

OCCUPATIONAL THERAPY AND PHYSICAL THERAPY IN CLIENTS AFTER OPEN HEART SURGERY: A REVIEW OF CURRENT LITERATURE

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Abstract :

Background: This review was undertaken to seek evidence that clarifies the effectiveness of occupational therapy and physical therapy programs after open-heart surgery.

Methods: A search was completed using the several online databases and a manual search on articles in print.

Results: Only one article suited to the clinical query. The article is a case-series and was based on a study conducted at a rehabilitation unit over a 14-month period. The study states significant functional improvement in clients that received inpatient occupational therapy and physical therapy prior to hospital discharge.

Conclusion: Even though the roles of occupational therapy and physical therapy in aftercare of cardiac surgery are well established, there continues to be a dearth of studies pertaining to the topic. More studies to strengthen the evidence are clearly warranted.

Keywords: Occupational therapy, Physical therapy, Open-heart surgery, Cardiac rehabilitation.

INTRODUCTION

Cardio-Vascular Disease (CVD) is a broad term used to define the abnormal functioning of the heart or blood vessels (cardiovascular system). CVD contributes to the risks for heart attack, heart failure, cardiac rhythm problems, stroke and sudden death, thus causing decreased quality of life and decreased life expectancy. Causes of CVD include structural defects, infection, inflammation, environment and genetics.¹ Forms of CVD include hypertension, coronary heart disease (CHD)- angina pectoris, myocardial infarction; stroke, rheumatic heart disease/ rheumatic fever, congenital cardiovascular defects and congestive heart failure (CHF).

CVD is the number one killer in America.² In 2003, CVD ranked the highest among all disease categories in hospital discharges. From 1979 through 2003, there has been a 31% increase in short-stay hospital discharges with CVD listed as the first diagnosis.³ CVD is more commonly found in ages above 65. In 1999, it accounted as the primary diagnosis at admission for 23% of nursing home residents aged 65 or older. The diagnosis was the highest disease category for these residents.⁴ In 2000, 12.4% of U.S. population was represented by people aged 65 years or more. It is projected

that this number will grow to encompass 20% of the population by 2030⁵. The prevalence of cardiac problems such as coronary artery disease, aortic valvular stenosis and mitral valve incompetence increase with age and often incapacitate the geriatric population and cause a considerable reduction in the quality of life.⁶ With the growing proportion of elderly individuals, and the associated high incidence and prevalence of co-morbidity and disability, the need for enhanced preventive and rehabilitative programs will increase.⁷

Occupational therapists (OT) and physical therapists (PT) have established roles in the care of clients with cardiovascular conditions. The most common problem encountered in cardiopulmonary clients, as with any chronic disease state, is a progressive decrease in activity/ exercise tolerance or endurance. A vicious cycle of inactivity and reduced muscular insufficiency (deconditioning) may develop causing increasing symptomatology, and further decrease in activity to avoid discomfort. Thus, PT with their expertise in prescribing exercise is an essential part of the cardiac rehabilitation team.⁸ While working with cardiac conditions, an OT plays an essential role in helping clients regain self-esteem, functional activity, and self-regulation. One of the primary functions of an OT involves educating the client to the varying levels of cardiac and metabolic demand of daily activity, and facilitating and monitoring client participation with a gradual augmentation of increased cardiac output for effective use of oxygen by the body.⁹ Interventions by OT/ PT encompass evaluation of status, graded activities and exercises to improve activity tolerance,

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Period of Study : Jan. 94 - Feb. 95

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training to enhance physical and functional performance in activities of daily living, adaptation or modification of the client's environment/ context to facilitate functional independence and safety, education on self-management measures, precautions and risk factors; and stress management training and psychosocial support as needed.

In medical settings, OT/PT commonly care for clients that have undergone a cardiac procedure. In 2003, an estimated 6,821,000 inpatient cardiovascular procedures were performed in the US; 3.9 million were performed on males and 2.9 million were performed on females.¹⁰ About 600,000 coronary artery bypass surgery (CABG) procedures are performed in the US annually. Other "open heart" surgeries include 80,000 valve surgeries, and 2,300 heart transplants annually.¹¹

The objective of this review was to study the evidence on the benefits of occupational therapy (OT) and physical therapy (PT) specifically in clients that have undergone open-heart surgeries. In order to assess the outcomes, the Functional Independence Measure (FIM™) scale, a commonly used interdisciplinary tool, was selected.

The clinical query for the search on evidence was as follows-

In clients status-post heart surgery, will use of physical and/or occupational therapy versus no PT/OT intervention, yield better functional outcomes as measured by changes on the FIM™ scale?

METHODS

Search of literature: The reviewer performed an electronic search using the following keywords- heart surgery, rehabilitation, clinical trial, occupational therapy, physical therapy, physiotherapy, FIM and meta-analysis. Databases chosen for the search were Ovid Full Text, EBM Reviews-ACP Journal Club, EBM Reviews Full Text, CINAHL and Ovid Medline ® 1966 to February Week 2 2006. The keywords used for the second search were Ovid Full Text and Ovid Medline ® 1966 to February Week 2 2006. Additionally, manual searches on print editions of the American Journal of Occupational Therapy (AJOT) published after December of 2004 up till February 2006 was performed.

Selection of literature: The online search was completed in 11 steps. The search revealed only one study that was suited to answer the clinical question.¹² No article was found pertinent to the clinical query via the manual search on the print editions of AJOT.

RESULTS

The article by Kong, Kevorkian and Rossi titled "Functional

Outcomes of Clients on a Rehabilitation Unit After Open Heart Surgery" was selected for the review.¹²

The study: The study is a case-series, level-4 study.¹³ Although, low on the hierarchy of evidence, it was the only available study that addresses the clinical question.

The study clients: The study involved a consecutive sample of 44 subjects (n= 44) admitted to a rehabilitation unit of a tertiary hospital during a 14-month period from January 1994 through February 1995. 31 had undergone CABG, 6 had valvular surgery, and 7 had both. The admission criteria involved ability of the client to tolerate at least 3 hours of PT and/or OT per day, demonstrate medical stability and potential for functional gains. The mean client age was 71.1±7.8 years (range 50 to 85 years).

Study exclusions: Clients that had life-threatening arrhythmias, or had severe CHF and required cardiac monitoring were not admitted to the rehabilitation unit and thus, excluded from the study.

Quality of data and study outcomes:

Statistical Tests Used in the Study:

The authors used the paired- *t* test to compare admission and discharge FIM™ scores; analysis of variance (ANOVA) was used to compare differences in discharge FIM™ scores in clients with different cardiac surgical procedures (CABG, Valvular alone, or both), and unpaired-*t* test was used to compare admission and discharge FIM™ scores of post-surgical stroke and non-stroke populations. The Fischer's Exact test was used to study the association of the presence of CHF in acute facility to that in the rehabilitation unit. Using the discharge FIM™ score as the dependent variable, the multiple regression analysis was used to analyze factors affecting functional outcome. The clinical variables chosen for the multiple regression analysis were the age of the client, admission FIM™ score, length of stay (LOS) in acute facility, and presence or absence of medical complications in rehabilitation. The α level was set at 0.05.

Strengths, Weaknesses & Validation of the study:

Validity is threatened, as it was a non-randomized, non-blinded study. Also, the study involved a relatively small sample size (n= 44), and clients were assessed on the FIM™ scale upon admission and discharge from the rehabilitation unit (Table 1 and 2). No further follow-up was conducted.

Although, the study mentions that clients received the same frequency of treatment, that is, at least 3 hours of PT and/or OT each day over two sessions, the duration of treatment (number of days) was not uniform. The individual clients may not have been treated equally but based upon their own limiting conditions and abilities. This is evident

Table 1
Functional Independence Measure

No helper	
7	Complete independence (timely, safely)
6	Modified independence (device)
Helper	
Modified dependence	
5	Supervision
4	Minimal assistance (subject=75%+)
3	Moderate assistance (subject= 50% +)
Complete dependence	
2	Maximal assistance (subject= 25%)
1	Total assistance (subject= 0%+)

From: Kong: J Cardiopulm Rehabil, Volume 16 (6). November/ December 1996. 413-418.

Table 2
Functional Independence Measure

<i>Motor</i>	<i>Cognitive</i>
Self-care Eating Bathing Dressing- Upper Body Dressing- Lower Body Going to the bathroom	Communication Comprehension Expression
Sphincter Control Bladder Management Bowel Management	Social Cognition Social Interaction Problem Solving Memory
Transfers Bed, chair, wheelchair Toilet Tub, shower	
Locomotion Walk/ wheelchair Stairs	

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by the fact that the length of stay (LOS) at the rehabilitation unit ranged anywhere between 2 and 25 days.

With 20 males and 24 females, gender distribution was relatively even. Ages of subjects ranged between 50 to 85 years with a mean age of 71.1 years. The study falls short of mentioning individual ages of the subjects to allow the readers to infer homogeneity/ similarity of population, and relationship of age factor to outcomes or adverse events. The authors clarify that a multiple regression analysis of the study

using discharge FIM™ as the dependent variable revealed that admission FIM™ ($b=0.85, p<0.00001$) and duration of stay at the acute facility prior to admission to the rehabilitation unit ($b=0.196, p<0.0072$) were statistically significant, whereas age and medical complications were not. Since, there was no comparison group other than the one treated, true treatment effect cannot be calculated.

Out of the 44 clients in the study, thirty-seven clients (84%) developed significant postoperative medical complications in the acute facility of which 14 had multiple complications (Table 3). Twelve clients (27%) developed medical complications in the rehabilitation unit with no client developing more than one complication (Table 4). However, these adverse events were not attributable to the treatment itself. In the study, Kong et al.¹² do state that most clients had significant postoperative medical complications with prolonged hospitalization, which is not representative of the average client that undergoes open-heart surgery. Per the authors, the study subjects were older, and studies have shown that older clients are more likely to have preoperative comorbidities and higher postoperative complications with longer hospitalization stay.^{14, 15} This assertion indicates that one may expect better statistical and clinical outcomes in general than what had resulted in the study.

Also, having the same consulting physician performing evaluation of admission criteria on each client, subjective differences between raters were minimized, thus deriving further strength for the study. All clients were accounted for in the results. The study clearly provides evidence that clients that received PT and/or OT interventions despite medical complications post cardiac surgery (thirty seven clients while in acute facility and 12 during stay at the rehabilitation unit) demonstrated a significant functional improvement as evidenced by FIM™ scores of 96.7 ± 19.4 (range 45-126) at discharge to 76.1 ± 17.1 (range 34-115) at admission. This difference was statistically significant ($t=-12.18, p<0.0001$). Gains on the FIM™ scale were mainly in the motor category versus the cognitive category. The average admission and discharge FIM™ scores for the motor category were 46.3 ± 11.6 and 66.3 ± 14.5 ($t=-13.81, p<0.0001$), respectively. The average admission and discharge FIM™ scores for the cognitive category were 29.5 ± 8.3 and 30.5 ± 7.6 ($t=- 3.15, p <0.0038$), respectively (Table 5).

There was no statistically significant difference between the means of the discharge FIM™ scores in clients that underwent CABG, valvular surgery, or both. The mean discharge FIM™ scores in clients that underwent CABG, valvular surgery, or both were 95.5 ± 20.9 , 102.2 ± 18.9 , and 87.1 ± 23.8 , respectively. However, a comparison of clients that had developed post- surgical stroke versus those who

Table 3
Acute Medical Complications of Open Heart Surgery Patients

<i>Type of Medical Complications</i>	<i>No.</i>
Congestive heart failure	17
Stroke	11
Pneumonia	10
Ischemic encephalopathy	4
Gastrointestinal bleeding	4
Acute cholecystitis	2
Mediastinal hematoma	2
Ischemic myelopathy	1
Angina pectoris	1
Total	52*

*The total number is more than 44, as some patients had more than one complication.

From: Kong: J Cardiopulm Rehabil, Volume 16(6). November/December 1996.413-418

Table 4
Medical Complications Experienced by Patients in the Rehabilitation Unit

<i>Type of Complication</i>	<i>No.</i>
Congestive heart failure	6
Arrhythmia	1
Tracheal stenosis	1
Postural hypotension	1
Gastrointestinal bleeding	1
Sternal wound infection	1
Deep vein thrombosis	1
Total	12

From: Kong: J Cardiopulm Rehabil, Volume 16(6). November/December 1996. 413-418

Table 5
Comparison of Mean Admission and Discharge Functional Independence Measures

<i>Categories</i>	<i>FIM Score</i>		<i>P Value</i>	<i>t value</i>
	<i>Admission</i>	<i>Discharge</i>		
Self-care	25.1	33.9	<0.001	-11.8
Sphincter control	6.4	9.9	<0.001	-9.1
Transfers	10.4	14.8	<0.001	-10.8
Locomotion	4.1	7.7	<0.001	-8.5
Communication	12.4	12.8	<0.01	-2.6
Social cognition	17.1	17.6	<0.007	-2.8

From: Kong: J Cardiopulm Rehabil, Volume 16(6). November/December 1996.413-418

had not, showed a lower mean admission and discharge FIM™ scores in the former group (66.2 ± 21.5 and 84.0 ± 24.1 , respectively) versus in the latter that demonstrated mean admission and discharge FIM™ scores (77.8 ± 15.6 and 98.7 ± 19.0 , respectively) and these differences were statistically significant ($t = -2.08$, $p < 0.05$; and $t = -2.04$, $p < 0.05$, respectively).

The outcome tool used in the study also contributes to its strength. The tool, Functional Independence Measure (FIM™), originally developed by the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation and, supported by 11 national professional organizations, has adequate reliability, validity, and responsiveness.¹⁶⁻²¹ Ottenbacher, Ysu, Granger et al. via a quantitative review have shown that the FIM™ scale has a good inter-rater reliability (intra-class correlation coefficient [ICC]= .90-.99) and test-retest reliability (ICC= .90-.93) in a group of clients with mixed diagnoses enrolled in rehabilitation programs.²²

DISCUSSION

The outcome in support of the PT and/or OT interventions in the study was statistically and clinically significant as shown by an improvement in the average FIM™ score by 20.6 points at discharge as compared to the admission. Clients improved in overall functioning from minimal assist level (4.22 average per test item) to a supervised level (5.37 average per test item), hence, achieving a level requiring no physical assistance. Also, 41 out of 44 (93%) clients were able to return to their own homes or a relative's home (average LOS at the rehabilitation unit being 12 ± 4.7 days, ranging 2- 25 days). This clearly demonstrates that PT and/or OT in post-cardiac surgical care yield favorable functional outcomes. Also, according to a report, although cardiac clients made up only 2% of the total Uniform Data Systems FIM client pool, they have shown substantial functional gains with inpatient rehabilitation.²³

Results of the study by Kong et al. have not been confirmed or substantiated by other studies. This literature review revealed only this study as relevant to the topic even after almost a decade since the study was performed. The scarcity of studies pertaining to the topic may be caused due to a variety of reasons. These may include reasons from assumptions that OT/ PT in cardio-pulmonary conditions is a relatively lesser-sought/ ventured avenue by therapists compared to neurological and orthopedic conditions, ethical implications involved in denying OT/PT services to eligible clients in order to design controlled groups, and that there is a paucity of information detailing functional outcome after rehabilitation.²⁴ Literature on rehabilitation pertaining to the elderly is limited and is particularly inadequate to delineate

specific intervention strategies.²⁵⁻³⁰ While this review has its own limitations for it being a single-reviewer endeavor and also due to the inability to find relevant unpublished material; more research is clearly warranted as evidenced just by the extreme shortage of published material on this topic.

One may generalize the study results to a variety of clinical settings. Skilled nursing facilities and swing-bed facilities often serve clientele that could also meet the 3-hour daily therapy criteria for rehabilitation hospitals. Studies have confirmed that a multidisciplinary approach that is timely and addresses medical, functional, and psychosocial aspects, helps reduce mortality and length of hospital stay, and improves the quality of life in a significant proportion of geriatric dependent clients, including those previously thought to be inappropriate for a rehabilitation program.³¹ A multidisciplinary approach has shown to decrease the number of disabled people after an acute hospital admission and to increase the percentage of people discharged back to their own home, in comparison to at-risk elderly individuals treated along traditional medical lines.^{32,33} A multidisciplinary approach also has relevant implications toward cost-effectiveness involved in the delivery of services and in decreasing the number of readmissions.³⁴⁻³⁷ Some researchers have also demonstrated that the delay in rehabilitation services elevates medical care costs.³⁸⁻⁴⁰ Following a multidisciplinary approach, PT and OT form an integral part of post-cardiac surgical care. The potential of harm from conservative treatment approaches of PT and OT practitioners is extremely low.

Clients expect to functionally improve and be integrated in their community to the best of their abilities. By providing appropriate services, we help clients meet this expectation and also help in reducing costs involved with institutionalization by facilitating appropriate return to the community.

The study by Kong et al. establishes the foundation of evidence for the use of OT and PT services in clients that have undergone open-heart surgery. The current state of literature clearly demands more research on the topic.

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