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Influence of Physical Training on Quality of Life in Post Operative Congenital Heart Disease – A Prospective Randomised Clinical Trial

KEYWORDS

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Heart diseases predominate as cause of death and disability in the western world and are of increasing importance in the developing countries. Heart diseases occur either due to acquired or congenital by acquired heart diseases like coronary artery disease and rheumatic heart disease are 60% of the cases leading to major health problem and remains a common disabling illness. Congenital heart defects are the defects present from birth of children. Approximately 30% of congenital heart disease are common in children, and 10-15% survive untreated to adulthood. The congenital heart individual projects with impaired physical and physiological characteristics. As this has been persisting for 2 or 3 decades of life, it results in decreased physical capacity of an individual which in turn impairs the mental well-being & social interactions.

Medical and surgical advices has walked into high percentage of survival and success rates. It is apparent from clinical practice that the management of disease is not always the major problem, issues pertaining to quality of life such as employment status; exercise participation and social life predominate.

Physical activity increases maximum cardiac output and ability of the muscles to extract and use oxygen from blood, beneficial changes in heamodynamic, hormonal, metabolic, neurological and respiratory function also occur with increased exercise capacity.

A.P. Government has introduced Arogyasri Scheme, in which number of heart diseases are operated worth of 1-2 lakhs per case, prognosis/ improvement in such cases in all the aspects of life need to be studied. At present Dr. NTR Vaidya Seva is the flagship scheme (2015) of all health initiatives of the State Government with a mission to provide quality healthcare to the poor.

The world famous cardiologist Dr. Cherian extended his service at India (Appolo, Chennai) and treated successfully number of heart patients. Dr. Vijayalakshmi, the first woman cardiologist in Karnataka, is the first woman in the State to specialise in interventional cardiology. Dr. Vijayalakshmi owns a world record for successfully performing heart operation on a child weighing 4.5 kg two years ago. Dr. Vijayalakshmi said that 65 per cent of congenital heart diseases can be treated without surgical procedure. In the case of 25 per cent of cases, there can be permanent cure through surgical procedures. In 10 per cent of cases which cannot be treated even through surgical procedures, palliative care can be provided, she said. The Union Government should adopt a three-pronged strategy to provide training to paediatricians on treating children with heart diseases and on new treatment procedures and preventive measures, create awareness among parents on how to follow simple methods to prevent the disease among children (Sivanandh).

Dr. Rajasekar, Cardiologist (H.O.D), Dr. Vanaja, Cardiologist at SVIMS extending their best medical knowledge to the heart patients. Dr Vijaya Chandra Reddy worked in the past SVIMS now performing his role as best cardiologist in Chennai hospitals.

On World Heart Day, September 29, the World Heart Federation is calling on people — specifically mothers who are gatekeepers to the home — to take action now to protect their own heart health, as well as that of their children and families to safeguard future generations (DR. R. N. Kalra).

Hence, the aim of the study is to a know the influence of physical training on quality of life in post-operative a cyanotic congenital heart disease.

OBJECTIVES

- to analyse the physical capacity in experimental group and control group.
- to analyse the quality of life in experimental group and control group.

MATERIAL AND METHODOLOGY

The study is approved by SVIMS Ethical Clearance Committee. An informed consent is taken from the subjects. The study is conducted in territory care centre SVIMS University, Tirupati, Andhra Pradesh. The study period (2014 Nov to 2015 Jun) was conducted for 8 months 30 samples were randomly divided 15 samples in each group experimental and control group. A Randomised experimental design was adopted. A prospective experimental study was done. An uncomplicated acyanotic congenital heart disease with age group 15-40 years of both sexes were included in the study. An experimental group underwent supervised graded aerobic exercises. A control group underwent unsupervised graded aerobic exercises.

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METHODOLOGY
30 subjects who met the inclusive criteria were randomly selected into two groups. 15 samples in each group i.e. experimental and control group informed consent was taken from each subject. The subjects pre-operatively was evaluated for physical capacity VO2 max and quality of life and further samples were assessed post operatively at the time of discharge and follow up assessment after 3 months.

PHYSICAL CAPACITY
Physical capacity is evaluated through bicycle ergo meter. It is measured as VO2 max.

QUALITY OF LIFE
Is assessed through SF-36 from questionnaires.

Congenital heart disease complicates ~ 1% of all live births. It occurs in about 4% of offspring of women with congenital heart disease. Substantial numbers of affected infants reach adulthood because of successful medical and/or surgical management, or because the alteration caused in cardiovascular physiology is well tolerated.

ETIOLOGY
Congenital cardiovascular malformations are generally the result of aberrant embryonic development of a normal structure, or failure of such a structure to progress beyond an early stage of embryonic or fetal development. Malformations are due to complex multifactorial genetic and environmental causes. Recognized chromosomal aberrations and mutations of single genes account for <10% of all cardiac malformations.

The presence of a cardiac malformation as one component of the multiple system involvement in Down's, Turner's, and the trisomy 13-15 (D1)and 17-18 (E) syndromes may be anticipated in occasional pregnancies by detection of abnormal chromosomes in fetal cells obtained from aminiotic fluid or chorionic villus biopsy. Identification in such cells of the enzyme disorders characteristics of Hurley's syndrome, homocystinuria, or type II glycogen storage disease may also allow one to predict cardiac disease.

PATHOPHYSIOLOGY
The anatomic and physiological changes in the heart and circulation due to any specific congenital cardio circulatory lesion are not static but rather progress from prenatal life to adulthood. Thus, malformations that are benign or escape detection in childhood may become clinically significant in the adult. For example, the functionally normal, congenitally bicuspid aortic valve may thicken and calcify with time, resulting in significant aortic stenosis; or the well-tolerated left-to-right shunt of an atrial septal defect may not result in cardiac decompensation, with or without pulmonary hypertension, until the fourth or fifth decade.

Hemostasis is abnormal in cyanotic congenital heart disease, due in part to the increased blood volume and engorged capillaries, abnormalities in platelet function and sensitivity to aspirin or nonsteroidal anti-inflammatory agents, and abnormalities of the extrinsic and intrinsic coagulation system. Oral contraceptives are contraindicated for cyanotic women because of the enhanced risk of vascular thrombosis.

The risk of stroke is greatest in children <4 years with cyanotic heart disease and iron deficiency, often with dehydration as an aggravating cause. In contrast, adults with cyanotic congenital heart disease do not appear to be at increased risk for stroke, unless there are excessive injudicious phlebotomies, inappropriate use of aspirin or anticoagulants, or the presence of atrial arrhythmias or infective endocarditis.

Symptoms of hyperviscosity can be produced in any cyanotic patient with erythrocytosis if dehydration causes a reduction of plasma volume. Phlebotomy, when required for symptoms of hyperviscosity not due to dehydration or iron deficiency, is a simple outpatient removal of 500ml of blood over 45 min with isovolumetric replacement with isotonic saline (5% dextrose if congestive heart failure exists). Acute phlebotomy without volume replacement is contraindicated. Iron repletion in decompensated iron-depleted erythrocytosis ameliorales iron-deficiency symptoms but must be done gradually to avoid a sudden excessive rise in hematocrit and result hyperviscosity.

EXERCISE
Advice on athletic and exercise is governed by the nature of the exercise and by the type and severity of the congenital cardiovascular lesion. Patients with lesions characterized by LV outflow tract obstruction, if more than mild to moderate, or pulmonary vascular disease, risk syncope or even sudden death. In Fallot's tetralogy, isotonic exercise-induced decrease in systemic vascular resistance relative to the right ventricular (RV) outflow obstruction augments the right-to-left shunt, increases hypoxemia, and causes an increase in subjective breathlessness due to the response of the respiratory center to the changes in blood gases and pH.

INSURABILITY AND EMPLOYMENT
Most patients with congenital heart disease must pay significantly more than standard life insurance rates, assuming their anomaly places them in a category that companies have determined is eligible for insurance. A paucity of actuarial survival data beyond adolescence for persons with most congenital cardiac lesions that have undergone operative repair has made it difficult to convince insurance companies to offer reasonable cost insurance even to individual patients whose long-term prognosis is quite good. Employment is affected by the patient's physical capacity relative to the type of job sought. Job discrimination exists, often because the employer is reluctant to accept health insurance responsibilities. Eligibility for some occupations is governed by public safety regulations, e.g., airline pilots, bus drivers.

SPECIFIC CARDIAC DEFECTS
The following table provides a classification of cardiac anomalies that recognizes the general categories of clinical presentation, functional consequences, and site of origin of congenital defects. Categorizing the defect(s) in an individual patient requires an answer to a number of basic questions. Is the patient acyanotic or cyanotic? Is pulmonary arterial blood flow increased or not? Does the malformation originate in the left or right side of the heart? Which is the dominant ventricle? Is

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TABLE -1:
Classification of Congenital Heart Disease

ACYNOTIC WITH LEFT-TO-RIGHT SHUNT			
I.	Atrial level shunt A. Atrial septal defect 1. Ostium primum 2. Ostium secundum 3. Sinus venosus B. Atrial septal defect with mitral stenosis (Lutembacher's syndrome)	III.	Aortic root to right heart shunt A. Reptured sinus of Valsalva aneurysm B. Coronary arteriovenous fistula
II.	Ventricular level shunts A. Ventricular septal defect 1. Inlet septum 2. Muscular septum 3. perimembranous septum 4. infundibular septum B. Ventricular septal defect with aortic regurgitation C. Ventricular septal defect with left ventricular to right atrial shunt	IV. V.	C. Anomalous origin of the left coronary artery from the pulmonary trunk Aortopulmonary level shunt A. Aortopulmonary windo B. Patent ductus arteriosus Multiple level shunts A.Complete common atrioventricular canal B. Ventricular septal defect with atrial septal defect C. Ventricular septal defect with patent ductus arteriosus
ACYANOTIC WITHOUT A SHUNT			
I.	Left heart malformations A. Congenital obstruction to left atrial inflow 1. Pulmonary vein stenosis 2. Mitral stenosis 3. Cor triatriatum B. Mitral regurgitation 1. Atrioventricular septal (endocardial cushion) 2. Congenitally corrected transposition of the great arteries 3. anomalous origin of the left coronary artery from the pulmonary trunk 4. miscellaneous (double-orifice mitral valve, congenital perforations, accessory commissures with anomalous chordal insertion, congenitally short or absent chordae, eleft posterior leaflet, parachute mitral valve, etc. C. Primary dilated endocardial fibroelastosis	II.	D. Aortic stenosis 1. Discrete subvalvular 2. Valvular 3. Supravalvular B. Aortic valve regurgitation C. Coarctation of the aorta Right heart malformations A. Acyanotic Ebstein's anomaly of the tricuspid valve B. Pulmonic stenosis 1. Subinfundibular 2. Infundibular 3. Valvular 4. Supravalvular (Stenosis of pulmonary artery and its branches) C. Congenital pulmonary valve regurgitation D. Idiopathic dilatation of the pulmonary trunk.
CYANOTIC			
I.	Increased pulmonary blood flow A. Complete transposition of the great arteries B. Double-outler right ventricle of the Taussig-Bing type C. Truncus arteriosus D. Total anomalous pulmonary venous connection E. Single ventricle without pulmonic stenosis F. Common atrium G. Tetralogy of Fallot with pulmonary atresia and increased collateral artrial flow H. Tricuspid atresia with large ventricular septal defect and no pulmonic stenosis I. Hypoplastic left heart (Aortic atresia, mitral atresia)	II.	Normal or decreased pulmonary blood flow A. Tricuspid atresia B. Ebstein's anomaly with right-to-left atrial shunt C. Pulmonary atresia with intact ventricular septum D. Pulmonic stenosis or atresia with ventricular septal defect (tetralogy of Fallot) E. Pulmonic stenosis with right-to-left atrial shunt F. Complete transposition of the great arteries with pulmonic stenosis G. Double-outlet right ventricle with pulmonic stenosis H. Single ventricle with pulmonic stenois I. Pulmonary arteriovenous fistula J. Vena caval to left atrial K. Communication
	OTHER		
I. II.	Congenitally corrected transposition of the great arteries The cardiac malpositions.	III.	Congenital complete heart block

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Source: Modified from JK Perloff, The Clinical Recognition of Congenital Heart Disease, Philadelphia, Saunders, 1991.

pulmonary hypertension present or not? With the above information as a foundation, the use of more refined diagnostic techniques such as transthoracic (precordial) and transesophageal echocardiography and Doppler imaging, magnetic resonance imaging, and/or hemodynamic study and angiocardiography leads to a precise anatomic and functional assessment.

MEDICINES:
ACE inhibitors
Fruselac
spironolactone
Eplerenone
Angiotensin II Receptor Blocker (ARBs)
Inotropic Therapy

DATA ANALYSIS

Descriptive statistics and t-test are used for data analysis and the level of significance is set at 5%. Summary of the descriptive statistics, including means and standard deviations were computed for the pre-operative at the time of discharge and post-operatively after 3 months. Variables and also represented graphically using bar diagrams. The variables are VO2 max and quality of life taken pre-operatively, at the time of discharge and post-operatively 3 months were shown in the tables below.

TABLE-2
VO2 max and QOL post operatively after 3 months in control and experimental groups

	Group	Mean	SD	t	df	Sig.(2 tailed)
VO2 max	Control	12.45043	6.042802	2.79498	28	0.0092*
	Experimental	19.52971	7.727536			
QOL	Control	13.53333	20.12059	2.63615	28	0.0135*
	Experimental	29.73333	12.7137			

Note:

* represents t-test values are significant at p<0.05
VO2 max-maximum oxygen consumed (ml/kg/min)
QOL-quality of life

The above table reveals the comparison of VO2max and QOL post operatively after 3 months in experimental and control group. The standard deviations values are significant.

DISCUSSION

This study is done to know the physical capacity and quality of life in acyanotic congenital heart disease patients after physical training. The parameters taken are VO2 max to measure physical capacity and SF36 to measure QOL in preoperative, patients, immediately after discharge and later 3 months after exercise training. The results of this study could yield better understanding of effect of physical training on the physical capacity which is an important predictor of health outcome and survival in adult patients with cardiovascular diseases.

RELATIONSHIP BETWEEN PHYSICAL TRAINING AND PHYSICAL CAPACITY

From Table-2, the result of the study demonstrated that there was little significant increase in VO2 max physical capacity post operatively at the time of discharge in the experimental group compared with the control it was significant increase in physical capacity post-operatively at 3 months after physical training in experimental group compared with the control group.

Aerobic training improves strength of the heart. Improves the ability of the muscles to extract and use more oxygen from the blood, there is an increased number of capillaries surrounding the muscle fibers, which allows a greater surface area over which oxygen can diffuse into the muscles, an increase in hemoglobin an increased volume of mitochondria. Aerobic training also improves the oxygen carrying capacity of the blood, occurs due to increased number of red blood cells. Coronary vasodilatation is mainly done by the bioavailability of nitric oxide (NO), which is produce by the endothelially derived enzyme no syntheses and is metabolized by reactive oxygen species. Reversal of endothelial dysfunction is achieved by regular physical exercise.

RELATIONSHIP BETWEEN PHYSICAL TRAINING & QUALITY OF LIFE

Release of endorphins monoamines such as nor epinephrine serotonin and dopamine, increase of warmth and heat reduces muscle tension. A positive reinforcement leads to strengthening of the behavior, increases mental well being once the mental well being is improved; an individual improves his behavior and active participation in social activities which ultimately improves quality of life.

From Table-2, the results demonstrated that there is no significant difference in QOL post operatively at the time of discharge between control and experimental groups. There is significant increase in QOL in experimental group compared with the control group after 3 months of exercise training postoperatively.

CONCLUSION:

Medical and surgical advances have led to a dramatic decrease in mortality among patients with congenital heart disease. Thus attention is focused on out comes other than death, successful treatment depends not only on increased length of survival but also on the quality of life in the above study, the physical training was given to post operatively acyanotic congenital heart disease patients to know the efforts on physical capacity and quality of life. Physical capacity is measured in the form of VO2 max and QOL was measured in terms of either subjective health status, emotional response to health problems interpersonal relationships and internal psychological states.

It is concluded from the study that physical training has positive effects on physical capacity which ultimately improves quality of life. SVIMS Institution extending its services to the poor and needy heart patients through Arogyasri, and NTR Seva Trust schemes.

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