Co-occurrence of Chronic Musculoskeletal Pain and Cardiovascular Diseases: A Systematic Review with Meta-analysis [57].	Crystian B Oliveira, Brazil, 2020	Systematic Review and Meta-analysis.	Sample sizes ranged from 103 to 7889 people with chronic musculoskeletal pain and 139 to 13974 people without Pain.	Was not presented.	The authors concluded that there is high evidence that people with chronic musculoskeletal pain have cardiovascular diseases.	Level I
A Simple Scale for Screening Lower-Extremity Arterial Disease as a Possible Cause of Low Back Pain: a Cross-sectional Study Among 542 Subjects [58].	M Gahier, France, 2020	Observational cross-sectional study.	542 individuals of both genders with a mean age of 64.5 years.	Validation of the exercise test for transcutaneous exercise oximetry (ex-tcPO 2).	A prevalence of vascular alterations was observed, being a possible cause for low back pain.	Level V
Markers of Cardiovascular Health in Older Adults with and Without Chronic Low Back and Radicular Leg Pain: A Comparative Analysis [69].	Peter C Coyle, USA, 2021	Observational cross-sectional study.	Individuals of both genders aged between 60 and 85 years.	Artery flow-mediated dilation (FMD), Oswestry Disability Questionnaire.	Patients with chronic low back pain radiating to the legs have a lower endothelial function and level of study when compared to patients without pain.	Level V

Pain Characteristics, Cardiovascular Risk Factors, and Cardiovascular Disease [60].	Isabel Rodríguez-Sánchez, Spain, 2022	Observational cross-sectional study.	10910 individuals of both genders over 60 years old.	Survey on chronic pain in Europe.	Individuals with chronic pain demonstrated a significant decrease in recreational physical activities, deterioration of mental health, worsening of sleep disturbance and diet.	Level V
Anxiety sensitivity and modifiable cardiovascular disease risk factors: the role of pain intensity among individuals with chronic pain [61].	Brooke Y Kauffman, USA, 2022	Observational cross-sectional study.	396 individuals of both genders aged between 18 and 64 years.	Anxiety Sensitivity Index-3 (ASI-3), Graded Chronic Pain Scale (GCPS).	The authors observed an increased sensitivity to anxiety in patients with chronic pain, which may be a predisposing factor for the risk of heart disease.	Level V
The association between short-term, chronic localized and chronic widespread pain and risk for cardiovascular disease in the UK Biobank [5].	Ann-Sofie Rönnegård, Sweden, 2022	Randomized controlled clinical trial.	475,171 individuals of both genders aged between 40 and 69 years.	Self-administered questionnaire.	The authors found significant correlations between chronification and increased pain intensity being associated with the risk for cardiovascular diseases.	Level II
Opportunities and challenges of pain-related myocardial ischemia-reperfusion injury [62].	Wenhua Jiang, China, 2022	Literature review.	Was not presented.	Was not presented.	The authors observed the hypothesis that chronic pain alters the autonomic nervous system by stimulating the sympathetic nervous system and inhibiting the parasympathetic action of the vagus nerve.	Level V
Prevalence of pain and its association with quality of life of patients with heart failure in a developing country: findings from a multicenter cross-sectional study [63].	Deema Mhesin, Palestine, 2022	Observational cross-sectional study.	142 individuals of both genders over 18 years old.	Brief Pain Inventory (BPI), European Quality of Life Scale (EQ5D).	Individuals with chronic pain had worse quality of life.	Level V
Sex-Specific Associations Between Preoperative Chronic Pain and Moderate to Severe Chronic Postoperative Pain in Patients 2 Years After Cardiac Surgery [64].	Jia Liu, China, 2022	Observational cross-sectional study.	495 individuals of both genders aged 21 to 84 years.	Numerical Rating Scale (NRS)	10.5% of individuals undergoing cardiac surgery had persistent chronic postoperative pain for more than 2 years, and individuals with previous chronic pain were more likely to have chronic postoperative pain.	Level V

Quality of life was assessed using the European Quality of Life Scale (EQ5D), Oswestry Disability Questionnaire, Pediatric Quality of life inventory 4.0 (PedsQL), Item Short Form Survey (SF-36), and Health Assessment Questionnaire (HAQ).

Psycho-emotional changes were also assessed using the Beck Depression Inventory, the Anxiety Sensitivity Index-3 (ASI-3), and the Hospital Anxiety and Depression Scale.

Sixteen studies were classified as level V of evidence, due to the type of study, but were included in the review due to the size of their samples and because they were carried out by renowned institutions.

Four studies were classified as level II of evidence, according to evidence-based practice; these are randomized controlled clinical trials where only one study had a low number of participants (62 individuals) as a sample, and the other three presented population demographic samples varying between 3302 and 475,171 individuals.

Three studies were classified as evidence level I, according to evidence-based practice, being systematic reviews and meta-analyses, both with a robust number of analyzed studies, following all the required criteria for reducing the risk of bias and data stratification.

Discussion

Despite the high relevance of the subject in the literature, there are still few studies with a high level of scientific evidence, which address the impact of pain in individuals with cardiovascular disease, but primary studies have shown a direct correlation between the two pathologies, being associated with clinical worsening of these individuals, highlighting the importance of a better approach to Pain [44-64].

Most of the analyzed studies are of the observational type carried out through questionnaires, where a direct correlation was observed with the increased risk of developing cardiovascular disease in individuals with chronic pain, a direct relationship between the intensity of the pain and the severity of the cardiovascular symptoms, and individuals with cardiovascular disease who did not present with pain showed a better prognosis [45-47,49,51,53-56,58-61,62-64].

Pain assessment was performed using self-administered questionnaires validated by the literature, more objective assessment methods can be used for more accurate measurement and better understanding of the impact of pain on these individuals.

Pain was also a potential factor for worsening functional

capacity, the literature also shows the same correlation in individuals with chronic low back pain and in the elderly, with chronic pain being responsible for the loss of functional capacity. Regardless of other comorbidities such as obesity, diabetes, and physical inactivity [50,54,68,69].

Pain can directly impact the rehabilitation of these individuals, one study observed a 27% incidence of musculoskeletal pain in individuals who were undergoing cardiac rehabilitation, and the other also evaluated what type of treatment was performed, only 5% performed specific treatment for pain, and the vast majority performed only drug treatment [49,52].

The literature is very consistent in not using only pharmacological treatments in individuals with chronic pain, the recommendation is that a multidisciplinary treatment be performed [12,13,16,18,21,24,31-34,41,42].

Among the outcomes analyzed in the study, we can highlight the reduced quality of life in individuals with pain, when compared to individuals without pain [49,50,54,55,60,62].

It is known that pain can negatively influence the quality of life, generating a vicious cycle that predisposes the individual to chronic pain, promoting a loss of cardiorespiratory fitness and increased mortality [67].

The practice of physical activities is essential for a good prognosis of both pathologies, and the practice of physical exercises is an important rehabilitation tool, but we must consider the complexity of performing exercises in individuals with chronic pain and cardiovascular disease [4].

Current guidelines for cardiac rehabilitation show exercise programs, but do not address recommendations for the specific treatment of pain, in a meta-analysis published in the scientific database Cochrane Library, the authors observed a lower adherence to the practice of exercises in individuals with pain, which makes rehabilitation difficult cardiac as well as worsening of the clinical picture of pain [4,65].

Other factors that were observed in this study were pain as a potential factor for the clinical worsening of these individuals, which can increase heart rate, blood pressure, high levels of anxiety, and changes in the autonomic nervous system, which makes it difficult to practice exercises, increasing the risk for adverse events [9,61,62].

Low back pain is a frequent cause of pain, and exerts a dose-response mechanism in individuals with cardiovascular disease, altering the homeostasis of the sympathetic nervous system, and promoting excitability of the sympathetic nervous system [62].

This study observed a relatively larger number of individuals with chronic pain, but it should be noted that one study demonstrated that after a two-year follow-up, 10.5% of individuals who had postoperative pain due to heart surgery had persistent pain and worsens quality of life when compared to individuals who did not develop postoperative pain, postoperative pain presents itself acutely where the treatment must be inserted at the beginning of the symptoms, avoiding the chronicity of the pain [64].

Final considerations for pain management

A literature review recently analyzed the effectiveness of physical exercise in individuals with chronic pain, noting that this treatment modality is effective, but it must be part of a multimodal rehabilitation protocol and applied individually respecting the limitations of each individual [12].

We must take into account a global assessment, not only the cardiorespiratory and musculoskeletal systems, but evaluating and optimizing the sensorimotor system, and its ability to cope with pain as well as fear and movement avoidance [12].

It is common for individuals with chronic pain to present movement disorders, with changes in motor control, which may be a potential factor for the clinical worsening of pain when performing exercises, among other factors that are associated with cognitive and behavioral changes caused by chronic pain [66].

In order to obtain better results, we suggest the use of therapeutic strategies and resources such as manual therapy, for example, to reduce pain and kinesiophobia, improve tissue distensibility, associated with motor control exercises, optimizing the improvement of movement. We used this treatment model where we found a good level of evidence in the literature in two reviews that we published recently, and it is possible to observe good results in clinical practice [70,71].

After the improvement of pain and acceptance of movement, rehabilitation should be carried out actively through patient education, seeking to increase their body perception and adherence to movement, introducing a program of physical activities to improve physical conditioning, injury prevention, and change in lifestyle [70,71].

Study limitations

We used only one research base to carry out the study, new studies should be carried out with a more comprehensive search in the literature.

Conclusion

Pain is a common pathology among individuals with Cardiovascular Disease, decreasing functional capacity, adherence to treatment and triggering changes in the autonomic nervous system, which can negatively impact cardiac rehabilitation.

New studies addressing pain treatment in this specific population should be carried out, with the aim of introducing specific pain treatments in cardiac rehabilitation guidelines.

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