

## Aritmie in Cardiologia dello Sport

# Sport and ACHD

Berardo Sarubbi

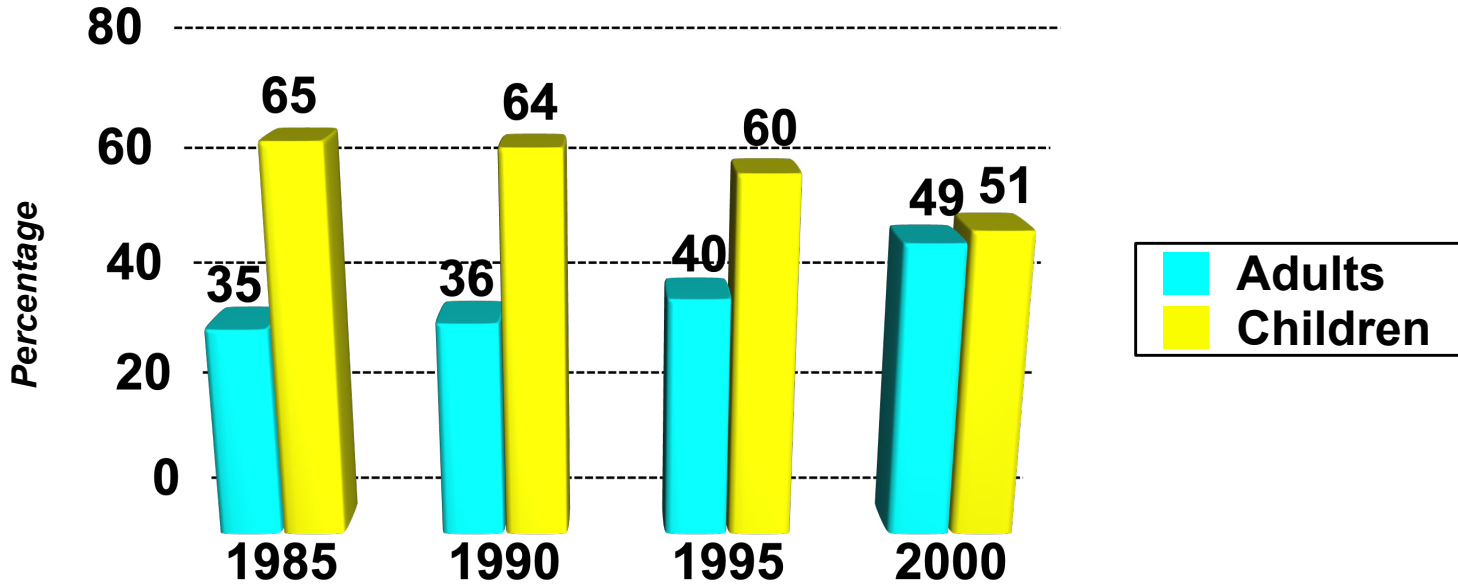
*UOC Cardiopatie Congenite dell'Adulto ed  
Aritmie Congenite e Familiari*

A.O.R.N. dei Colli – Ospedale Monaldi – Napoli

[www.berardosarubbi.it](http://www.berardosarubbi.it)

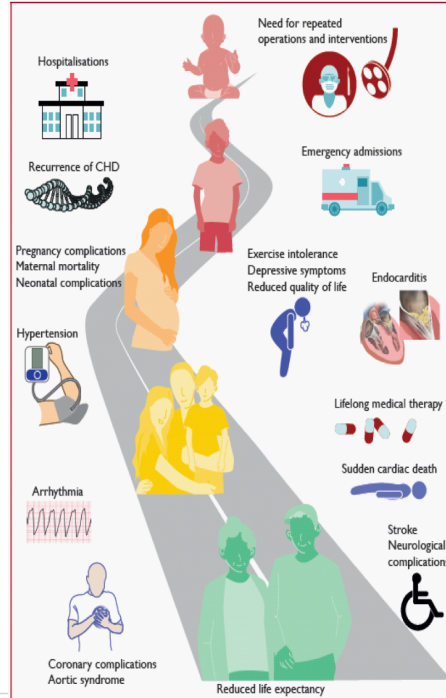


# Changings demographics in CHDs



**Congenital Heart Disease in the General Population Changing Prevalence and Age Distribution. J. Marelli et al. Circulation. 2007;115:163-172.**

- Congenital heart disease (CHD) refers to structural abnormalities of the heart present at birth, affecting **approximately 1%** of live births.
- Advances in surgical techniques have dramatically increased survival into adulthood.



## Congenital heart disease A lifelong chronic condition



**ESC**

European Society  
of Cardiology

# Who will be our adult congenital heart disease patient tomorrow?

**Berardo Sarubbi  \* and Giancarlo Scognamiglio **

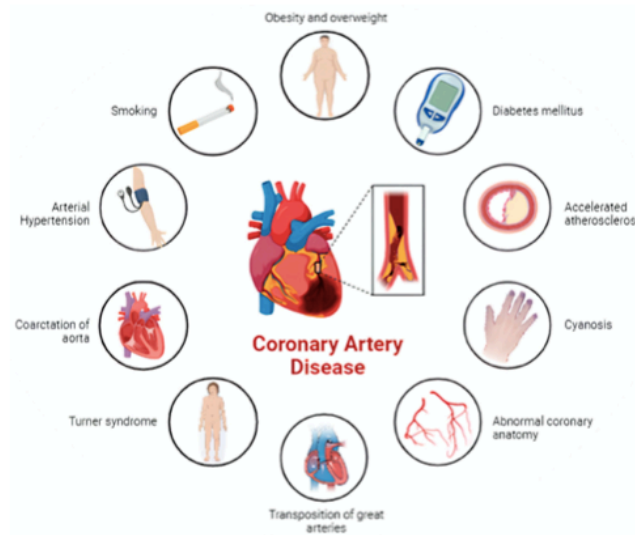
*Adult Congenital Heart Disease Unit, Monaldi Hospital, Leonardo Bianchi Street, Naples 80131, Italy*



Review

# The Unique Challenge of Coronary Artery Disease in Adult Patients with Congenital Heart Disease

Nunzia Borrelli, Assunta Merola, Rosaria Barracano, Michela Palma, Ippolita Altobelli, Massimiliana Abbate, Giovanni Papaccioli , Giovanni Domenico Ciriello , Carmen Liguori, Davide Sorice, Lorenzo De Luca, Giancarlo Scognamiglio and Berardo Sarubbi \*



# Obesity in Congenital Heart Disease



Tamayo C., Manlhiot C., Patterson K., Lalani S., McCrindle B.W.: Longitudinal evaluation of the prevalence of overweight/obesity in children with congenital heart disease. *Can. J. Cardiol.* 2015 Feb;31(2):117-123.

# DIFFICULTIES IN DAILY LIFE:

- Sport (59%)
- Employment (51%)
- Education (34%)

Kamphuis M., et al.: Disease-related difficulties and satisfaction in adults with mild or complex congenital heart disease. *Cardiol. Young*

# Obstacles to Exercise

## ACHD specific obstacles

- Cardiovascular limitations
- Restrictive lung disease
- Skeletal muscle abnormalities

Physical Obstacles

- Busy schedules
- Cost
- Socio-economic status
- Embarrassment
- Cognitive limitations
- Patient misconceptions
- Physician cautions
- Parental over-protection

Physo-Social Obstacles

>50% of individuals believed  
parents and doctors limited their  
activity more than they should have  
(Rhodes 2006)



## AHA Scientific Statement

### Exercise and Acute Cardiovascular Events

#### Placing the Risks Into Perspective

A Scientific Statement From the American Heart Association  
Council on Nutrition, Physical Activity, and Metabolism  
and the Council on Clinical Cardiology

*In Collaboration With the American College of Sports Medicine*

Paul D. Thompson, MD, FAHA, Co-Chair; Barry A. Franklin, PhD, FAHA, Co-Chair;  
Gary J. Balady, MD, FAHA; Steven N. Blair, PED, FAHA; Domenico Corrado, MD, PhD;  
N.A. Mark Estes III, MD, FAHA; Janet E. Fulton, PhD; Neil F. Gordon, MD, PhD, MPH;  
William L. Haskell, PhD, FAHA; Mark S. Link, MD; Barry J. Maron, MD;  
Murray A. Mittleman, MD, FAHA; Antonio Pelliccia, MD; Nanette K. Wenger, MD, FAHA;  
Stefan N. Willich, MD, FAHA; Fernando Costa, MD, FAHA

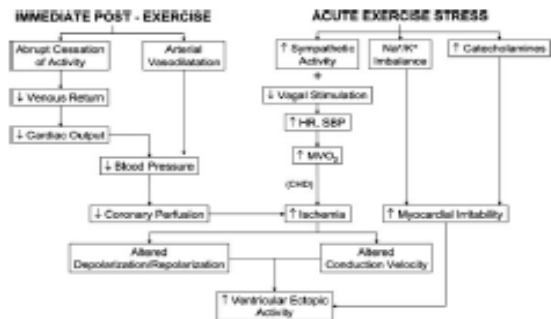


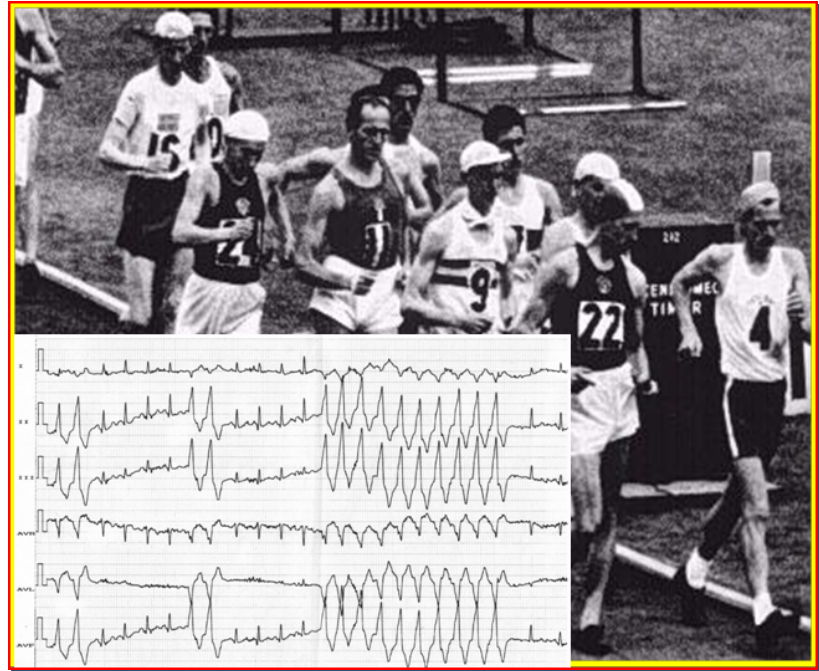
Figure 1. Physiological alterations accompanying acute exercise and recovery and their possible sequelae. HR indicates heart rate; SBP, systolic blood pressure; and MVO<sub>2</sub>, myocardial oxygen uptake. Reprinted from Franklin,<sup>10</sup> with permission.

**Sports trigger cardiac arrest in athletes who are affected by cardiovascular conditions which predispose to life-threatening arrhythmias**

81% of sudden death events  
occurred during exercise

# Causes of sudden death during physical activity

- Mechanical
- Electrical
- Neuro-mediated





European Heart Journal (2016) **37**, 627–629  
doi:10.1093/eurheartj/ehv523

**EDITORIAL**

# Sudden cardiac death during exercise in patients with congenital heart disease: the exercise paradox and the challenge of appropriate counselling

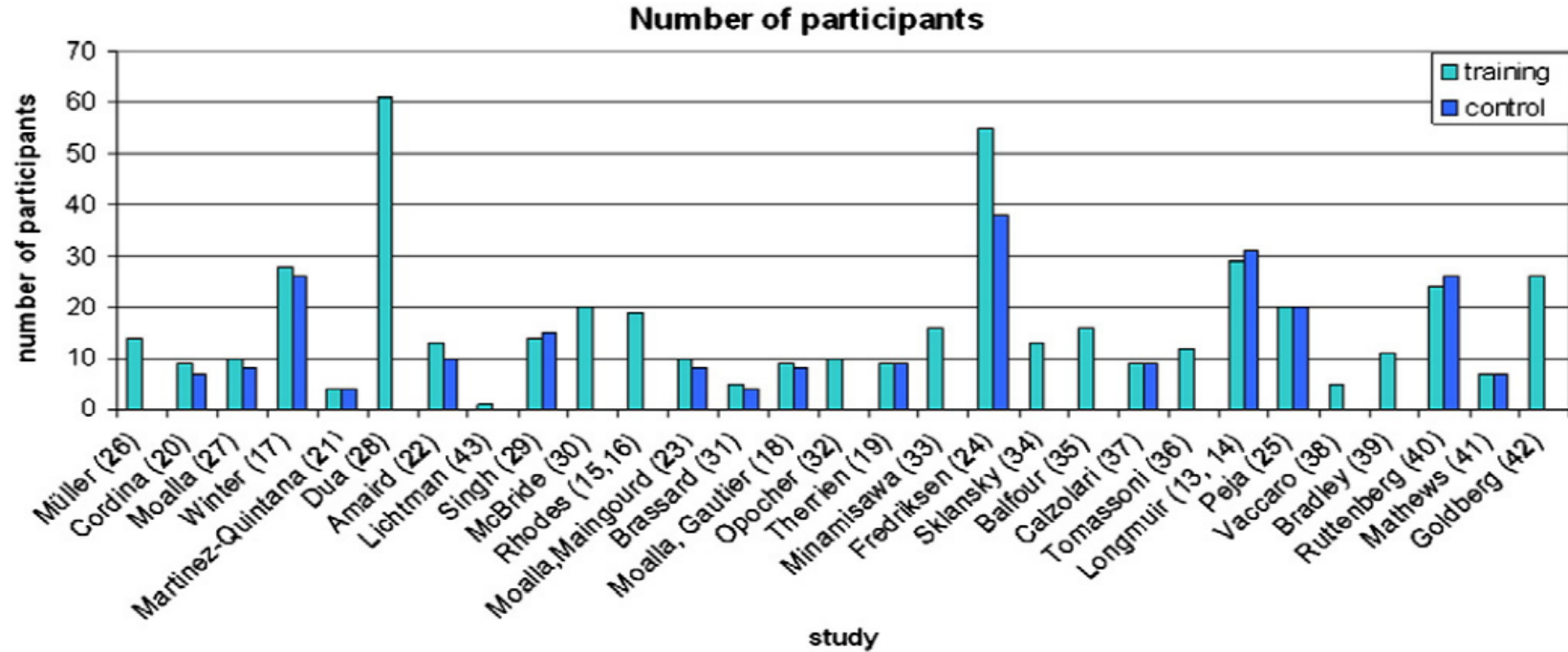
**Gerhard-Paul Diller\* and Helmut Baumgartner**

Division of Adult Congenital and Valvular Heart Disease, Department of Cardiovascular Medicine University Hospital of Münster, Münster, Germany.

*Online publish-ahead-of-print 21 October 2015*

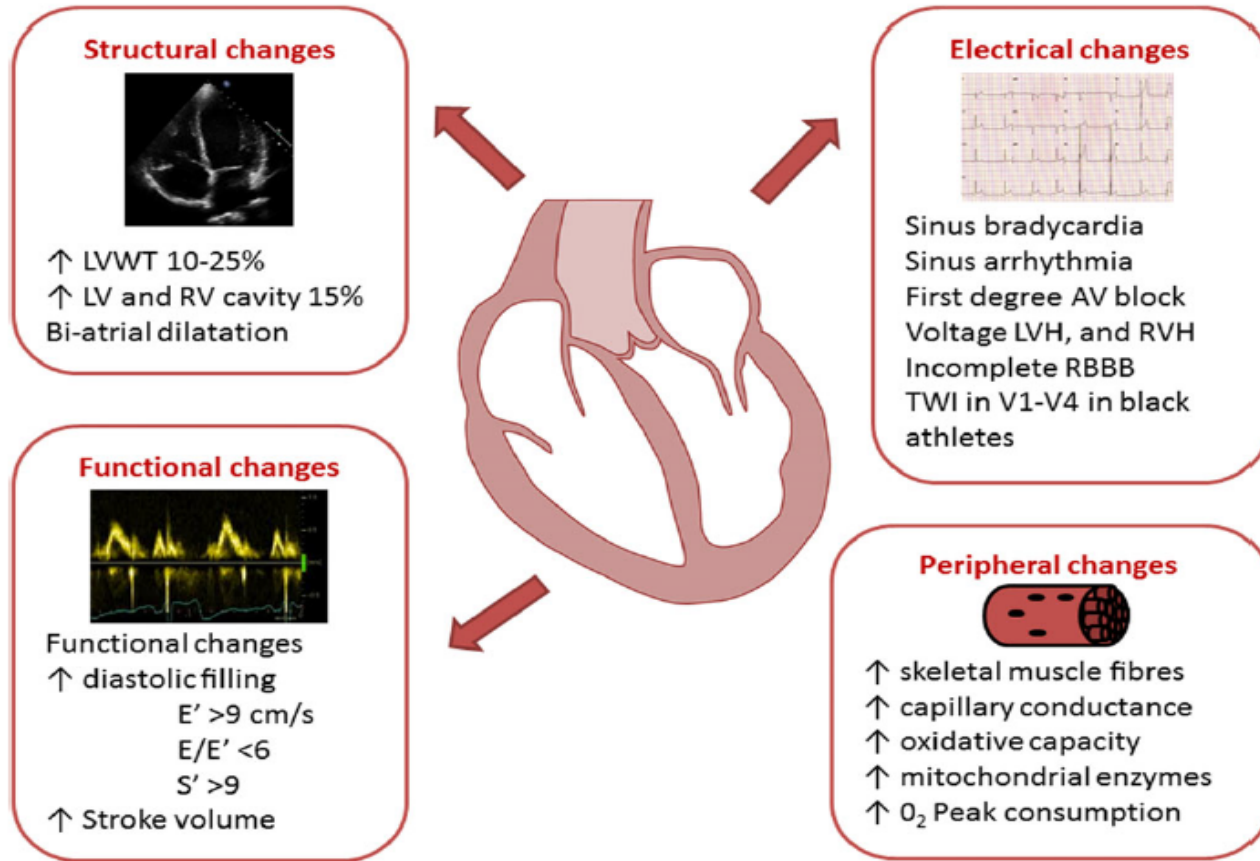


# Exercise is Beneficial in GUCH



Duppen N, Int J Cardiol 168 (2013) 1779–1787

# Cardiovascular and peripheral adaptation to exercise in athletes



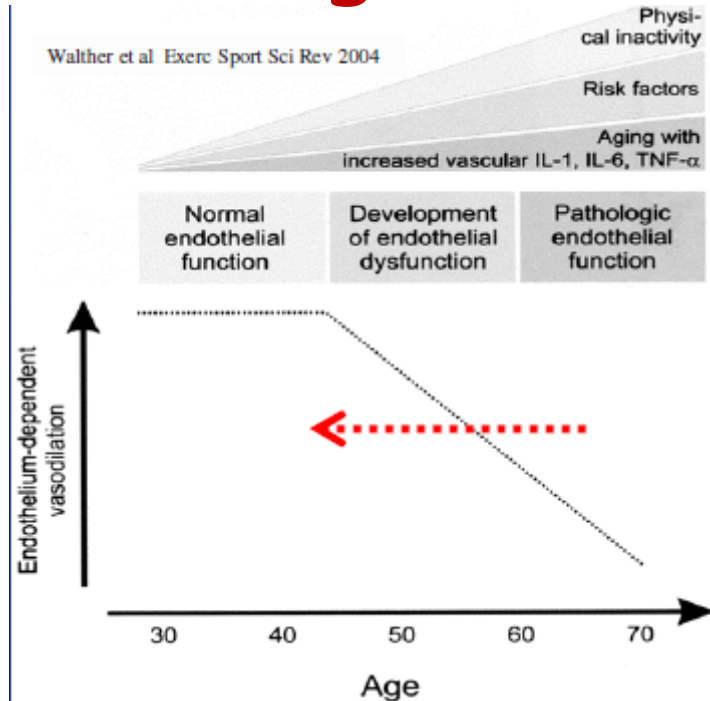
How does exercise  
help ?



Answer **Multifactorial**

- Improving endothelial function
- Improving cardiac function
- Improving skeletal muscle function

# Exercise as therapy in Congenital Heart Disease



## Consider:

- Coarctation
- L-R shunts
- Valve dysfunction

# Congenital Heart Disease and Sport: Italian Experience



**Linee Guida SICP 2001**

**COCIS 2023**

**Tabella 13** - Raccomandazioni per la concessione dell'idoneità agonistica nei soggetti con tetralogia di Fallot.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Classe | LDE |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|
| <p>Premettendo che il giudizio di idoneità va strettamente individualizzato, i pazienti operati per TF possono partecipare a sport del gruppo A, purché siano rispettati i seguenti criteri:</p> <ul style="list-style-type: none"> <li>le pressioni ventricolari destre siano normali (&lt;35 mmHg), l'insufficienza tricuspidale lieve e l'insufficienza polmonare non significativa (ECO e/o RM cardiaca);</li> <li>il ventricolo destro sia normale o lievemente dilatato con funzione conservata. Per la sua valutazione si raccomanda l'effettuazione di RM cardiaca, anche per escludere la presenza di fibrosi;</li> <li>non vi siano shunt residui con funzione ventricolare sinistra normale;</li> <li>le dimensioni indicizzate della radice aortica siano nei limiti (&lt;2.1 cm/m<sup>2</sup> superficie corporea) con insufficienza assente o lieve;</li> <li>la durata del QRS sia &lt;160 msec ed in assenza di aritmie ventricolari o atriali documentate all'Holter e/o al TE massimale;</li> <li>vi sia una normale tolleranza allo sforzo (con raggiungimento al TCP di almeno l'80% del VO<sub>2</sub>max teorico di soggetti normali di età, sesso e superficie corporea comparabile e normali valori di VE/VCO<sub>2</sub>).</li> </ul> | I      | B   |
| <p>In casi selezionati con esiti "ottimali" della correzione chirurgica, potrebbe essere presa in considerazione la concessione dell'idoneità agonistica anche per gli sport di gruppo C sulla base di un'esplicita indicazione (scritta) da parte dei Centri Cardiologici-Cardiochirurgici con documentata esperienza e sotto stretto follow-up clinico.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | II     | C   |



| CLASSIFICAZIONE DEGLI SPORT<br>IN RELAZIONE ALL'IMPEGNO CARDIOVASCOLARE |                         |                              |                  |             |                     |
|-------------------------------------------------------------------------|-------------------------|------------------------------|------------------|-------------|---------------------|
|                                                                         |                         | GRUPPO A                     | GRUPPO B         | GRUPPO C    | GRUPPO D            |
|                                                                         |                         | Sport di Destrezza o Postura | Sport di Potenza | Sport Misti | Sport di Resistenza |
| risposte cardiovascolari acute e croniche all'esercizio                 | Frequenza Cardiaca      | +/++                         | ++               | ++/+++      | +++                 |
|                                                                         | Pressione Arteriosa     | +                            | +++              | ++          | ++                  |
|                                                                         | Gettata Cardiaca        | +                            | ++               | ++          | +++                 |
|                                                                         | Rimodellamento cardiaco | -                            | +                | ++          | +++                 |



Novità COCIS 2023

# CONTROINDICAZIONI ASSOLUTE



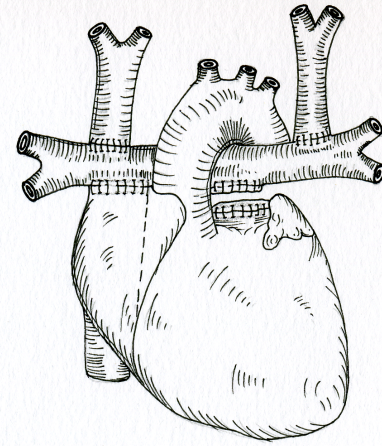
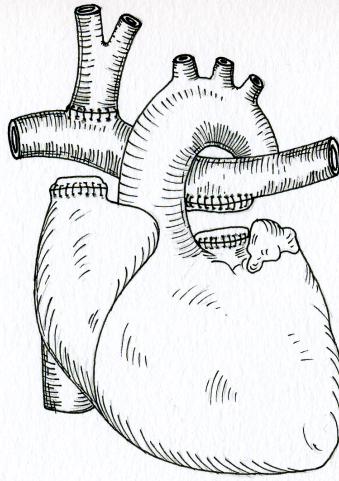
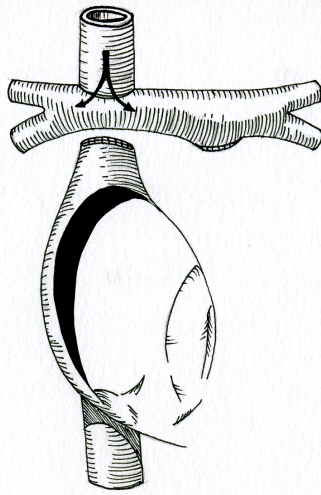
Vi sono patologie che, per gravità e/o complessità, controindicano di per sé la pratica sportiva **AGONISTICA**:

- **Atresia della polmonare**, a setto integro o con DIV (quando non è stato possibile il recupero completo del VD);
- **Sindrome di Eisenmenger**,
- **Ipertensione polmonare primitiva**;
- **Cardiopatie con circolazione univentricolare**;
- **Sindrome di Marfan, sindrome di Ehlers-Danlos e altre connettivopatie** (associate a valvulopatie e/o dilatazione aortica).

Naturalmente una controindicazione all'attività sportiva agonistica non implica l'esclusione da qualsivoglia attività fisica e sportiva con **finalità ludico-ricreativa e RIABILITATIVA**.

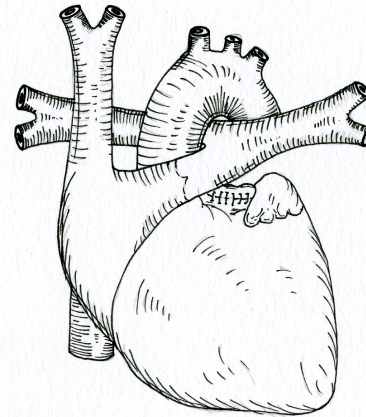
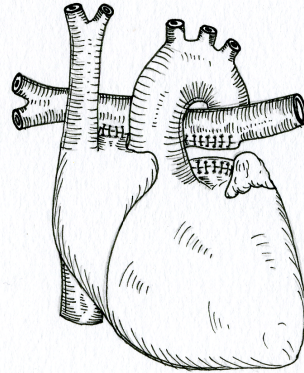
Essa deve essere, tuttavia, programmata da medici competenti, sulla base di adeguati parametri clinici e funzionali (prescrizione dell'esercizio fisico).





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# Should We Recommend Exercise after the Fontan Procedure?

**Nigel Sutherland, BPhysio<sup>a</sup>, Bryn Jones, MBBS, FRACP<sup>b,c,d</sup>,  
Yves d'Udekem, MD PhD FRACS<sup>a,b,c\*</sup>**

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<sup>b</sup>Murdoch Childrens Research Institute, Melbourne, Vic, Australia

<sup>c</sup>Department of Paediatrics, Faculty of Medicine, The University of Melbourne, Melbourne, Vic, Australia

<sup>d</sup>Department of Cardiology, The Royal Children's Hospital, Melbourne, Vic, Australia

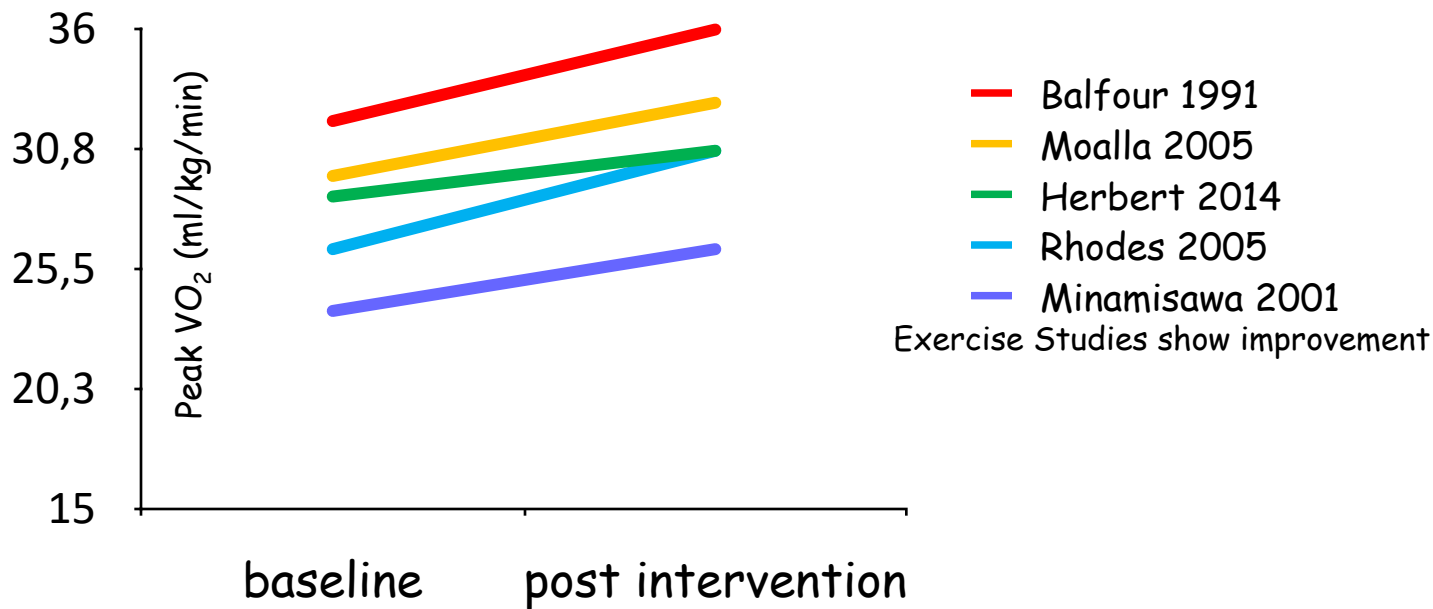
*Received 22 January 2015; accepted 3 March 2015; online published-ahead-of-print xxx*

# Fontan Exercise

## Improvement in Exercise

Overall studies are mixed but support benefit from recommended exercise

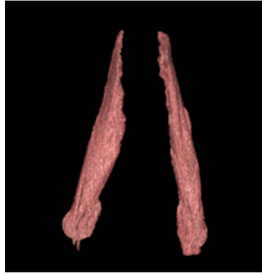
## Function



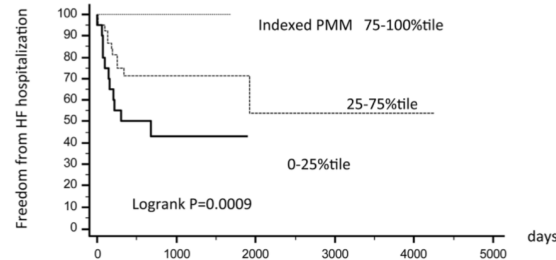
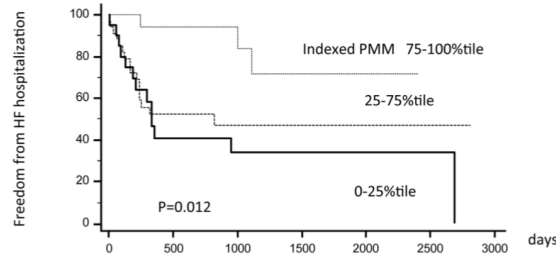
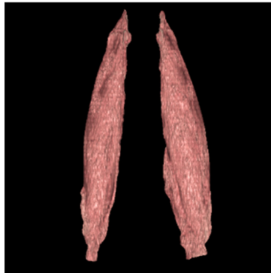
# Skeletal Muscle Mass

Lower volume of Psoas Major Muscle (PMM) - Poorer prognosis of Heart Failure (HF)

Fontan patient



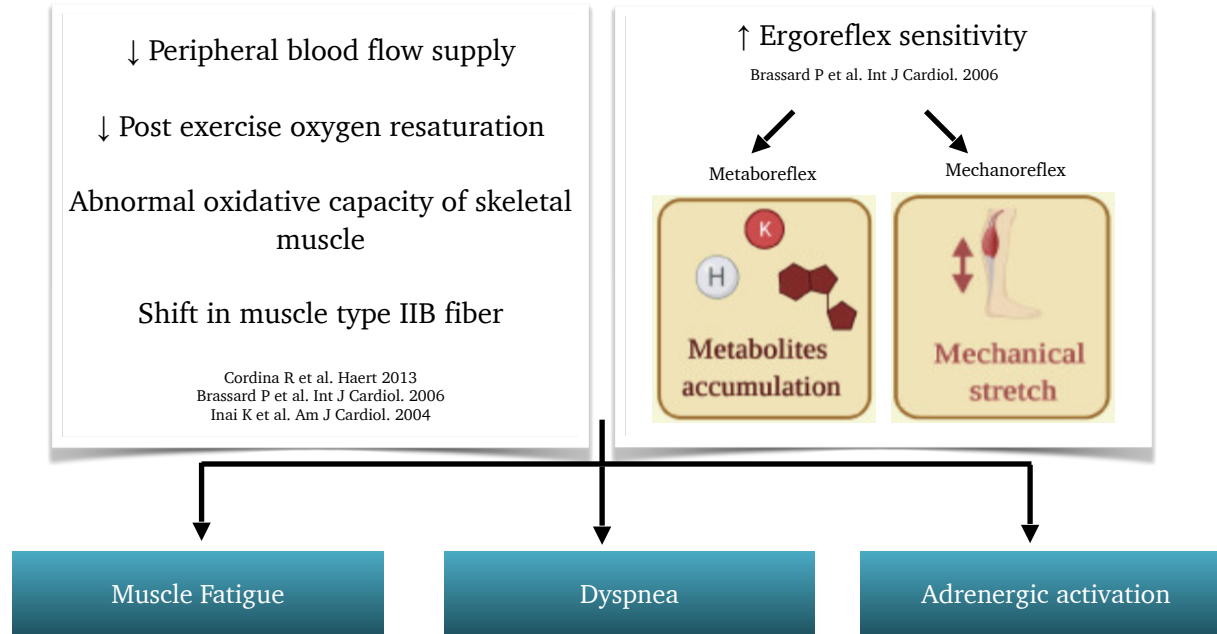
Age-matched control



Shiina Y et al. J Cardiol. 2021

# Skeletal Muscle Function

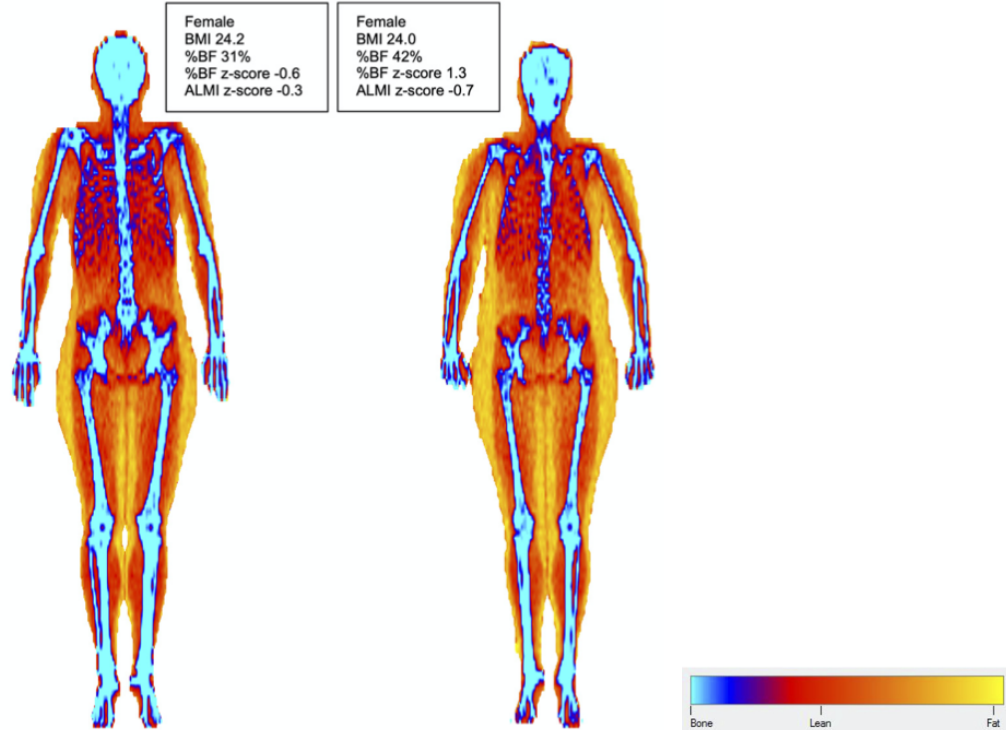
"Fontan- related myopathy"



# Adiposity

50% Moderate- high adiposity

Android fat distribution +++



Cao JY et al. Int J Cardiol. 2021

# Ventilatory efficacy

Forced vital capacity (FVC) is a predictor of survival in adults with CHD

≈ 50% of Fontan patients present FCV below normal, which is consistent with restrictive physiology

Restrictive lung disease is associated with less pulmonary expansion during inspiration contributing to lower exercise capacity

|                                | Lung function test         |                                  |       |
|--------------------------------|----------------------------|----------------------------------|-------|
| FVC (L)                        | 2.2 (1.9–2.8) <sup>a</sup> | 2.5 (2.3–2.9)                    | 0.011 |
| Predicted FVC (%)              | 83 (65–94)                 | 86 (77–102)                      | ns    |
| FEV <sub>1</sub> (L)           | 2.0 (1.7–2.5)              | 2.2 (2.1–2.6)                    | 0.011 |
| Predicted FEV <sub>1</sub> (L) | 76 (67–89)                 | 87 (79–97)                       | 0.015 |
| MVV (L/min)                    | 80 (69–101)                | 90 (83–103)                      | 0.012 |
| TLC (L)                        | 3.4 (3.2–4.0)              | 3.7 (3.2–4.7)                    | ns    |
| Predicted TLC (%)              | 76 (74–94)                 | 81 (75–91)                       | ns    |
| DLCO (mL/min/mmHg)             | 16.2<br>(12.2–18.1)        | 18.0 (14.1–18.4)                 | ns    |
| Predicted DLCO (%)             | 57 (44–64)                 | 61 (51–66)                       | ns    |
| MIP (cmH <sub>2</sub> O)       | –66 (–95–<br>–54)          | –103 (–134–<br>–90) <sup>b</sup> | 0.008 |
| Predicted MIP (%)              | 65 (53–91)                 | 102 (90–124) <sup>b</sup>        | 0.008 |

4-month supervised exercise training - 60-min exercise sessions

The Inspiratory Muscle Training (IMT)  
increases inspiratory muscle strength and spirometry

Abdulkarim A et al. J Am Coll Cardiol. 2023

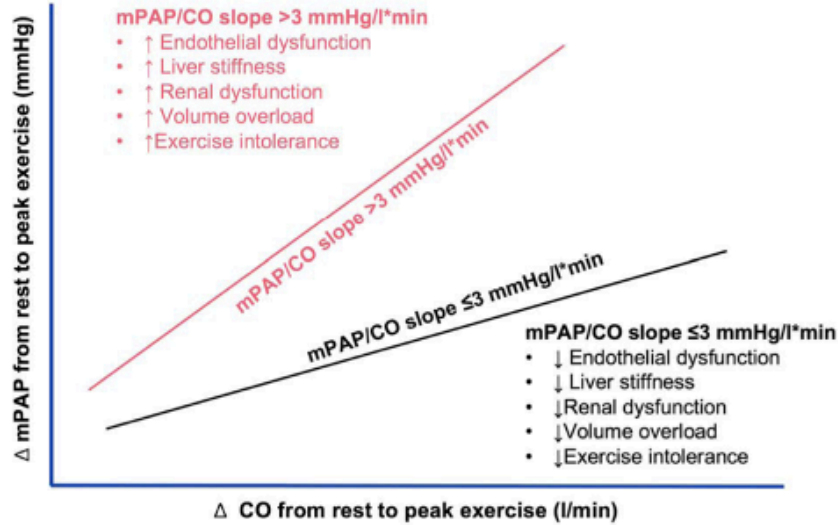
Callegari A et al. Congenit Heart Dis. 2019

Opotowsky AR et al. Am J Physiol Heart Circ Physiol. 2014

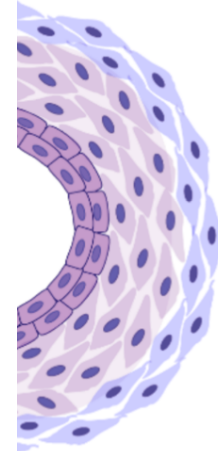
Turquetto ALR et al. Int J Cardiol. 2021

# Pulmonary Endothelial Function

The abs



ry vascular



ionary artery

Egbe AC et al. J Am Coll Cardiol. 2020

# Functional Capacity



European Journal of Preventive Cardiology (2021) 28, 1269–1278  
doi:10.1177/2047487320942869

## Physical exercise training in patients with a Fontan circulation: A systematic review

Linda E. Scheffers<sup>1</sup>, Linda E.M. vd Berg<sup>1,2</sup>, Gamida Ismailova<sup>2</sup>, Karolijn Dulfer<sup>3</sup>, Johanna J.M. Takkenberg<sup>4</sup>, and Wim A. Helbing<sup>1a</sup>

16 studies - 264 pts

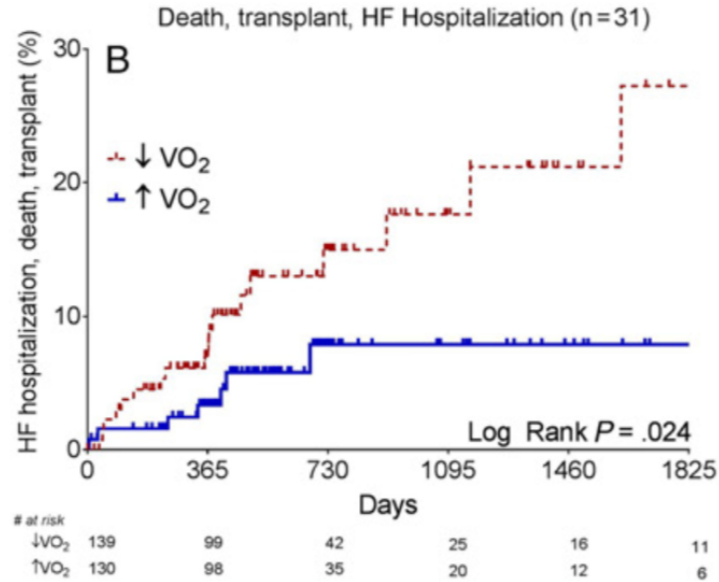
↑ Peak VO<sub>2</sub> in 56% of the studies

Average +1.72 ml/kg/min (+6.3%)

|                                        | Year of publication | Study design                | Training group n | Control group n | Kind of training                                          | Intensity of training                | Duration in weeks | Training sessions per week n |
|----------------------------------------|---------------------|-----------------------------|------------------|-----------------|-----------------------------------------------------------|--------------------------------------|-------------------|------------------------------|
| Studies including children only:       |                     |                             |                  |                 |                                                           |                                      |                   |                              |
| Jacobsen <sup>17,23</sup>              | 2018                | Cohort                      | 13               | 0               | Aerobic + resistance exercises                            | —                                    | 12                | 3–4                          |
| Sutherland (home) <sup>25</sup>        | 2018                | Randomised trial            | 11               | 0               | Aerobic + resistance exercises                            | 65–85% of HR at peak VO <sub>2</sub> | 8                 | 2                            |
| Sutherland (hospital) <sup>25</sup>    | 2018                | Randomised trial            | 6                | 0               | Aerobic + resistance exercises                            | 65–85% of HR at peak VO <sub>2</sub> | 8                 | 2                            |
| Wittekind <sup>26</sup>                | 2018                | Cohort                      | 10               | 0               | Aerobic + resistance exercises                            | 70–80% of HRR                        | 12                | 2                            |
| Hedlund <sup>28,39</sup>               | 2017                | Cohort with controls        | 30               | 25              | Aerobic training                                          | —                                    | 12                | 2                            |
| Laohachai <sup>30</sup>                | 2017                | Cohort                      | 23               | 0               | Inspiratory muscle training                               | 30% of MIP                           | 6                 | 7                            |
| Longmuir <sup>24</sup>                 | 2013                | Randomised trial            | 30               | 0               | Aerobic + resistance exercises                            | —                                    | 52                | 7                            |
| Opoche <sup>19</sup>                   | 2005                | Cohort                      | 10               | 0               | Aerobic training                                          | 50–70% of HR at peak VO <sub>2</sub> | 32                | 2                            |
| Studies including adults only:         |                     |                             |                  |                 |                                                           |                                      |                   |                              |
| Fritz <sup>21</sup>                    | 2019                | Randomised controlled trial | 42               | 22              | Inspiratory muscle training                               | Adjusted individually                | 26                | 7                            |
| Wu <sup>31</sup>                       | 2018                | Cohort                      | 12               | 0               | Inspiratory muscle training                               | 40% of MIP                           | 12                | 5                            |
| Cordina <sup>32</sup>                  | 2012                | Cohort with controls        | 6                | 5               | High-weight resistance training focusing on calf muscles. | —                                    | 20                | 3                            |
| Lichtman <sup>20</sup>                 | 2008                | Case study                  | 1                | 0               | Aerobic + resistance exercises                            | 19/20 on Borg scale                  | —                 | —                            |
| Studies including children and adults: |                     |                             |                  |                 |                                                           |                                      |                   |                              |
| Ait Ali <sup>18</sup>                  | 2018                | Cohort with controls        | 8                | 6               | Respiratory training                                      | —                                    | 12                | 1                            |
| Duppen <sup>9,13–16</sup>              | 2015                | Randomised controlled trial | 26               | 17              | Aerobic training                                          | Rest HR plus 60–70% of HRR           | 12                | 2                            |
| Brassard <sup>22</sup>                 | 2005                | Cohort with controls        | 5                | 9               | Aerobic + resistance exercises                            | 50–80% of HR at peak VO <sub>2</sub> | 8                 | 3                            |
| Minamisawa <sup>29</sup>               | 2001                | Cohort                      | 11               | 0               | Aerobic training                                          | 60–80% of peak HR                    | 8–12              | 2–3                          |
| Balfour <sup>27</sup>                  | 1991                | Cohort                      | 1                | 0               | Aerobic training                                          | >70% of peak HR                      | 12                | 3                            |

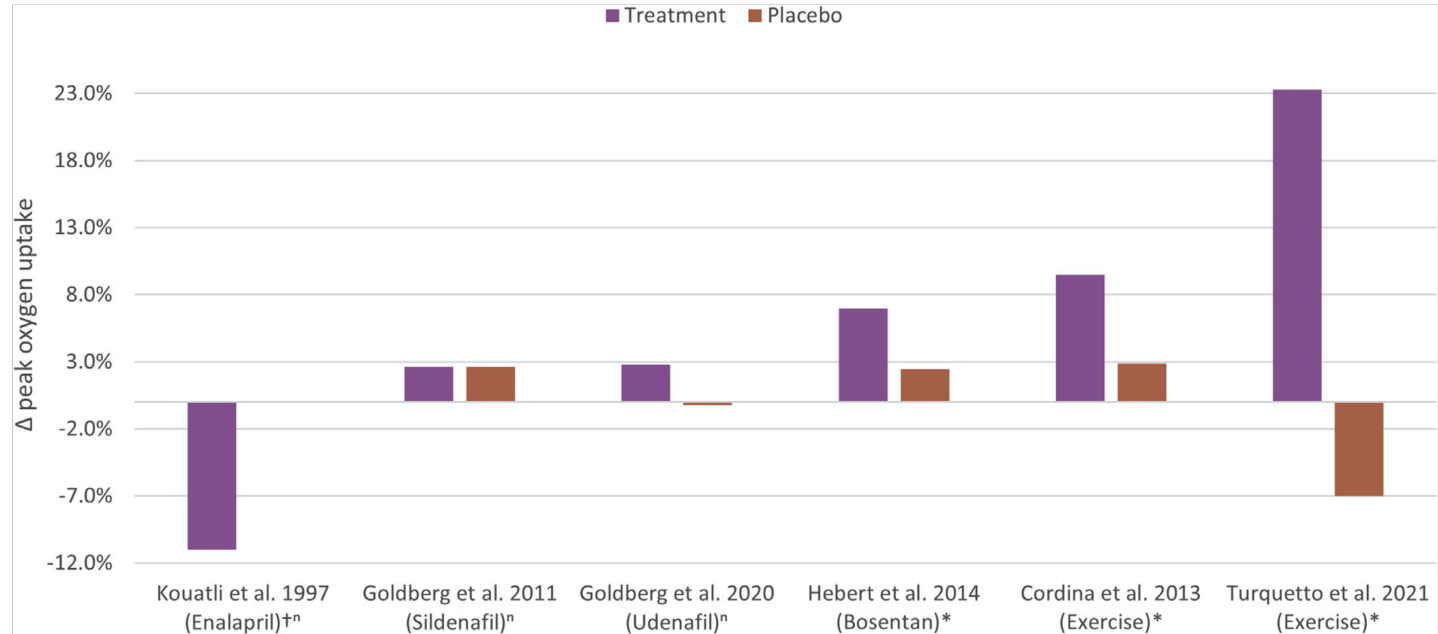


# Functional Capacity



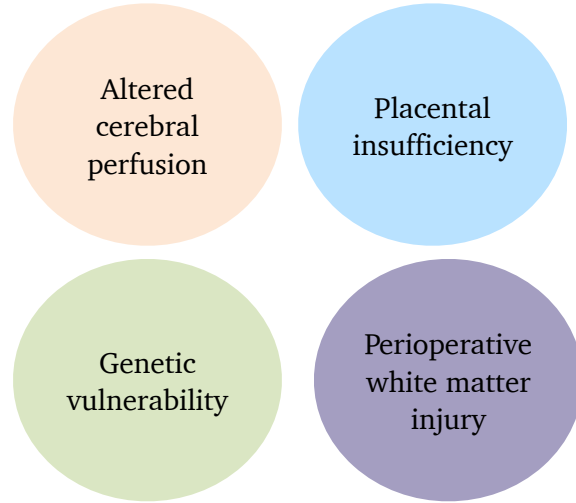
Cunningham JW et al. . Am Heart J. 2017

# Functional Capacity



Khouri M Canadian Journal of Cardiology 2022

# Neuroprotective Role



Verrall CE et al. *Front Pediatr*. 2023  
Selvanathan T et al. *Can J Cardiol*. 2022  
Pike NA et al. *Brain Behav*. 2021  
Beca J et al. *Circulation* 2013

Fontan associated cerebral findings

Reduced Hippocampal Volume

Altered white matter microstructure



Memory Performance

Executive functions

Cognitive functions

Mood regulating processes

# Sleep Quality

↑ Sleep time

↑ Sleep Efficacy

↓ Sleep Disorders

*Callegari A et al. , Front Cardiovasc Med. 2022*  
*Hedlund ER et al. Cardiol Young. 2019*  
*Verrall CE et al. Front Pediatr. 2023*

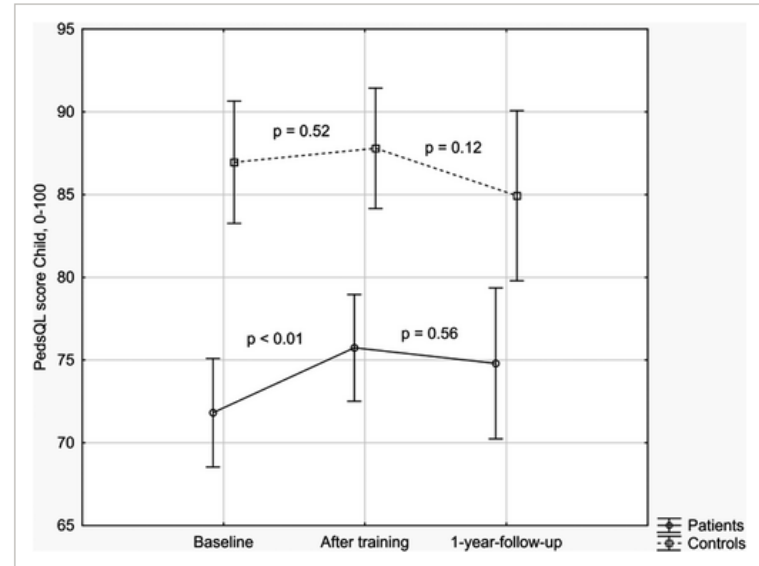
# Quality of life

Fontan patients report a lower quality of life, both in the physical and psychosocial domains

Sutherland N. Et al. Cardiol. Young. 2018  
Uzark K et al. J Pediatr. 2016  
Hedlund ER Cardiol Young. 2018  
McCrindle BW Circulation. 2006



12-week endurance training programme



Hedlund ER Cardiol Young. 2018



## Super-Fontan: Is it possible?

Rachael Cordina, MBBS, PhD, FRACP,<sup>a,b</sup> Karin du Plessis, PhD,<sup>c,d</sup> Derek Tran, BAppSc(ExPhys),<sup>a</sup> and Yves d'Udekem, MD, PhD, FRACS,<sup>c,d,e</sup> Sydney and Melbourne, Australia

From the <sup>a</sup>Sydney Medical School, University of Sydney; <sup>b</sup>Department of Cardiology, Royal Prince Alfred Hospital, Sydney, New South Wales; <sup>c</sup>Heart Research Group, Murdoch Children's Research Institute; <sup>d</sup>Department of Paediatrics, Faculty of Medicine, The University of Melbourne; and <sup>e</sup>Department of Cardiac Surgery, Royal Children's Hospital, Melbourne, Victoria, Australia.

This project was supported by a grant from the National Health and Medical Research Council (Project Grant 1047923). The authors acknowledge support provided to the Murdoch Children's Research Institute by the Victorian Government's Operational Infrastructure Support Program. Y.d.U. is a National Health and Medical Research Council Clinician Practitioner Fellow (1082186).

Received for publication Sept 27, 2017; accepted for publication Oct 16, 2017.

Address for reprints: Yves d'Udekem, MD, PhD, FRACS, Department of Cardiac Surgery, Royal Children's Hospital, Flemington Rd, Parkville, Victoria 3052, Australia (E-mail: yves.dudekem@rch.org.au).

J Thorac Cardiovasc Surg 2017;151:3

0022-522X/36.00

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<https://doi.org/10.1016/j.jtcvs.2017.10.047>

Although outcomes have improved in recent decades for patients with univentricular Fontan physiology, important risk of late failure still exists.<sup>1</sup> Most people living with a Fontan circulation have reduced peak exercise capacity, achieving approximately 60% of predicted peak oxygen uptake ( $\text{VO}_2$ ) measured at cardiopulmonary exercise testing (CPET), and reduced exercise capacity is predictive of mortality.<sup>2</sup> Anecdotal, many doctors caring for these patients recognize there are some physically superior individuals with normal or even supranormal exercise capacity who thrive well into adulthood. We sought to characterize our Fontan cases with superior exercise capacity as the "Super-Fontans."

### MATERIALS AND METHODS

Participants in the Australian and New Zealand Fontan Registry (approved by Human Research Ethics Committees Bi-Nationally) who were aged 16 years of age or more and had undergone CPET since 2010 were screened for inclusion. Subjects with both  $\text{VO}_2$  and peak workload 80% or more of predicted were included in this "superior" cohort. Maximal exercise testing was performed with a ramp-protocol cycle test on an electrically braked bicycle ergometer. Fifteen-second averages of breath-by-breath data were calculated. Peak  $\text{VO}_2$  was defined as maximal averaged value at peak workload. Anaerobic threshold was calculated locally using the V-slope method. Peak  $\text{VO}_2$  was compared with predicted normal values.<sup>3</sup>

### RESULTS

Of 133 participants who had CPET data recorded, 14 (11%) had superior exercise capacity. Subject characteristics are shown in Table 1, and CPET data are shown in Table 2. Of the 14 "Super-Fontans," 11 had documentation in their medical record about current levels of physical activity, and all of them were participating in moderate to vigorous sporting activities at least 3 times per week. All are functioning well socially and are employed or studying full-time toward graduate or

postgraduate qualifications. Mean follow-up time was  $3.8 \pm 2.1$  years. There were no major clinical events recorded during the follow-up period.

### DISCUSSION

Babies born with univentricular physiology now commonly survive well into adulthood after they undergo the Fontan operation.<sup>1</sup> They are expected to have a reduced life expectancy and impaired, progressively decreasing exercise capacity. This report characterizes a subset of "Super-Fontan" individuals exhibiting markedly superior exercise capacity.

One of the striking features of this "Super-Fontan" group was their frequent participation in regular vigorous sporting activities. Most of the cohort (86%) with superior exercise capacity had favorable cardiac anatomy, including tricuspid atresia and double-inlet left ventricle. Other consistent features included minimal valvar regurgitation, no outflow/aortic obstruction or profound desaturation (although 36% had a small fenestration), and, according to employment or academic achievements, a high level of social functioning. Our cohort was equally likely to be male or female and, on average, had normal body mass index. The group was composed of predominantly young adults (mean age, 24 years; range, 16-34 years). It is unclear whether this level of superior performance can be maintained later in adulthood. Another interesting feature of our "Super-Fontan" group was the high frequency of factors that might be expected to inhibit exercise capacity. Twenty-one percent of the subjects had atrioventricular connection, 1 subject had



The Australian and New Zealand Fontan Registry.

#### Central Message

A subset of "Super-Fontans" exist with normal exercise capacity and likely improved outcomes. Characterizing differences between them and the rest of the population may provide key therapeutic insights.



# Screening and Prescription

## Screening

- Structural Assessment
- Functional Assessment
- Rhythm Assessment

## Setting

- Hospital based
- Home based
- Community based
- Supervised
- Semi-supervised
- Unsupervised

## Individualized Action Plan

- Disease Education
- Psychocological support
- Lifestyle management
- Nutritional Counselling
- Breathing techniques

## Exercise Prescription

- Favorite lifestyle activities
- Individualized exercises



Prima di prescrivere qualsiasi attività fisica o sportiva in un bambino, adolescente o giovane adulto con cardiopatia congenita, prima e dopo l'eventuale correzione chirurgica, sono necessari:

1. un preciso inquadramento diagnostico della patologia ed una definizione della sua gravità. Entrambi questi aspetti sono oggi resi agevoli dall'ampia disponibilità di metodiche non invasive quali, l'ECG a riposo, l'ECG da sforzo e di Holter, l'ecocardiogramma in tutte le sue applicazioni, la risonanza magnetica, eccetera;
2. una ragionevole previsione sulla possibile evoluzione nel tempo della cardiopatia e dell'eventuale *impatto su di essa*, sia esso favorevole o sfavorevole, *dell'attività fisico-sportiva prescelta*;
3. la valutazione, per quanto possibile oggettiva, della capacità funzionale del soggetto, mediante test da sforzo, o meglio ancora mediante un test cardio-polmonare. Il test cardio-polmonare è particolarmente utile nei soggetti con cardiopatie congenite complesse sottoposte a correzione chirurgica, che si accompagnano, prima dell'intervento, ad una grave riduzione della capacità funzionale.



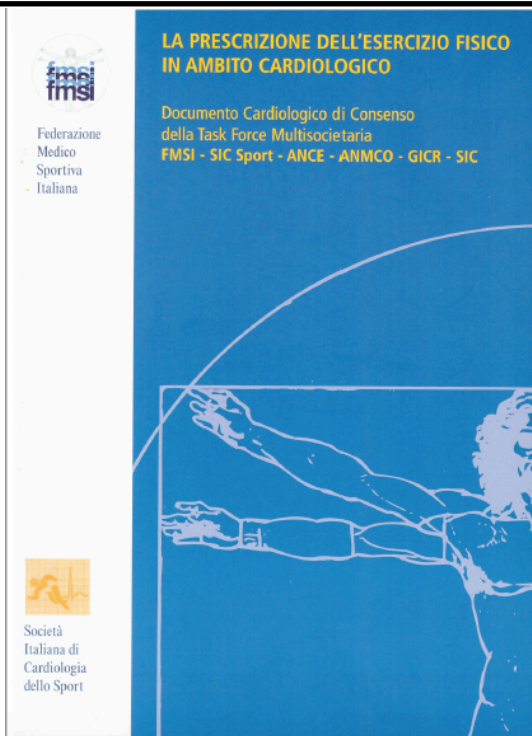


# Exercise as therapy in Congenital Heart Disease

- How to prescribe exercise?
- How much to prescribe?



# CHD and exercise prescription: The Italian Experience



Task-Force 2007



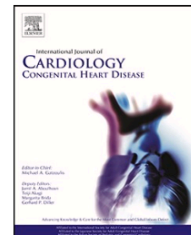
Task-Force 2025



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## International Journal of Cardiology Congenital Heart Disease

journal homepage: [www.journals.elsevier.com/international-journal-of-cardiology-congenital-heart-disease](http://www.journals.elsevier.com/international-journal-of-cardiology-congenital-heart-disease)



### Empowering congenital heart disease treatment: Physical activity prescription. The Italian proposal

Berardo Sarubbi<sup>a,e,\*</sup>,<sup>1</sup> , Raffaella Marzullo<sup>b</sup>, Michela Cammarano<sup>c</sup>, Massimiliana Abbate<sup>a</sup>, Antonio Orlando<sup>a</sup>, Attilio Turchetta<sup>d</sup>, Paolo Zeppilli<sup>c</sup>, on behalf of Italian Federation of Sports Medicine, Italian Society of Sports Cardiology, with the collaboration of Italian Association of Hospital Cardiologists and Italian Society of Cardiology

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<sup>e</sup> Parthenope University of Naples, Naples, Italy

**Prescrizione dell'esercizio fisico nei pazienti con fattori di rischio e malattie cardiovascolari.**

## **CARDIOPATIE CONGENITE**

*Berardo Sarubbi, Raffaella Marzullo, Michela Cammarano, Attilio Turchetta, Paolo Zeppilli.*

*Con il contributo di Antonio Orlando e Massimiliana Abbate*



| <b>Tetralogia di Fallot</b>                                                                                                                                                                                                                       | <b>Attività fisica prescrivibile</b>                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Assenza di sequele emodinamicamente significative - Assenza di aritmie ipercinetiche - Assenza di ischemia inducibile - Assenza di dilatazione dell'aorta ascendente- Assenza di fattori di rischio per Morte Cardiaca Improvvisa                 | A scelta del paziente                                                                                                         |
| Ostruzione destra significativa asintomatica - Insufficienza polmonare di grado moderato-severo asintomatica- Funzione biventricolare preservata - Assenza di aritmie spontanee e/o inducibili<br>(2-3 sedute settimanali – durata fino a 20 min) | Camminata veloce<br>Nuoto<br>Esercizi acquatici<br>Danza<br>Yoga dinamico<br>Ciclismo su Terreni Pianeggianti<br>Sci di Fondo |
| Ostruzione destra severa sintomatica - Insufficienza polmonare moderata-severa sintomatica- Disfunzione e/o dilatazione ventricolare- Aritmie atriali/ventricolari<br>(2 sedute settimanali – durata fino a 10-15 min)                            | Camminata<br>Yoga<br>Ginnastica e stretching                                                                                  |



**Prescrizione dell'esercizio fisico nei pazienti con fattori di rischio e malattie cardiovascolari.**

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| <b>Ventricolo destro sistemico</b>                                                                                                                                                       | <b>Attività fisica consigliata</b>                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Buona capacità funzionale – no aritmie<br>(2-3 sedute settimanali – durata fino a 30 min)                                                                                                | Camminata veloce<br>Corsa leggera<br>Nuoto<br>Esercizi acquatici<br>Danza<br>Yoga dinamico<br>Ciclismo su Terreni Pianeggianti |
| Discreta Capacità funzionale – Insufficienza valvola AV sistemica < moderata – Extrasistolia sopraventricolare e/o ventricolare isolata<br>(2 sedute settimanali – durata fino a 20 min) | Camminata<br>Yoga<br>Ginnastica e stretching                                                                                   |
| Disfunzione ventricolare - Insufficienza valvola AV sistemica > moderata – aritmie maggiori                                                                                              | Valutazione caso per caso                                                                                                      |



**Prescrizione dell'esercizio fisico nei pazienti con fattori di rischio e malattie cardiovascolari.**

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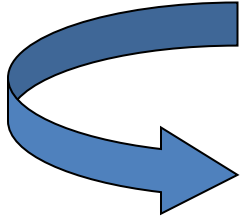
*Con il contributo di Antonio Orlando e Massimiliana Abbate*



| <b>Cuore univentricolare</b>                                                                                                                                                                                                   | <b>Attività fisica consigliata</b>                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Palliazione sec Glenn: Saturazione >80% a riposo e >70% durante sforzo<br>- Buona funzione contrattile Ventricolo Unico- Assenza di scompenso cardiaco - Assenza di aritmie<br>(2-3 sedute settimanali – durata fino a 20 min) | Camminata veloce<br>Nuoto<br>Esercizi acquatici<br>Danza<br>Yoga dinamico<br>Ciclismo su Terreni Pianeggianti<br>Ginnastica e stretching |
| Palliazione sec Fontan : Saturazione >90% durante sforzo - Buona funzione contrattile ventricolo unico- Assenza di scompenso cardiaco - Assenza di aritmie<br>(2-3 sedute settimanali – durata fino a 15 min)                  | Camminata veloce<br>Nuoto<br>Esercizi acquatici<br>Danza<br>Yoga dinamico<br>Ciclismo su Terreni Pianeggianti<br>Ginnastica e stretching |



# Congenital Heart Disease and Exercise





**"Pediatric congenital cardiac becomes a postoperative adult: the changing population of congenital heart disease"**

Perloff JK. Circulation 1973; 47:606-619



... we are obliged to look beyond the present and define our ultimate goal: the quality of long-term survival...



# JOINT INTERNATIONAL CONGRESS IN ADULT CONGENITAL HEART DISEASE



Save the date!

**NAPLES**  
**2-3**  
**OCTOBER**  
**2026**

*See you soon in Naples*

*Scientific directors:*

Margarita **Brida**  
Michael A. **Gatzoulis**  
Berardo **Sarubbi**  
Giancarlo **Scognamiglio**

## MAIN TOPICS

- Arrhythmia
- Advanced heart failure
- Challenges in percutaneous treatment
- Advanced imaging
- Role of AI
- Ageing and acquired heart disease
- Surgery for complex patients

*Information and registration:*

<https://www.defla.it/evento/joint-international-congress-in-adult-congenital-heart-disease/>



*Organizing secretariat:*

[www.defla.it](http://www.defla.it) - - [congressi@defla.it](mailto:congressi@defla.it)

