

Pediatric cardiac surgery: what to expect from physiotherapeutic intervention?

Cirurgia cardíaca pediátrica: o que esperar da intervenção fisioterapêutica?

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Abstract

This study aims to gather and present scientific evidence on the role of a physiotherapist in the pre, peri and postoperative of pediatric cardiac surgery. This professional is able to prevent, minimize or reverse possible respiratory dysfunction and motor sequelae resulting from these interventions. Studies discuss the involvement of respiratory system, specifically the clearance of bronchial secretions and ventilatory adequacy, as a result of surgical procedure. Scientific evidences suggest the effectiveness of physiotherapy in reducing indices of: pneumonia, atelectasis, hospitalization, sequelae deleterious, and length of bed restriction, beyond clinical improvement. These data confirm positive contribution of physiotherapeutic intervention in these surgeries.

Descriptors: Physical Therapy Modalities. Cardiac Surgical Procedures. Heart Defects, Congenital.

Resumo

O objetivo deste estudo é reunir e apresentar evidências científicas sobre a atuação do fisioterapeuta nos períodos pré, peri e pós-operatório da cirurgia cardíaca pediátrica. Esse profissional está habilitado a prevenir, minimizar e reverter possíveis disfunções respiratórias e sequelas motoras decorrentes dessas intervenções. Estudos discutem o comprometimento do sistema respiratório, especificamente do clearance de secreção brônquica e da adequação ventilatória, resultantes do procedimento cirúrgico, havendo evidências científicas quanto à eficácia da fisioterapia na redução: dos índices de pneumonias, atelectasias, período de internação, sequelas deletérias, tempo de restrição ao leito, além da melhora clínica. Esses dados atestam a contribuição positiva da intervenção fisioterapêutica nessas cirurgias.

Descritores: Modalidades de Fisioterapia. Procedimentos Cirúrgicos Cardíacos. Cardiopatias Congênitas.

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INTRODUCTION

Heart diseases are among the most common congenital defects at birth and affect 80 to 10 children per 1,000 live births. It is estimated that every year in Brazil, there is the appearance of approximately 28 000 new cases of heart diseases, which are needed for the same period, an estimated 23,000 surgical procedures to repair congenital defects only [1]. Records show that 50% of cases require further surgery in the 1st year of life [2-4]. Tetralogy of Fallot, pulmonary valve stenosis, transposition of great vessels or of the great arteries (TGA), patent ductus arteriosus (PDA), aortic coarctation and interauricular (IAC) or interventricular communication (IVC) are among the most common need corrections [5,6].

The most common causes of morbidity and mortality in cardiac surgery in adults are the pulmonary complications that occur with wide variation of incidence: 6% -76% [7]. Data on the incidence in the pediatric population remain undefined. It is known that, the earlier the surgery, the smaller the physical and psychological consequences for the child [8].

Currently, pediatric cardiac surgery has a universe of its own. This involves the integration of clinical data, recent technological advances and development of new surgical techniques. Thus, they are increasingly effective results and generate less aggression to the child [3,9].

In this context, the physiotherapist has been requested in the multidisciplinary team of some health services, in pre-, peri- and postoperatively to improve the patient's condition, prevent and recover from pulmonary complications, assist in social rehabilitation, decrease the deleterious effects from surgery and strict bed rest [8,10]. Specifically, these studies point to benefits such as improved oxygenation, maintenance of satisfactory conditions of ventilation and maintenance of patent airway [3,11]. There is also a trend towards improvement in expiratory tidal volume, lung compliance and resistance [12]. Still, there are indications that the role of the physiotherapist in patients undergoing cardiac surgery reduces the staying time of the intensive care unit (ICU), assists in ambulation as early as possible [5] and reduces hospital stay [13-15].

Given this reality of care, this study aims to gather scientific evidence on the role of the physiotherapist in the pre-, peri- and postoperative period of cardiac surgery in children.

SOURCES

Were performed systematic searches using the following

databases: LILACS, MEDLINE, SciELO, CAPES portal, PubMed and BIREME. The descriptors used to search for articles, according to the Health Sciences Descriptors (DeCS), were "physiotherapy", "postoperative", "heart surgery" and "children", besides the respective terms in the English language "physical therapy" "postoperative", "thoracic surgery" and "children". It was also consulted the bibliographic collection of the State University of Santa Catarina (UDESC) and the Center for Studies of Respiratory Therapy (CEFIR), available online.

Among the publications, there were selected those in Portuguese and English that included literature reviews, treatment and clinical trials of the pre-, peri- and/or postoperative of pediatric cardiac surgery. Were considered relevant and added to the review the records published between 1956 and 2010, or not directly related to physiotherapy, but those that could contribute to the objective of the study.

DISCUSSION

Determine and choose the appropriate physiotherapy intervention to pediatric patients, whether in pre-, peri- or postoperative, requires from the physiotherapist knowledge of the pathophysiology of heart disease in question, and clear understanding of anatomy, the type of surgery, restorative or palliative, and the patient's clinical condition. Based on knowledge and analysis of this information, the physiotherapist can provide more effective approaches [16-18].

It contains some major surgery peculiarities to be considered while handling physiotherapy. One example is a possible evolution of pulmonary hypertension, resulting from the adaptation of pulmonary flow postoperatively, a situation that restricts sudden maneuvers of physiotherapy [4,8,16,19-21].

Another situation is palliative surgical procedures indicated in cyanotic congenital heart disease, such as Glenn correction, considered preparatory to the pediatric technique that currently has most changed the Fontan operation. In such cases, attention should be paid to patient positioning, which must be at least 45 degrees of elevation, and avoid an increase in pulmonary vascular resistance with maintenance of PEEP (positive end expiratory pressure) low (up to 5 cmH₂O) [4,8,16,19-21].

It is evident that the different surgeries, corrective or palliative, present risks from the intervention itself and the condition of each patient, resulting in a high number of variables to be considered for a successful action. There have been efforts in the search for methods of evaluating the quality of cardiac surgery, risk scores, which use enables

comparisons between different services, which allow to infer the prognosis and assist in clinical decision making. Given this context, risk scores adjusted for pediatric surgical procedures have been proposed, despite the wide range of birth defects make it difficult to standardize.

Along these lines, one trial assessed in the pediatric population of a public hospital in the northeast, the applicability of a risk score of mortality adjusted for surgery for congenital heart defects (RACHS-1). We used the RACHS-1 score to classify the surgical procedures in risk categories 1 to 6 and it was performed logistic regression analysis to identify risk factors associated with mortality. As factors were identified: age, type of heart disease, pulmonary flow, type of surgery, duration of cardiopulmonary bypass (CPB) and time of anoxia. There was linear correlation between the categories of the RACHS-1 and the mortality rate, however, mortality was greater than that predicted by the scoring system, suggesting that although there is ease of application of RACHS-1, this should not be applied to Brazilian reality, because it does not include other variables present in our country. The authors concluded that it was important to create risk models adapted to Brazil [22].

CARDIAC SURGERY PREOPERATIVE (CSPR)

In the pre-operative cardiac surgery (CSPO), the role of the physiotherapist is intended to ensure a patent airway and adequate ventilation, because the child with heart disease with surgical indication may present hypersecretion and atelectasis [5,10]. Another important approach is education, which is to guide the parents about the importance of physiotherapy for the prevention and rapid restoration of respiratory function in children [23,24].

Vibration, tapping, manual chest pressure, suction of the airways, coughing and postural drainage are conventional bronchial hygiene maneuvers available between the resources that can be used. Other possibilities are the technique of expiratory flow increase (EFI), the active cycle of breathing, forced expiration technique as well as encouraging inspiratory exercises and non-invasive ventilation (NIV) [8,10,23]. It is noted that although the combined use of postural drainage and percussion is usual in clinical practice, there are still few comparative studies emphasizing that, especially in heart diseases. Thus, there is the relevance of future research to evaluate such clearance techniques [25] that, in addition to routinely used, are geared to parents for home treatment of their children.

As the guidance is an effective practice for physiotherapy, Garbossa et al. [26] found the effects of physiotherapy guidelines on the level of anxiety in adults

undergoing coronary artery bypass grafting. This is a randomized clinical trial with 51 adults divided into control and intervention groups. The levels of anxiety and pain were assessed pre- and postoperatively, and only the intervention group received guidance on surgical procedures and instructions on exercise ventilation. We observed lower anxiety scores in patients who were counseled preoperatively. It is suggested performance of clinical trials with similar purpose and method, because in pediatric patients similar studies have not been found.

There are also few prospective clinical trials to assess the pulmonary complications in children undergoing cardiac surgery, as well as the effects of physiotherapy in the preoperative and postoperative period, regarding prevention of these complications [23,27]. Likewise, few studies have evaluated the incidence of pulmonary complications after heart surgery in adults [23,28-29].

The study by Felcar et al. [23] showed that preoperative physiotherapy associated with post-surgical physiotherapy decreases the frequency and risk of postoperative pulmonary complications in children with heart disease, compared to the intervention performed only after surgery. This study followed 135 children up to 6 years old who underwent surgery for various congenital heart diseases, divided into two groups: one submitted to pre- and postoperative physiotherapy and the other group only postoperatively. The presence of pulmonary complications, especially pneumonia, associated with other complications, such as length of hospital stay was significantly higher in the group who received preoperative physiotherapy.

There are published reports that corroborate this finding and the indication for physiotherapy in pre- and postoperatively, based on reducing the length of hospital stay and stay in the ICU [13-15].

Garcia & Piva [24] affirmed that the management of children with heart disease should be global in all periods related to cardiac surgery. The process of inclusion of physiotherapy during CSPR has gained space, although the effectiveness of this activity still needs clear-cut research.

CARDIAC SURGERY IMMEDIATE POSTOPERATIVE (CCIPO)

The patient's condition in the immediate postoperative period of cardiac surgeries (CCIPO) depends on three factors: 1) diagnosed heart disease, 2) presence of malformations associated with the cardiac presentation and 3) surgical procedure, which involves the duration of surgery, and anesthetic drugs used, duration of aortic occlusion and CPB, the volume of diuresis output during

surgery and received blood and blood products, and perioperative complications [10,11].

Support physiotherapy starts on the child's arrival to the ICU. The professional will collaborate with the team to adjust the positioning of the patient in bed and ensure proper location of vascular access, drainage and tracheal cannula, known the risk of displacement during transport from the operating room [10,11].

Subsequently, it is recommended to perform physiotherapy assessment in CCIPO, which includes: inspection of the chest wall expansion, lung auscultation, chest X-ray analysis, interpretation of arterial blood gases associated with the assessment of the severity of clinical presentation and discussion with ICU staff, verification of ventilatory support, measurement of oxygen saturation (S_pO_2) monitoring and other vital signs [10,11].

In most cases, children undergoing heart surgery are transported to the ICU intubated. It is known that weaning should be a priority, rapid and the extubation should be performed as soon as possible. Usually, the first six hours, after the anesthetic effect and after careful clinical and laboratory evaluation, patients are extubated. This practice reduces the chances of pneumonia and hypertrophy of the diaphragm and increased morbidity and mortality [4]. Simplest cases, of low surgical risk may have even earlier extubation.

Ventilatory support is necessary, often in cases where there is associated respiratory disease, especially pneumonia and bronchiolitis, and cardiogenic pulmonary edema, respiratory system depression by sedation, laryngeal edema, and especially in the presence of pulmonary hypertension [30]. With an indication of support, children are initially placed in controlled ventilation with the parameters adjusted to the respiratory rate for age and interpretation of arterial blood gases. Fraction of inspired oxygen (FiO_2) indicated is that sufficient to maintain the partial pressure of oxygen (PaO_2) between 80-90 mmHg, S_pO_2 above 90%, the lowest possible inspiratory pressure to maintain the partial pressure of carbon dioxide (P_aCO_2) between 35-45 mmHg and maintaining positive end expiratory pressure of 3-4 mmHg to avoid microatelectasis [10,11,30].

A successful surgery can be determined by the adequacy of ventilatory parameters and oxygen, which depend on the hemodynamics of each variety of congenital heart disease. Specifications of respiratory parameters include maintaining low peak inspiratory pressure, short inspiratory time, tidal volume of up to 7 ml/kg/weight and have great relevance to patient outcomes. The appropriate ventilatory management, as well as patient positioning, help to reduce the maximum intrathoracic pressure and venous stasis of

trunk and upper limbs, which facilitates the drainage of blood in the lungs [4,8,16,19-21].

In a study by Freire Sobrinho [3], from the total number of patients in CCIPO, 83% (323) were extubated in the operating room due to intensive physiotherapy support. Only 0.6% of patients (two) required reintubation due to depression of respiratory function. In this research, physiotherapy maneuvers were used for chest expansion and antalgic posture correction, aiming to preserve a satisfactory pulmonary ventilation and maintain a patent airway.

Because pain is a common condition, especially postoperatively, it can be avoided antalgic posture through exercises with the upper limbs associated with breathing and also one should proceed with guidelines on proper positioning in bed [10]. In addition to respiratory dysfunction of the child, other complications are described in CCIPO such as low cardiac output syndrome, characterized by sweating, signs of psychomotor agitation, cold extremities, pale lips, filiform or absent peripheral pulses, hypotension and oliguria. The physiotherapist should be aware of these signals [11].

CARDIAC SURGERY POSTOPERATIVE (CCPO)

The bleeding in the CCPO is indicated by Silveira et al. [31] as the most serious situation in patients with complicated evolution. Along these lines, we studied 17 children in the CCPR, in CCIPO, at 1st and between 4th and 7th day of CCPO. In this sample, four children showed dysfunction of multiple organs and systems, including hematologic dysfunction, with a mortality of 17.6%. The earliest death, 16 hours of CCPO, occurred with the child who spent more time on CPB, estimated at 130 minutes. The other two children who died also had a long time on CPB, corresponding to more than 105 minutes.

These findings corroborate the literature that the longer infusion time in CPB, further trauma to the cellular elements. It should be noted that the six patients who bled excessively, all showed alterations in at least one of the tests performed preoperatively, as follows: count prothrombin time, changed partial thromboplastin time and platelet count, in addition to be patients with the highest infusion time [31].

The thrombocytopenia and qualitative platelet changes are considered the main causes of bleeding in the CCPO. There is evidence that children with a disorder of hemostasis in CCPR more likely to have bleeding when undergoing surgery with CPB [31].

The function of the respiratory system is undoubtedly affected during and after cardiac surgery, mainly due to the

pain. The change of mechanical ventilation from the surgical incision, a situation found after sternotomy and the own anatomy and physiology resulting from the procedure, lead to decreased lung compliance in CCPO. In this situation, we recognize the importance of physiotherapy to restore function and prevent respiratory complications [32].

The sternotomy is perhaps one of the factors that are most associated with the loss of lung function in CCPO. Some authors attribute the pulmonary and hypoventilation due to pain along the sternum to reduce the movement of the chest wall and abdomen post-sternotomy [33]. There are few studies assessing the impairment of lung function after cardiac surgery in children. Caséca et al. [32] showed that all pulmonary function parameters evaluated in the CCPO remained significantly deteriorated until five days after the intervention. Only minute ventilation (MV) returned to levels comparable to the preoperative from the 4th day of CCPO.

In addition to the sternotomy, thoracotomy is the other commonly used incision in cardiac surgery. Access by lateral thoracotomy, performed in surgeries such as IAC, IVC and TGA, for example, presents specific features and affects the lung function, which requires specific care. This incision should be preferred because it is less invasive, resulting in better cosmetic results, minimizes chances of heart damage and postoperative pulmonary complications. Moreover, it preserves the integrity of the chest cavity to provide good exposure of the operative area without an incision is performed as large as the sternotomy.

For these factors, lower infection rates, lower rates of bleeding and early postoperative are attributed to thoracotomy. It is considered that, in children, this approach does not impact or change in the development of the chest, the pectoral muscle and breast tissue, maintaining the continuity and integrity of the bony part of the chest. It would be a surgical option to prevent the installation of the deformity called pigeon breast [34-38].

Also due to the incision, the pain complaints during the postoperative are common. Researchers assessed the location and intensity of pain in adult patients undergoing cardiac surgery by sternotomy performed during the hospitalization period, and the influence of type of incision in lung function. There was significant impairment of lung function of individuals and, despite the findings, the pain did not correlate significantly with individual characteristics and the surgical procedure [39]. There were no similar studies involving children, which would be relevant and valid for a better management of the physiotherapist during the postoperative in pediatrics.

Because of the pain and changes in the biomechanics of breathing muscles after surgery, patients adopt apical

and surface breath. This leads to decrease in vital capacity and functional residual capacity, which leads to retention of secretions and atelectasis, which agreed that the ventilatory impairment is a loss of pulmonary function of greater impact [7,40,41]. It is directly associated with the type of surgical incision and the degree of cardiopulmonary compromise in the perioperative period and in the CCPO.

Atelectasis is the most common complication resulting from hypoventilation; it corresponds to 80% of pulmonary complications identified in cardiovascular surgery [42]. Its incidence is attributed to the use of anesthetics, narcotic drugs and stop ventilation during CPB. It is also associated with other factors, such as pain, hypersecretion before surgery, decreased ciliary function, limiting the inspiratory effort, ineffective cough reflex and other events that promote the accumulation of pulmonary secretions [10.42-44]. Atelectasis is attributed to the CCPO as a result of the cephalic displacement of the diaphragm caused by anesthetic drugs, compression of the lungs by mediastinal structures, inadequate intubation, inactivity of the lungs during CPB and inflammatory reactions caused by this and the surgical pleural management [10.43].

The procedures of physiotherapy to reverse atelectasis involve changes in position, PEEP and other therapies [11.45], and PEEP has been used successfully, alone or associated with alveolar recruitment maneuvers and techniques of mucociliary clearance [46]. Another resource introduced by Silva et al. [42] is hypertonic saline solution and sodium chloride at 6%. Inhalation of this solution immediately before and after physiotherapy for three days in a child, caused crises of productive cough and sputum induction, with subsequent complete resolution of atelectasis in the CCPO.

To prevent atelectasis and other complications during the CCPO, the physiotherapist guides the patient on the proper positioning in bed, ways to avoid antalgic postures, and exercises with upper limbs associated with breathing and active cycle of breathing [8.10, 23,45,46]. Breathing exercises improve breathing efficiency, increase the diameter of the airways and contribute to dislodge secretions. They also prevent alveolar collapse, and facilitate lung expansion and clearance of the peripheral airways [12].

João & Faria Jr. [11] reported that respiratory physiotherapy started in the first days after arrival in the ICU contributes to maintaining adequate ventilation and acts effectively in the prevention of atelectasis, which culminates with successful extubation.

After the extubation, physiotherapy may be indicated several times a day for a few days to promote bronchial clearance. In infants, during the CCPO, just a small amount of mucus may block much of the lung. In this situation, a

therapeutic alternative in the management of the child is the application of bronchial hygiene techniques, such as tapping and gentle vibrations, with the child in the lateral position. Indicated for the aspiration, the physiotherapist must be alert to any change in the presentation and the patient's condition [5]. In the episodes of child's coughing, the physiotherapist should help for fixing and support on the site of surgical incision, which can be performed using hands or a soft baffle (doll), since the support of the rib cage provides the security needed to carry the child to cough effectively. The professional may need to trigger a cough, applying gentle pressure in the trachea [5].

A clearance technique that has gained ground in the pediatric and neonatal ICU is the EFI, defined as increased active, active-assisted, or passive expiratory flow in order to raise, move and delete the tracheobronchial secretions [47]. The maintenance of bronchial hygiene is the focus of the physiotherapist in CCPO, because it prevents the collapse of terminal airways by mucous plugs, which prevents the increase in respiratory activity and, consequently, the cardiac work [23].

Studies have compared the effectiveness of bronchial hygiene. Main et al. [12] compared the effect of isolated aspiration with physiotherapy clearance techniques: manual vibration, percussion, compression, manual hyperinflation and postural drainage positioning. The sample consisted of 83 subjects, infants or children with respiratory or heart disease, mechanical ventilation, whose average age was 9 months. The expiratory tidal volume, lung compliance and resistance were assessed 15 minutes before treatment and after 30 minutes, and this monitoring was extended for an additional 60 minutes in the cases where there was no need for clinical intervention. The authors found that the application of physiotherapy techniques tended to improve expiratory tidal volume, lung compliance and resistance.

It is not a rule that every child in CCPO will present hypersecretion, however it is necessary that the physiotherapist regularly evaluates the status of the patient, because pulmonary complications can be installed quickly. Importantly, the child can leave his bed shortly after surgery and may be discharged after about a week, with orders to continue the breathing exercises. However, some children need to be encouraged to move about and undertake to return to their normal activities of daily living [5].

Research has attempted to explain the causes of pulmonary dysfunction as a main consequence of the thoracic and cardiac surgery, but the factors responsible for these changes require further elucidation [42-44]. Anyway, the role of physiotherapy has acquired credibility and autonomy in the CCPO, regardless of the postoperative

day, but linked to the clinical presentation of the child [48].

The clinical and demographic characteristics of children undergoing cardiac surgery, as well as the prevalence of pulmonary complications, were studied by Borges et al. [48]. The sample of 37 children came from the university hospital of Maranhão, with a predominance of girls and diseases that are considered low risk, with emphasis on the PDA, IVC and IAC. Most children made use of CPB for more than 30 minutes, suffered a median sternotomy, using only the mediastinal drain and made use of invasive mechanical ventilation postoperatively. Only three (8.1%) participants had pulmonary complications, of which two died. The authors attributed the low rate of pulmonary complications as a result of low staying in CPB and ventilatory support, and the composition of the sample being of children with congenital heart disease at low risk.

It would valid the realization of a similar study with children with serious heart disease to determine the incidence of pulmonary complications in this group. Similarly, foster research in physiotherapy interventions with pre-, peri- and postoperatively would allow the assessment of the effects of this therapy on pulmonary complications.

This type of analysis was performed by Renault et al. [49] in adults. The authors compared the effects of deep breathing exercises and incentive spirometry flow in 36 patients undergoing coronary artery bypass grafting, equally divided into two groups according to the type of exercise performed. There were analyzed: forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), maximal respiratory pressures and SpO_2 , and FVC and FEV_1 were measured before and on the seventh postoperative day, and SpO_2 and respiratory pressures in preoperative, first, second and seventh postoperative day. The patients underwent NIV for two periods during the first 24 hours after extubation. In both groups, there decrease in FVC and FEV_1 between the preoperative and the seventh day as well as maximal respiratory pressures and SpO_2 , which re-established until the last day of collection, and significant differences of these data between groups were not observed.

The literature on the subject explained herein did not include pediatric clinical trials that assessed the effects of two different techniques after surgery, so it shows the need for such studies.

Routinely, when hemodynamic and respiratory stability are achieved, the child is transferred to the infirmary, where it should be continued physiotherapy for the prevention and maintenance of the clinical presentation. At this stage, it is important to note the re-establishment and adjustment of motor and psychomotor development of the patient [50].

As this is a later stage, if there is no pulmonary impairment, the behavior of the physiotherapist aims to stimulate the neurological development [10].

The techniques of conventional sensorimotor stimulation are generally well tolerated by children with heart disease. They can be performed in association with recreational resources in group therapy after the application of breathing techniques for each specific case. The chest deformities should be avoided through proper positioning and activities through the stimulation of the upper limbs. In older children, they are not rare the disorders resulting from postural antalgic posture adopted after the surgery. Chest muscles stretching and active exercises are indicated in those patients in the total absence of pain. The correction of postural deviations can be an outpatient indication at a later time [50].

COMPLEMENTARY THERAPIES

The hospital is a stressful environment for the child, added to illness, hospitalization and surgical and invasive procedures. This summation leads to the manifestation of anxiety and pain of an emotional nature, as well as physical pain. In this context, non-conventional therapies have gained ground with the traditional therapy, the latter directed to the control of physical pain, tissue perfusion, cardiac monitoring and rest.

Music therapy is an alternative that promotes health through the patient's relationship with musical experiences. Although its mechanism is not completely understood, it is believed that music stimulates the pineal gland in the release of endorphins, which decreases pain and reduces the release of catecholamines, with consequent reduction in heart rate and blood pressure.

Haten et al. [51] assessed 84 children from 1 to 16 years who underwent 30 minutes of music therapy within the first 24 hours of CCPO. There were measured, at the beginning and end of the session with classical music, the following data: heart rate, blood pressure, mean arterial pressure, respiratory rate, temperature, SpO₂ and facial pain. There was a statistically significant improvement in facial pain, heart rate and respiratory rate in the group receiving music therapy, compared to the group that did not receive, showing the beneficial action of this therapy in these cases.

During hospital stay, including CCIPO, the mother's presence is another factor that contributes to reducing stress and soothes the child's experience, and her participation becomes positive during some medical procedures, nursing and physiotherapy sessions [3.52].

Today, we discuss the evolution through which cardiac

surgery has undergone with relation to improvement in the structure of the ICU and the full range of equipment for monitoring of patients, most prepared team in clinical and surgical timing and multidisciplinary patient care. To this set of factors is attributed a significant improvement in the outcome of cardiac interventions, compared to previous years [11]. The insertion of the physiotherapist in the team with his resources, exercises and techniques as well as complementary therapies, is part of this innovation.

FINAL CONSIDERATIONS

From this review, it is noted that there is a lack of research on the role of physiotherapy in the pre-, peri- and postoperative pediatric cardiac surgery. In the studies published on this subject, there is methodological weakness, a sample not collected in a randomized manner and absence of control group, in addition to the lack of studies in pediatrics. However, the role of physiotherapy has been considered relevant in the rehabilitation of heart disease. In practice, it is up to the physiotherapist to be part of the multidisciplinary teams to work in all phases of pediatric cardiac surgery to improve the prognosis, both to avoid or mitigate the complications to which the child is exposed to or to produce scientific evidences on the outcomes of this performance.

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