

Clinical Research

Habitual Physical Activity in Adults With Congenital Heart Disease Compared With Age- and Sex-Matched Controls

Camilla Sandberg, RPT, MSc,^{a,b} Jeremy Pomeroy, PhD,^c Ulf Thilén, MD, PhD,^d
Anna Gradmark, MD, PhD,^a Karin Wadell, RPT, PhD,^b and Bengt Johansson, MD, PhD^a

^a Heart Centre and Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden

^b Department of Community Medicine and Rehabilitation, Physiotherapy, Umeå University, Umeå, Sweden

^c Phoenix Epidemiology and Clinical Research Branch, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Phoenix, Arizona, USA

^d Department of Cardiology, Skåne University Hospital, Lund University, Lund, Sweden

ABSTRACT

Background: Most adult patients with congenital heart disease (CHD) have reduced aerobic exercise capacity. Their habitual physical activity (PA) level is, however, less well studied. In this study, habitual PA level in a cohort of adults with CHD compared with healthy age- and sex-matched controls was investigated.

Methods: Eighty adults with CHD, classed as either “complex” (n = 40) or “simple” (n = 40), and 42 healthy controls were studied with a combined uniaxial accelerometer and heart rate monitor worn during 4 consecutive days. We analyzed: (1) the time spent during moderate or vigorous PA; (2) accelerometer counts per day; and (3) to what extent the World Health Organization recommendations on PA were reached.

The positive effects of regular physical exercise training and being physically active in general are extensively documented.^{1,2} In patients with acquired cardiovascular disease and chronic heart failure, exercise training has become established parts of the secondary prevention programs.^{3,4} In addition, a sedentary lifestyle and time spent sitting have emerged as important risk factors for cardiovascular events and all-cause mortality.⁵⁻⁷ The current World Health Organization (WHO) recommendations on physical activity (PA) for promoting health in adults aged 18–64 years is 150 minutes per week spent at a moderate to vigorous PA level (3–6 metabolic equivalent [MET]).⁸ Walking on a firm surface at 2.5 mph (4.02 km/h) corresponds to a PA level of 3.0 MET.⁹ The current PA recommendations for adults with congenital heart disease to promote a physically active lifestyle is

RÉSUMÉ

Introduction : La plupart des patients adultes atteints d'une maladie cardiaque congénitale (MCC) ont vu leur capacité d'exercice aérobique diminuée. Cependant, leur niveau d'activité physique (AP) habituelle a fait l'objet de très peu d'études. La présente étude examinait le niveau d'AP habituelle d'une cohorte d'adultes souffrant d'une MCC par rapport aux témoins en santé appariés selon l'âge et le sexe.

Méthodes : Nous avons étudié 80 adultes souffrant d'une MCC qui étaient classifiés comme « complexes » (n = 40) ou « simples » (n = 40), et 42 témoins en santé au moyen d'un accéléromètre uniaxial combiné à un moniteur de fréquence cardiaque, qui ont été portés durant 4 jours consécutifs. Nous avons analysé : 1) le temps consacré à

approximately 30 minutes of daily activity at an individualized intensity based on hemodynamic and electrophysiological parameters.¹⁰

There are a number of different methods available for measuring PA.¹¹ In questionnaires with the aim of identifying time spent at different intensities during a period of time¹² recall bias is a potential problem. PA level can also be assessed with an accelerometer, a uniaxial device that records acceleration and deceleration in 1 axis (typically the vertical axis), or a triaxial device that measures in 3 axes. Importantly, different accelerometers process the raw data differently.¹¹ Nevertheless, no differences have been found between uniaxial and triaxial accelerometers in measurement of PA level in population studies.¹³ It is common to use a specified accelerometer count per minute as a cutoff to define a moderate to vigorous PA level.^{14,15} However, it is important to keep in mind that the physical demand of specific counts per minute vary widely between individuals. Yet another method used is time spent with a heart rate (HR) ≥ 1.75 times the resting HR measured using an HR monitor.¹⁶

Most adult patients with congenital heart disease have a reduced exercise capacity.¹⁷ To what extent this reduction is

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Corresponding author: Camilla Sandberg, Heart Centre, Umeå University Hospital, SE-90185 Umeå, Sweden. Tel.: +46907858441.

E-mail: camilla.sandberg@medicin.umu.se

See page 552 for disclosure information.

Results: Patients with simple lesions had higher total accelerometer counts per day compared with patients with complex lesions and controls (simple lesions: median [interquartile range] 107.7 [76.3-139.1] vs complex lesions: 72.8 [49.2-101.0] and controls: 78.3 [58.7-106.9]; $P \leq 0.001$ and $P = 0.002$). Furthermore, no differences in time spent during moderate or vigorous PA was found between patients and controls. In addition 46% of the patients with simple lesions, 55% of the patients with complex lesions, and 44% of the controls did not reach the World Health Organization-recommended level of daily PA, but no significant differences between groups were found. There were no differences in achieving recommended PA level between patients in New York Heart Association (NYHA) class I vs NYHA class II and III.

Conclusions: Patients with CHD follow the same PA level pattern as the general population. Broad strategies to promote an active lifestyle are needed across the population and especially for patients with complex CHD and impaired NYHA class.

caused by the heart defect per se or a sedentary life style because of restrictions and/or overprotection is unknown. There is sparse and contradictory information regarding the habitual PA level of adults with congenital heart disease. In a cohort of 61 adults with congenital heart lesions of different complexity Dua et al. found that those classified as NYHA class II or III were less physically active and spent less time at moderate or vigorous PA compared with those classified as NYHA class I. Only a minority in NYHA class I and II and none in the NYHA class III reached the recommendations on PA.¹⁸ In contrast, Müller et al. found no differences between different diagnosis groups considering time spent in moderate to vigorous PA. In addition, they reported that most (76%) met the recommendations of daily PA.¹⁹ None of these studies included a reference population for comparison.

The aim of the present study was to objectively investigate the habitual PA level in a cohort of adults with congenital heart disease compared with healthy age- and sex-matched controls using a combined accelerometer and HR monitor.^{20,21}

Methods

Adult patients with congenital heart disease were recruited from the adult congenital heart disease units in Umeå and Lund, Sweden. The inclusion criteria were periodic outpatient medical visits for congenital heart disease and clinically stable condition over the past 3 months. Exclusion criteria were intellectual disability or mental illness affecting independent decision-making, extracardiac disease affecting PA or other circumstances making participation unsuitable (eg, inconvenience wearing the monitor). One hundred thirteen patients were asked to participate, twenty-three (20.4%) denied participation and 5 did not appear at clinical visit. Eighty-five patients were finally included. To achieve a balanced diversity of diagnoses and complexity, because the simple lesions were

l'AP modérée ou vigoureuse; 2) les données quotidiennes de l'accéléromètre; 3) dans quelle mesure les recommandations de l'Organisation mondiale de la Santé étaient atteintes.

Résultats : Les patients porteurs de lésions simples montraient des données quotidiennes totales plus élevées à l'accéléromètre que ceux porteurs de lésions complexes et que les témoins (porteurs de lésions simples : médiane [intervalle interquartile] 107,7 [76,3-139,1] vs porteurs de lésions complexes : 72,8 [49,2-101,0] et témoins 78,3 [58,7-106,9]; $P \leq 0,001$ et $P = 0,002$). De plus, aucune différence dans le temps consacré à l'AP modérée ou vigoureuse n'était observée entre les patients et les témoins. Par surcroît, 46 % des patients porteurs de lésions simples, 55 % des patients porteurs de lésions complexes et 44 % des témoins n'atteignaient pas le niveau d'AP quotidienne recommandé par l'Organisation mondiale de la Santé, mais aucune différence significative entre les groupes n'était observée. Il n'existait aucune différence dans l'atteinte du niveau d'AP recommandé entre les patients de la classification I de la New York Heart Association (NYHA) vs ceux de la classification II et III de la NYHA. **Conclusions :** Les patients atteints d'une MCC observent le même niveau d'AP que la population générale. De grandes stratégies pour promouvoir un mode de vie actif sont nécessaires dans l'ensemble de la population et particulièrement chez les patients atteints d'une MCC complexe et ayant une classification moindre de la NYHA.

much more common, patients were recruited into 4 different groups based on diagnosis: (1) shunt lesions; (2) left-sided lesions; (3) tetralogy of Fallot, pulmonary atresia, or transposition of the great arteries; and (4) Eisenmenger physiology, patients with Fontan procedures, or total cavopulmonary connection or other complex lesions, until the group was filled with at least 20 patients with complete data. Groups 1 and 2 were classed as "simple" and 3 and 4 as "complex" (Table 1) according to a classification previously used by others and that harmonizes with the expected exercise capacity.¹⁷ One hundred twenty-nine age- and sex-matched individuals (73 men, 56 women) who lived in the Umeå area were randomly selected from the national population registry, contacted via

Table 1. Distribution and classification of heart lesions

Simple lesions, N = 40	n	Complex lesions, N = 40	n
CoA	12	d-TGA (atrial switch)	5
AS	3	ccTGA	2
AR	3	ToF	8
AS/AR	4	PA	3
VSD	14	DORV	2
ASD	1	DILV (no intervention)	1
PFO	1	TCPC*	7
PDA	1	Atriopulmonary Fontan	2
MR	1	Ebstein	3
		Eisenmenger	6
		Miscellaneous	1

Distribution of heart lesions and classification into simple or complex lesion categories.

AR, aortic regurgitation; AS, aortic stenosis; ASD, atrial septal defect; ccTGA, congenitally corrected transposition of the great arteries; CoA, coarctation of the aorta; DILV, double inlet left ventricle; DORV, double outlet of right ventricle; d-TGA, d-transposition of the great arteries; MR, mitral regurgitation; PA, pulmonary atresia; PDA, persistent ductus arteriosus; PFO, persistent foramen ovale; TCPC, total cavopulmonary connection; ToF, tetralogy of Fallot; VSD, ventricular septal defect.

*Patients palliated for tricuspid atresia, PA, or DILV.

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