

## EFFECTIVENESS OF PHYSIOTHERAPY IN REVERSAL OF COMPLICATIONS ON MYOCARDIAL REVASCULARIZATION

*Eficácia da Fisioterapia na Reversão das Complicações na Revascularização do Miocárdio*

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**Abstract:** Coronary diseases are related as the main causes of death worldwide, requiring surgical intervention when there are no more efficient resources for regression of arterial obstructions. Myocardial revascularization surgery can trigger numerous complications in the postoperative period, among them: a decrease in respiratory muscle strength, a decrease in thoracic complacency and consequent impairment of pulmonary volumes and capacities. Unfitness and loss of physical fitness can also be found in most cases. Therefore, this study aimed to verify the effectiveness of physical therapy in the resolution of complications in the postoperative period of myocardial revascularization. It was observed that physiotherapy is effective in the resolution of the mentioned disorders, and should be started during the hospital phase, being extended after discharge.

**Keywords:** Myocardial Revascularization; Rehabilitation; Physiotherapy.

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**Resumo:** as doenças coronarianas estão relacionadas como as principais causas de óbito em todo mundo, sendo necessária intervenção cirúrgica quando não há mais recursos eficientes para regressão das obstruções arteriais. A cirurgia de revascularização do miocárdio pode desencadear inúmeras complicações no período pós-operatório, dentre elas: diminuição da força da musculatura respiratória, decréscimo na complacência torácica com consequente prejuízo aos volumes e capacidades pulmonares. A inaptidão e perda do condicionamento físico também podem ser encontrados na maioria dos casos. Diante disso, este estudo teve como objetivo verificar a eficácia da fisioterapia na resolução das complicações no pós-operatório de revascularização do miocárdio. Foi observado que a fisioterapia é eficaz na resolução das desordens citadas, devendo ser iniciada ainda na fase hospitalar, sendo estendendo-se após a alta.

**Palavras-chave:** Revascularização Miocárdica; Reabilitação; Fisioterapia.

## INTRODUCTION

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Myocardial revascularization surgery (CABG) is performed more than thirty years, it is characterized by sternotomy (incision in the chest wall that exposes the lungs and heart to the external environment)<sup>1</sup>. Cardiopulmonary function is replaced by extracorporeal circulation, performed by a machine that acts by pumping and oxygenating the blood with pressure and temperature ideal to continue body metabolism<sup>2</sup>.

The major causes of myocardial revascularization are coronary arteries, which according to the World Health Organization are the second largest cause of death in the world today, second only to stroke<sup>2</sup>.

The most common etiologic agents of coronary disease include obesity, stress, smoking, high blood pressure and, in particular, sedentary lifestyle. These factors are usually associated with poor eating habits, such as uncontrolled fat intake, which, together with these percussors, can lead to the formation of fat plaques on the vessel walls, called atheroma plaques<sup>3</sup>.

Studies show that coronary heart disease will continue to be the leading cause of mortality in the world in the first decades of the 21st century. In Brazil, cardiovascular diseases account for about 30% of all deaths, with acute myocardial infarction being its main cause<sup>3</sup>.

The extracorporeal circulation used in cardiac surgery may lead to some complications, such as the systemic inflammatory reaction, since the contact of blood on a non-endothelial surface triggers the activation of immunological components and the release of biochemical mediators<sup>4</sup>.

Other complications may also arise, such as

those associated with sternotomy, which interfere with the stability and compliance of the chest wall, since there is a decrease in the blood supply to the intercostal muscles, reducing the strength of the respiratory muscles with a corresponding decrease in pulmonary volumes<sup>4,5</sup>.

Some of these factors, predisposing to postoperative complications, can be minimized by adequate evaluation and preoperative management, including the use of respiratory physiotherapy, bronchodilators, treatment of heart failure and smoking cessation when present<sup>1</sup>.

Physiotherapy should be started in the preoperative period in order to evaluate and guide patients. Physiotherapy management in cardiac surgery includes the evaluation, education of procedures that will be used, their relationship with respiratory capacity, and the risk of postoperative complications<sup>5</sup>.

The purpose of this study was to verify the efficacy of physiotherapy in the recovery of cardiopulmonary function after myocardial revascularization surgery.

## METHODOLOGY

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This study consisted of a systematic review of the literature, in which the efficacy of physical therapy in the recovery of cardiopulmonary function after myocardial revascularization surgery was verified.

The research was carried out in the electronic databases: MedLine, LILACS, CINAHL, Cochrane, High Wire Press and SciELO, being accepted articles in Portuguese and English, with period of publication between 2002 and 2011. The present study also consulted books that cover The

respective theme. This study occurred between July and September of 2014.

## LITERATURE REVIEW

When we talk about pulmonary repercussions due to the VRM, it is essential to mention the pressure gradients involved in the ventilation, namely: Transrespiratory Gradient (Prs), Transpulmonary Gradient (Pp) and Transthoracic Gradient (Pw). The Prs is the result of the difference between the alveolar pressure (Palv) and the pressure in the opening mouth (Pao) - usually in resting conditions equal to 0cmH<sub>2</sub>O. This gradient causes the gas to flow into and out of the lungs<sup>6</sup>.

However, the transpulmonary gradient maintains the degree of alveolar insufflation, alterations of this gradient during respiration lead to corresponding changes in the alveolar volume. It is expressed by the equation:  $Pp = Palv - Ppl$ , where Ppl refers to pleural pressure, which under resting conditions equals -5cmH<sub>2</sub>O<sup>6</sup>.

The last gradient, transthoracic, is represented by the difference between pleural pressure and body surface (Psc). This gradient denotes the total pressure required to expand or contract together the lungs and rib cage<sup>6</sup>.

According to the study carried out by Renault et. al, patients submitted to RVMR develop mostly pulmonary dysfunction, with a significant reduction in lung volumes, respiratory mechanic damage, decreased pulmonary compliance and increased respiratory work. Reduction of lung volumes and capacities contribute to changes in gas exchange, resulting in hypoxemia and decreased capacity and diffusion. According to the author, the restrictive picture may last for more than 116 days<sup>7</sup>.

Physiotherapy is part of the multidisciplinary care offered to patients in an intensive care unit. Its extensive performance is present in several stages of

intensive care, mainly in post-surgical recovery, in order to avoid respiratory and motor complications.

A study conducted in 2010 by Barros et. al. Had as objective to verify the influence of respiratory muscle training on the recovery of pulmonary function in individuals submitted to myocardial revascularization. Thirty-eight people participated in the study, being divided into two groups, one group that underwent conventional physiotherapy plus respiratory muscle training (TMR), and the other group only performed conventional physiotherapy. The authors observed a greater increase in inspiratory (Pimáx) and expiratory pressure (Pemáx) and, at the peak of expiratory flow (PEF) in the group that performed conventional physiotherapy plus MTR. The authors conclude that the association of conventional physiotherapy and respiratory muscle training is more effective in restoring the parameters evaluated. The muscular training was performed with a linear loader (Treshold)<sup>8</sup>.

The work of Ferreira et. al., Corroborates the findings elucidated previously. In this study, thirty individuals awaiting myocardial revascularization and / or cardiac valve surgery underwent a preoperative home-based training program for inspiratory muscle training using a linear load device. The authors concluded that inspiratory muscle training is safe and improves forced vital capacity and maximal voluntary ventilation<sup>9</sup>.

Leguisamo et al. Proposed in a study with eighty-six individuals undergoing CABG, to verify the effectiveness of a preoperative physiotherapeutic orientation program in relation to the reduction of hospitalization time, prevention of pulmonary radiological complications, pulmonary volume changes And inspiratory muscle strength. For this, the intervention group (44 individuals) was evaluated and received physiotherapeutic guidance at least 15 days before the surgical procedure, whereas the control group received only routine

care on the day of hospital admission. Thus, at the end of the study, they reported that preoperative patients will be better prepared to cooperate with postoperative treatment and may also reduce hospital stay<sup>5</sup>.

Olmos et. al., also confirms the results found in the aforementioned study. He compared the days of hospital stay related to respiratory physiotherapy in the preoperative period of CABG. Fifty-six patients undergoing elective cardiac surgery participated in the study. Participants were assessed for preoperative risk factors and physical therapy, and were divided into groups that received preoperative physiotherapy and counseling and did not undergo physical therapy. The study authors observed a reduction in the number of hospital stay days in the group that received orientation and physiotherapy in the preoperative period when compared to the group that did not receive<sup>10</sup>. The myocardial revascularization surgery is closely related to the occurrence of pain, varying according to the constitutional aspects of the individuals, nature of the operative procedures including the location and type of incision, character and magnitude of the trauma and duration of the surgeries, occurrence of complications, Physiological and psychological characteristics and emotional preparation<sup>13</sup>.

The work of Lima et. al., Aimed to analyze the efficacy of transcutaneous electrical nerve stimulation (TENS) on the painful process and respiratory muscle strength in patients submitted to CRVM. Twenty subjects participated in the study, being divided into two groups, a therapeutic analgesic treatment plus physiotherapy, and no other group was administered analgesic therapy, physical therapy and TENS. The researchers observed that TENS was effective in reducing algic and there was no increase in respiratory muscle forces without

postoperative myocardial revascularization<sup>11</sup>.

Gregorini et. al., Applied TENS in a group of subjects submitted to cardiac surgery. The aim of this study was to evaluate the effectiveness of transcutaneous electrical nerve stimulation of short duration to reduce pain and possible interferences in respiratory muscle strength, volume and lung capacity. The authors concluded that short-duration TENS was effective in reducing pain, improving respiratory muscle strength, lung volume and capacity<sup>12</sup>.

Mechanical and postural alterations also accompany MRVC, since bone and muscle structures are involved in the surgical procedure, with biomechanics of the thorax and adjacent joints being compromised. After major surgeries, pain impairs movement in 82.6% of patients and sleep in 25.5%. Immobilism predisposes to the occurrence of deep venous thrombosis, pressure ulcers, accumulation of secretions, reabsorption and loss of bone and muscle mass<sup>13</sup>.

The negative effects of immobility and exercise-induced stress reduction on multisystem function, giving a special focus to cardiopulmonary and cardiovascular function. An understanding of human physiological function provides the basis for and prescription of preventive exercises. Exercise is a term used to describe the therapeutic and prescriptive application of exercises in the management of cardiopulmonary and cardiovascular dysfunction in subacute and chronic conditions, the aim is to explore the cumulative effects and adaptation to the same in the long term and to improve the function of all stages Of the oxygen transport routes. In addition, mobilization and exercise may be prescribed because of their preventive effects<sup>14</sup>. The cardiopulmonary unit maintains oxygen transport and cellular respiration.

Oxygen is continuously used by every cell in the body for oxidative phosphorylation and synthesis of adenosine triphosphate (ATP). The heart and peripheral circulation improve its function and may respond to the increased demand produced by the acute effects of exercise<sup>15</sup>.

The fact that the absence of gravitational stress and the stress produced by exercise are the two primary factors that contribute to deconditioning from bed rest provide the basis for prescription of gravitational stress and exercise to minimize cardiopulmonary dysfunction. These measures are the two major interventions available to the physiotherapist to manage cardiopulmonary dysfunction<sup>15</sup>.

After cardiac transplantation, patients improve their quality of life, but frequently present postoperative clinical problems, such as physical deconditioning, atrophy and muscle weakness, and lower maximal aerobic capacity, due in part to preoperative inactivity and factors such as Body surface donor / recipient, heart deprivation, among others<sup>16</sup>.

Motor physical therapy has great significance for the development of respiratory capacity, trying to avoid atelectasis in lower lung areas and being important in the prevention of venous vascular processes, particularly thromboembolism and thrombophlebitis, among others, mainly by venous changes in the lower limb. Early mobilization reduces the damaging effects of bed rest and maximizes the speed at which habitual activities can be resumed<sup>17</sup>.

Currently, new therapeutic techniques allow the majority of patients to be discharged early after myocardial infarction and revascularization without loss of functional capacity. In recent years, numerous benefits of regular exercise for patients with cardiopathy have been described, as well as improvement in functional capacity<sup>18</sup>.

Physiotherapeutic treatments in the hospital phase are based on simple procedures, such as metabolic exercises of extremities, to reduce edema and increase circulation; Effective coughing techniques to eliminate respiratory obstructions and keep the lungs clean; Active exercises to maintain the range of motion and mechanical elasticity of the muscles involved; Treadmill training, and other activities, since the early mobilization of patients after cardiac surgery demonstrates to reduce the detrimental effects of prolonged bed rest, increases patient self-confidence, and decreases hospital cost and stay<sup>19</sup>.

Physiotherapy has been considered a fundamental component in the rehabilitation of cardiovascular surgical patients with the purpose of improving cardiovascular conditioning and avoiding thromboembolic occurrences and analgic postures, offering greater physical independence and safety for hospital discharge and subsequent recovery of daily life activities<sup>19</sup>.

## CONCLUSION

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Elucidated techniques and exercises facilitate a better control and execution of diaphragmatic breathing, better mobility of the chest wall and accessory muscles, symmetry of the respiratory pattern and reduction of high respiratory rates. However, not all techniques are indicated for all patients. It is up to the physiotherapist to determine which procedures should be indicated for the deficits presented by each individual.

With this, it can be concluded that physiotherapy is effective in the resolution of cardiopulmonary impairment involved in the postoperative period of myocardial revascularization surgery. In view of the above, it was also possible to observe that the techniques used by respiratory

and motor physiotherapy vary according to the countries and the practice of each service.

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