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EXERCISE THERAPY FOR PATIENT UNDERGOING CARDIAC SURGERY

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ABSTRACT

Cardiac surgery is very important for the patient, but the situation is very stressful and causes other problems. Exercise therapy is a physical activity plan that is designed and provided to help patients recover from any diseases and conditions that interfere with daily activities or to maintain the welfare of these patients through health education, therapeutic activities, range of motion and gait training. The results of a systematic search were carried out through four data sources on articles that had been published from January 1, 2009 to December 1, 2019. The reporting items used selected reporting items for systematic review. Assessment of study quality used instruments from the Downs and Black checklist. Seven studies were obtained that were eligible for analysis.The form of exercise therapy carried out in the article varies greatly include walking, brisk walking, jogging, cycling, tai chi, calisthenic, thoracic exercises, and respiratory physiotherapy protocol very supportive in the healing process of cardiac surgery patients.

Keywords: cardiac; exercise therapy; surgery

ABSTRAK

Bedah jantung sangat penting bagi pasien, tetapi situasinya sangat menegangkan dan menyebabkan permasalahan lain. Exercise therapy adalah rencana aktivitas fisik yang dirancang dan disediakan untuk membantu pasien pulih dari segala penyakit dan kondisi yang mengganggu aktivitas sehari-hari atau untuk menjaga kesejahteraan pasien tersebut melalui pendidikan kesehatan, aktivitas terapeutik, latihan rentang gerak dan gaya berjalan. Pencarian sistematis dari empat sumber data mengidentifikasi artikel yang telah diterbitkan dari 1 Januari 2009 hingga 1 Desember 2019. Item pelaporan menggunakan item pelaporan pilihan untuk tinjauan sistematis. Kualitas studi dinilai menggunakan instrumen dari Downs dan Black. Namun, hanya tujuh studi yang memenuhi syarat untuk dianalisis. Bentuk terapi latihan yang dilakukan dalam prosedur bedah jantung tersebut sangat bervariasi antara lain jalan kaki, jalan cepat, jogging, bersepeda, tai chi, senam, latihan toraks, dan protokol fisioterapi pernafasan sangat mendukung dalam proses penyembuhan pasien bedah jantung.

Keywords: exercise therapy; jantung; pembedahan

INTRODUCTION

Cardiac surgery as an action to overcome the problem of cardiovascular disease from year to year is increasing both in developed and developing countries (Ramesh et al., 2015). Although cardiac surgery is very useful and very important for the patient, the situation is very stressful for the patient and causes other problems such as pain, anxiety, complications, hemodynamic disorders and immobilization which will affect the recovery process from cardiac surgery. These factors can affect the effectiveness of treatment and the quality of life of patients undergoing major cardiac surgery (Chandrababu et al., 2017; Ramesh et al., 2015; Tung et al., 2012). Immobilization is a problem that often occurs in cardiac surgery patients. Immobilization can cause pulmonary complications (Nardi et al., 2019). Efforts to prevent problems and complications that arise as a result of immobilization are needed exercise therapy.

Exercise therapy is a physical activity plan designed and provided to help a patient recover from any disease and condition that interferes with daily activities or to maintain the patient's well-being through health education, therapeutic activities, range of motion and gait exercises. It is the systemic execution of planned physical movements, activities intended to enable the patient to reduce risk, improve function, restore or prevent impairment, optimize overall health, and improve fitness and to achieve a level of well-being (Leelayuwat, 2017; Li et al., 2019), and prevention of cardiac morbidity and mortality (Laustsen, Hjortdal, & Petersen, 2013; Nardi et al., 2019; Scalvini et al., 2013). Seeing this, exercise therapy is very beneficial for cardiac surgery patients, however in the field this therapy is not optimally carried out.

There are international guidelines that recommend cardiac surgery given physical exercise therapy to maintain or increase the functional capacity of patients. The benefits of physical exercise therapy are enormous, including increasing fitness, lowering blood pressure, reducing myocardial oxygen demand, providing benefits to endothelial function, coagulation, clotting factors, inflammatory markers, playing a role in the formation of collateral coronary blood vessels, and increasing coronary blood circulation. (Laustsen et al., 2013).

The forms of exercise therapy that can be given to cardiac surgery patients include; When the patient is in the preoperative phase, the patient can be educated about the importance of early mobilization carried out in the next 24 hours, exercises to maintain a sitting position in a chair, continued standing and walking, giving this therapy is able to support the physiological expansion of the lungs. In the preoperative phase, the patient also needs to do exercise therapy in the form of deep breathing exercises, this exercise is to maintain short apnea, besides that the patient is taught to do effective coughing exercises followed by slow and gentle breathing with the lips half closed. Other forms of intervention that can be given to patients are chest and abdominal breathing with the aim of moving the muscles in the lung area so that lung ventilation becomes better, the use of volume and flow incentives is taught to promote deep breathing exercises with an open glottis. After entering the intensive care unit in the postoperative phase, the patient needs to be trained in early mobilization such as stimulation of chest and abdominal breathing, this exercise is able to accelerate the weaning phase of mechanical ventilation (Sturgess, Denehy, Tully, & El-Ansary, 2014).

Giving active-passive early mobilization exercises, with slight changes in posture, effective coughing, deep breathing exercises can be done every day for all postoperative patients. If the patient is hospitalized for a longer period of time, the treatment plan can be modified following the gradual development and status of the patient's clinical condition, such as sitting, standing, walking from bed to chair and vice versa. Therefore in the treatment ward, patients need to perform breathing exercises with or without motor exercises as indicated during the preoperative education period, gradually from day one to day six until complete breathing and motor autonomy are achieved (Nardi et al., 2019).

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This study aims to identify an effective form of exercise therapy in cardiac surgery patients through a systematic literature study. We synthesized current knowledge and identified the use of exercise therapy in cardiac surgery patients. This literature review aims to answer the following questions; What forms of intervention are used in exercise therapy? And among the interventions implemented, how effective was the use of exercise therapy to treat problems associated with heart surgery?

METHOD

Strategies in searching literature

A systematic review is used to find out what forms of exercise therapy there are in cardiac surgery, how they are applied and look for their effectiveness. The framework in reporting uses Preferred Reporting Items for Systematic Reviews and Meta-analysis (Page & Moher, 2017). Electronic databases from Cumulative Index of Nursing and Allied Health (CINAHL), MEDLINE, ProQuest and Science Direct are systematically sought to identify published original English language, published from 1 January 2009 to 1 December 2019. Searching for literature sources over the past ten years it is hoped to find information on the latest developments relating to exercise therapy in cardiac surgery. The search term includes exercise therapy and cardiac surgery.

Search Outcome

All exercise therapy interventions that focus on solving problems related to these therapies are used in cardiac surgery patients in the preoperative to postoperative period. This study uses inclusion criteria which are all interventions related to physical exercise therapy in cardiac surgery. These studies were excluded if the article (a) did not discuss physical exercise therapy in cardiac surgery (b) does not describe physical exercise therapy, (c) did not use the English language, and (d) studies with qualitative methods.

Study Quality Assessment

Instruments from Downs and Black were used to assess the quality of this study. The Downs and Black instrument is an assessment instrument that is widely used to assess the quality of studies. The assessment score consists of 27 items referring to the strength of the study. A score of 1 is assigned where possible for studies reporting strength whereas a score of 0 is not. All other items were evaluated according to the instrument. The scores were then categorized into very good (26-27), good (20-25), moderate (15-19), and poor (≤14).

Data Abstraction

When the search results for an article have been obtained the first time the results are extracted by the first author independently, other writers do the same. Then all the authors discuss together and approve the articles selected for systemic review. Studies are grouped and compared based on the targeted population, intervention design, intervention delivery techniques, effectiveness analysis, and outcome findings (Moher, Liberati, Tetzlaff, Altman, & The, 2009)

Synthesis

The author does not take steps until the meta-analysis because the articles obtained are very limited in number and the articles were also heterogeneous with each other, which was large in the studies included. For example, suppose that exercise intervention is performed before surgery and some are after surgery. Also, the variables measured from each article are different. Therefore, the authors report the results of this study as a narration summary.

RESULTS

The Preferred Reporting Items for Systematic Reviews and Meta-analysis flow diagram for the screening and selection of studies obtained is shown in Figure 1 (Moher et al., 2009). The electronic search generated 5988 articles through keyword searches from four databases namely CINAHL, MEDLINE, ProQuest and

Science Direct. No duplicate articles were found by the author in the search, so the first author filtered 5988 articles. After screening the titles and abstracts, 1355 articles were obtained, then with certain reasons and approval from the authors, 1340 articles were excluded so that 15 full-text articles were obtained which were then assessed for feasibility. All the authors then evaluated 15 articles for eligibility, 8 studies that did not use exercise intervention, 8 of these articles were deleted, resulting in 7 studies for further in-depth review that specifically met the inclusion criteria. Seven articles met the inclusion criteria and thus became the final sample (Figure 1).

Figure 1. Identification of articles for systematic review

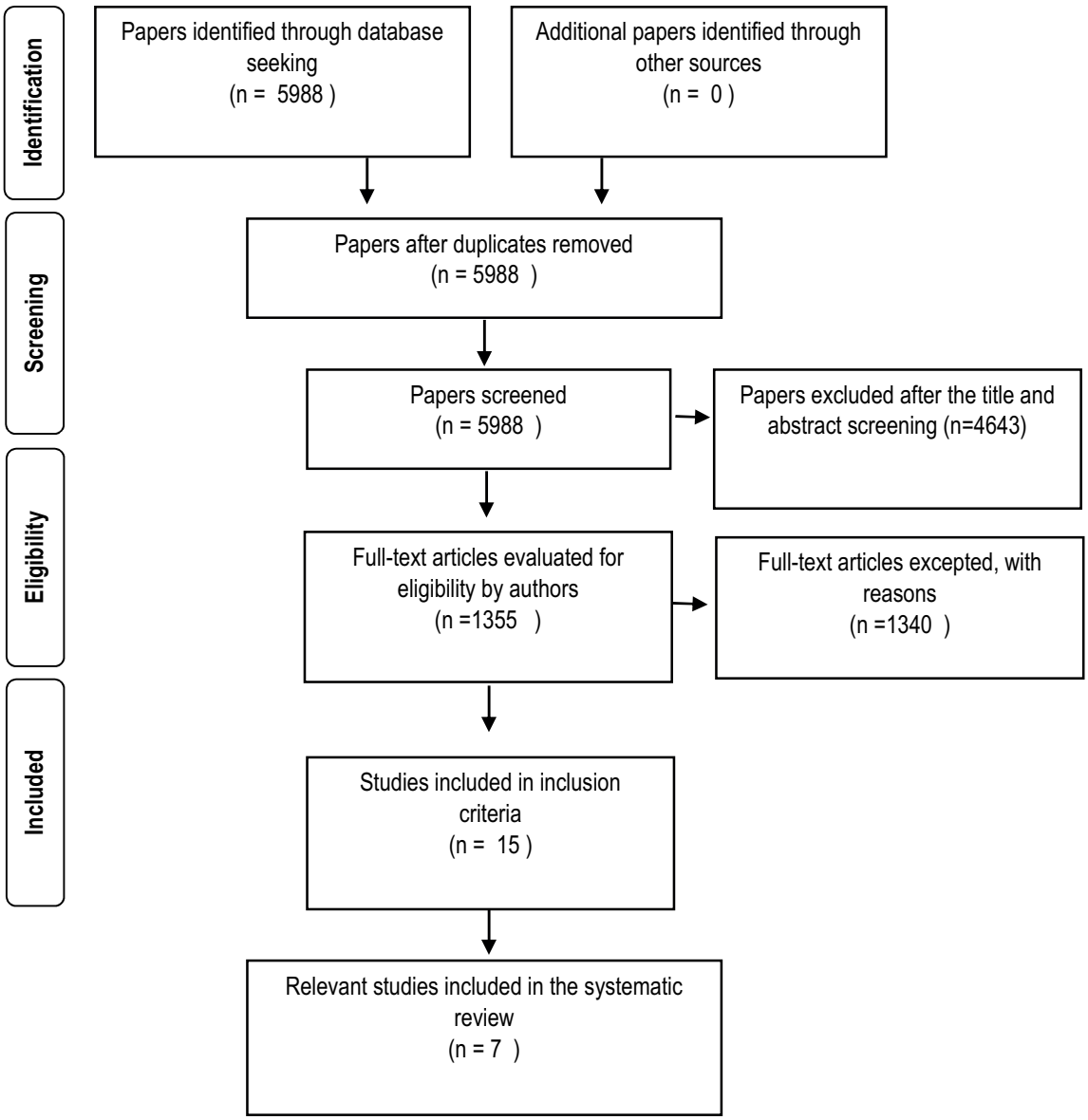

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Table 1. Exercise Therapy Studies and Quality Appraisal Scores

References	Place and Time of Research	Target Population	Downs and Black Checklist Quality Score
(Laustsen et al., 2013)	Aarhus University Hospital, Denmark from August 2008 to January 2011	Patients undergoing cardiac surgery during the period (N=364). All referred valve surgery 46%, CABG/CABG + valve surgery 54%. Completers valve surgery 42%, CABG/CABG + valve surgery 58%. Non-completers valve surgery 53%, CABG/CABG + valve surgery 47%	Fair (Total score = 15)
(Feier et al., 2019)	The Guangdong Provincial People's Hospital from January 2016 to December 2017	Patients with aortic valve surgery (N= 480). 61.4% with aortic stenosis, 60.8% with aortic insufficiency	Fair (Total score = 16)
(Nardi et al., 2019)	The Cardiac Surgery Unit of The Tor Vergata University Hospital of Rome from May-November 2017	Patients pre-operative cardiac surgery (N=65).	Fair (Total score = 15)
(Scalvini et al., 2013)	The Cardiac Center of The Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy from January 2006 and June 2010	Patients underwent cardiac surgery procedures (N=200)	Poor (Total score = 14)
(Sturgess et al., 2014)	The Large Tertiary Public Hospital in Melbourne, Australia from January–September 2007	Patients open heart surgery procedures (N=38), CABG 81.6%, valve repair/ replacement 13.2%, and others 5.2%.	Good (Total score = 22)
(Tung et al., 2012)	One hospital in Taipei, Taiwan from September 2010 to April 2011	Patients' cardiac surgery (N=35), CABG 51.4%, valve surgery 22.9%, and CABG combine valve surgery 25.7%.	Poor (Total score = 14)
(Valkenet et al., 2013)	University Medical Center Utrecht (UMCU), Utrecht, the Netherlands from January 2008 and December 2009	Patient elective cardiac surgery (N=346).	Poor (Total score = 13)

Table 2. Intervention, Study Outcomes, Key Findings

References	Intervention	Study Outcomes	Findings
(Laustsen et al., 2013)	Exercise-based cardiac rehabilitation consisting of aerobic and muscle strength training for 1 h twice a week for 8 weeks	Investigate factors associated with heart surgery patients not completing ECR	Readmission within 8 weeks post-discharged, the use of antidepressant, overweight is a factor related to ECR not completing, while age, sex, smoking habits and types of surgery are not related to not completing ECR.
(Feier et al., 2019)	Physical exercise was	Determine the effect of	Physical exercise has a beneficial effect

	provided 3 months after aortic valve surgery. Exercises include walking, tai chi, jogging, cycling, and brisk walking. The continuing program, which consists of graduated cardiovascular training and strength exercise, was identical regardless of the training location	Cardiac rehabilitation after aortic valve surgery by comparing the usual treatment of improving the peak oxygen uptake (VO2 peak) to the self-assessed mental health	on peak oxygen uptake compared to the control group (24.2 ml/kg/min vs 20.6 ml/kg/min) as measured by cardiopulmonary exercise test 3 months after surgery
(Nardi et al., 2019)	Group A is given preoperative respiratory physiotherapy protocol, group B is given a preoperative respiratory and motor physiotherapy protocol, Group C or control group no preoperative specific physiotherapy protocol but only a simplified perioperative standard physiotherapy protocol	Evaluate whether a physiotherapy program based on respiratory training with or without musculoskeletal mobilization, started preoperatively, may provide a significant improvement in pulmonary and musculoskeletal recovery postoperatively in patients undergoing elective cardiac surgery	As compared with group C, a statistically significant improvement was observed in the two preoperatively treated groups A and B in terms of longer pre- and postoperative distance traveled at the 6-minute walking test, better pre- and postoperative peak expiratory flow value, and better PaO2 and SaO2 values in postoperative blood gas measurements ($p < 0.05$, for all comparisons). A statistically significant reduction of the postoperative length of in-hospital stay was also observed in group B
(Scalvini et al., 2013)	The exercise intervention consisted is Calisthenic (upper and lower limbs, trunk, neck, shoulders, education, and bronchial clearing), stretching/relaxation (5 min x2), and Interval training on a cycle ergometer.	Compare exercise capacity after home-based cardiac rehabilitation or in-hospital rehabilitation	At the end of the 4-week study, the 2 groups showed improvement from their respective baseline values only in the 6MWT. No difference was found in time X group interaction
(Sturgess et al., 2014)	All participants have prescribed a twice-daily walking program postoperatively. The experimental group also completed a progressive, individualized thoracic exercise program. Baseline pre-operative measures of the shoulder and thoracic range of movement, pain, and HRQOL were repeated at 4 weeks following discharge and 3 months postoperatively.	Investigate whether thoracic exercises result in improved pain, range of movement and health-related quality of life following open-heart surgery, and to evaluate the patient perception of the role of thoracic exercises in the recovery.	At 4 weeks following discharge, the experimental group reported 1.7 cm on the visual analog scale less sternal pain (95% CI of median 2.8–0.0, P=0.03) than the control group. The experimental group reported a trend toward the greater perception of the contribution of their physiotherapy program than the control group (median difference 1.2 cm, 95% CI -2.1– -0.0, P=0.04). There were no other differences between the two groups.
(Tung et al., 2012)	A preoperative	Examine the feasibility of a	The results reveal that the two-week

	individualized exercise prescription had three components: (a) warm-up phase: 5 min of warmup, in which the exercise was initiated and the resistance was increased gradually until a low-intensity level was achieved; (b) training phase: approximately 30 min of training at a low-intensity level; (3) cool-down phase: 5 min of cooling down to decrease the treadmill rate and resistance until the treadmill stops. Respondent is given usual care consisting is deep breathing maneuvers, with the use of an incentive spirometer, coughing and forced expiration techniques, and early mobilization	preoperative individualized exercise prescription in cardiac surgery	exercise-training program contributed to a decreased peak respiratory exchange ratio after the surgery and earlier ambulation
(Valkenet et al., 2013)	Group 1 consisted of patients who visited the physical therapist at the outpatient clinic. Patients who were referred to the physical therapist through the inpatient clinic (mostly a few days before surgery) were classified as group 2. All patients were seen by a physical therapist for a preoperative assessment. During this assessment, patients received instructions and education concerning postoperative deep breathing exercises, incentive spirometry, coughing with wound support, and the importance of early postoperative mobilization.	Investigate the effect of inspiratory muscle training before cardiac surgery on postoperative pneumonia in routine care	At high risk in group 1, 1 patient (1.1%) developed postoperative pneumonia. In group 2, 8 out of the 252 patients at high risk (3.2%) developed this pulmonary complication (adjusted odds ratio 0.34, 95% confidence interval 0.04–3.38). No significant differences were found regarding median (25th–75th percentile) ventilation time (7 [5–9] hours versus 7 [5–10] hours), length of stay in the intensive care unit (23 [21–24] hours versus 23 [21–25] hours), or total postoperative length of stay (7 [6–11] days versus 7 [5–9] days)

The results of the study quality assessment showed that the lowest quality had a score of 13 points and the highest quality had 22 points. Table 1 presents the overall quality assessment scores and a detailed summary of the characteristics of the study. One study was rated good with a total score of 22 points, this is because the design used was a randomized trial with blinded parallel groups. (Sturgess et al., 2014). The results of the assessment obtained that the three studies had a fairly strong quality category because these studies reported internal validity, including measures to address confounders and reduce bias. The other three studies have a poor category because they have threats to internal validity (bias, confounding factors) and external validity. Table 2 describes the form of physical exercise intervention, study outcomes and findings from the analyzed articles.

DISCUSSION

Articles analyzed to explain exercise intervention as a non-pharmacological therapy which is very helpful in the healing process of cardiac surgery patients. The form of exercise therapy carried out in the article varies greatly and the outcome of interventions measured also varies depending on the research objectives, in the article which can be seen in table 2.

Exercise therapy given to cardiac surgery patients has various benefits for the patient such as increasing body fitness, lowering blood pressure, increasing blood flow in the coronary arteries, reducing oxygen demand in the myocardium; has benefits on coronary vascular endothelial function, coagulation and clotting factors, and markers of inflammation, as well as development of coronary collateral vessels (Feier et al., 2019; Laustsen et al., 2013). Walking exercises, brisk walking, tai chi, and cycling has given 3 months after surgery on the aortic valve have a beneficial effect on peak oxygen uptake. The increased slope of VE / VCO2 is inversely proportional to cardiac output at peak training and is at least partly explained by decreased lung perfusion. (Feier et al., 2019), The respiratory physiotherapy protocol intervention in the preoperative phase provided benefits in increasing mileage on the 6-minute walk test, better postoperative, pre and postoperative peak flow values, and resulted in better postoperative blood gas values on PaO2 and SaO2 indicators. (Nardi et al., 2019). Prescription of two weeks preoperative individual exercise contributes to a reduction in the ratio of peak respiratory exchange after surgery and previous ambulation (Tung et al., 2012).

Exercise therapy such as calisthenic (upper and lower extremities, trunk, neck, shoulders, education, and bronchial clearance), stretching/relaxation, and interval training on a cycle ergometer performed for 4 weeks in hospital and at home with videoconferencing guidelines to under supervision did not show a significant difference in the ability of the 6-minute walk test. A home exercise program under the supervision of a health worker is effective and comparable to conventional inpatient rehabilitative approaches, providing similar improvements in exercise capacity and quality of life as found in the study by Ades and colleagues. Physical exercise therapists can promote patient outcomes after discharge with structured assessments and provide patient information while in the hospital or at home. Physical exercise therapists are still needed especially for an advocacy role in cardiac rehabilitation procedures, therapists can educate patients about the value of participating in interventions, good lifestyles, and ensuring patient compliance with recommendations can reduce the risk of re-hospitalization. (Scalvini et al., 2013).

The physical exercise program in the form of walking twice a day which was carried out in the post-surgical phase and the individual mamou thoracic exercise program reduced sternal pain, increasing a better perception of the contribution of the physiotherapy program to the intervention group compared to the control group. Thoracic exercise can reduce postoperative pain by improving neuromuscular control and activation patterns of the anterior pectoral and abdominal muscles, which can be inhibited in the presence of pain (Sturgess et al., 2014). The advantage of this study is that various forms of physical exercise can be used in cardiac surgery patients, the weakness of this study is the limited number of articles analyzed.

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CONCLUSION

Forms of physical exercise therapy such as walking, brisk walking, jogging, cycling, tai chi, gymnastics, chest exercises, and respiratory physiotherapy protocols are effective in supporting the healing process of cardiac surgery patients. This form of therapy can be recommended to be given to cardiac surgery patients according to the phase of the operation and the clinical condition of the patient.

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