Exercise Guidelines in PO CHD Patients

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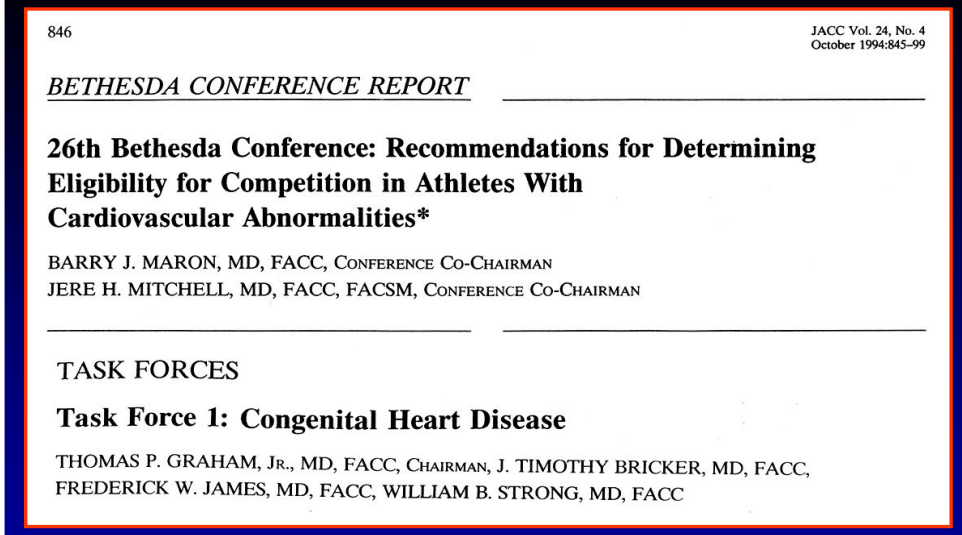
Why Exercise Guideline is needed ?

- ✓ Pts c certain CHD may be at increased risk on exercise
- ✓ Overprotection is common in children c CHD
  → Sedentary lifestyle c diminished physical work capacity
- ✓ Physical inactivity-associated CV & other disease
- ✓ Perception & motor activity are ass c
  physical, emotional, psychological & cognitive development
  -> should not be discouraged !
- ✓ If restriction of execise is needed, information should be given at early adolescent stage (10-12yrs)



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BETHESDA CONFERENCE REPORT

26th Bethesda Conference: Recommendations for Determining Eligibility for Competition in Athletes With Cardiovascular Abnormalities*

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TASK FORCES

Task Force 1: Congenital Heart Disease

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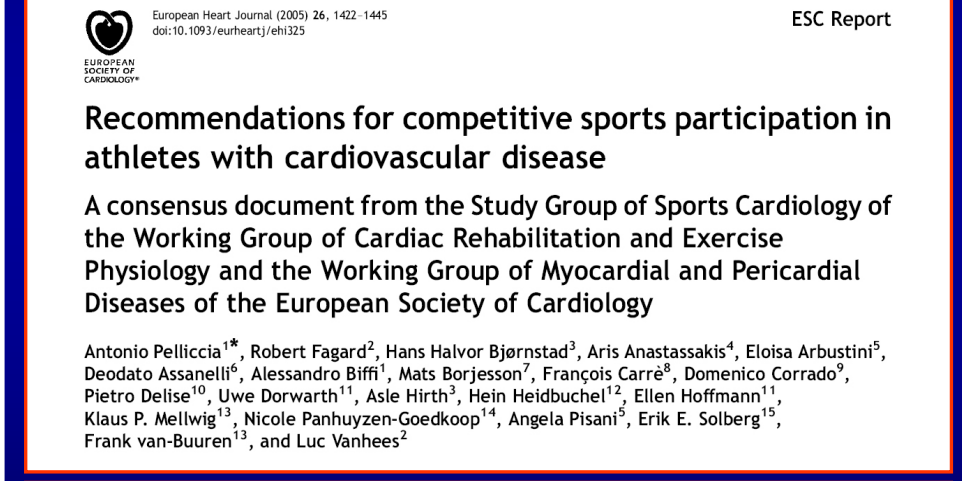

European Heart Journal (2005) **26**, 1422–1445
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ESC Report

EUROPEAN SOCIETY OF CARDIOLOGY®

Recommendations for competitive sports participation in athletes with cardiovascular disease

A consensus document from the Study Group of Sports Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology

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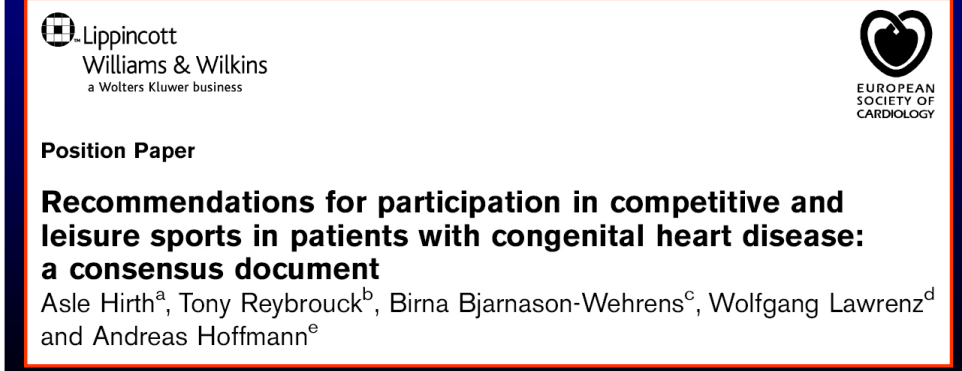

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Position Paper

Recommendations for participation in competitive and leisure sports in patients with congenital heart disease: a consensus document

Asle Hirth[a], Tony Reybrouck[b], Birna Bjarnason-Wehrens[c], Wolfgang Lawrenz[d] and Andreas Hoffmann[e]

✓ Exercise recommendation for CHD pts

- 1985 - 16th Bethesda conference
- 1994 - 26th Bethesda conference report
- 2005 - ESC Report
  → not applied to recreational or leisure sports activities
- 2006 - Consensus report including 'leisure sports'

✓ Competitive athletes

- Amateur or professional
- Regular exercise training
- High premium on athletic excellence and achievements in official sports competition

✓ Recommendations for 'leisure' 'recreational' or sports are difficult to state

- Diversity of individual state, response to exercise, ass. residua
- Lacking of evidence

Classification of Exercise

- ✓ Competitive vs Recreational
- ✓ Isotonic (dynamic) vs Isometric (static)

- Classification of Exercise (I) -
: Competitive vs Recreational

Competitive	Recreational
requires vigorous, systematic training	Not requires
physically, emotionally demanding	less demanding
higher desire to win / achieve	less
No (little) lattitude of judging to stop	

→ *Overlap is common !!*

– Classification of Exercise (II) –
: Isotonic (Dynamic) vs Isometric (Static)

Isotonic (Dynamic)	Isometric (Static)
rhythmic contraction	sudden contraction
small force	large force
steady state (+)	steady state (-)
CO, SV, O2 consumption ↑	small change
syst BP↑ but unchanged mBP	syst, dias, mBP ↑
volume overload	pressure overload
Amenable to control	not amenable to control

→ ***Overlap is common !!***

Considerations to Determine Recommendations

✓ **Patient**

- Severity of CV abnormality
- Physiologic consequences of abnormality
- Psychologic response to training & competition

  → should be modified by judgment of physician

✓ **Exercise**

- Type / duration / intensity of exercise
- Risk of bodily collision
- Training program for given sports
- Emotional response to the activity
- Risk of syncope : athlete / spectator / bystander

Classification of Sports

	A. Low Isotonic	B. Moderate Isotonic	C. High Isotonic
I. Low Isometric	Billiards Bowling Cricket Golf Riflery	Baseball Softball Table tennis Tennis (doubles) Volleyball	Badminton Cross-country skiing (classic) Field hockey* Race walking Racquetball Running (long distance) Soccer* Squash Tennis (singles)
II. Mod. Isometric	Archery Auto racing*† Diving*† Equestrian*† Motorcycling*†	Fencing Field events (jumping) Figure skating* Football (American)* Rodeoing*† Rugby* Running (sprint) Surfing*† Synchronized swimming†	Basketball* Ice hockey* Cross-country skiing (skating) Football (Australian)* Lacrosse* Running (middle distance) Swimming Team handball
III. High Isometric	Bobsledding*† Field events (throwing) Gymnastics*† Karate/Judo* Sailing Rock climbing*† Water skiing*† Weight lifting*† Windsurfing*†	Body building*† Downhill skiing*† Wrestling*	Boxing* Canoeing/kayaking Cycling*† Decathlon Rowing Speed skating

*: danger of bodily collision, † ; increased risk if syncope occurs

Table 1. Classification of sports (*Eur Heart J 2005;26:1422-45*)

	A. Low dynamic	B. Moderate dynamic	C. High dynamic
I. Low static	Bowling Cricket Golf Riflery	Fencing Table tennis Tennis (doubles) Volleyball Baseball[a]/softball[a]	Badminton Race walking Running (marathon) Cross-country skiing (classic) Squash[a]
II. Moderate static	Auto racing[a,b] Diving[b] Equestrian[a,b] Motorcycling[a,b] Gymnastics[a] Karate/Judo[a] Sailing Archering	Field events (jumping) Figure skating[a] Lacrosse[a] Running (sprint)	Basketball[a] Biathlon Ice hockey[a] Field hockey[a] Rugby[a] Soccer[a] Cross-country skiing (skating) Running (mid/long) Swimming Tennis (single) Team handball[a]
III. High static	Bobsledding[a,b] Field events (throwing) Luge[a,b] Rock climbing[a,b] Waterskiing[a,b] Weight lifting[a] Windsurfing[a,b]	Body building[a] Downhill skiing[a,b] Wrestling[a] Snow boarding[a,b]	Boxing[a] Canoeing, Kayaking Cycling[a,b] Decathlon Rowing Speed skating Triathlon[a,b]

Adapted and modified after Mitchell et al.[5], [a]Danger of bodily collision. [b]Increased risk if syncope occurs.

Table 2 Recommendations for competitive sport participation in athletes with CHDs

Lesion	Evaluation	Criteria for eligibility	Recommendation	Follow-up
ASD (closed or small, unoperated) and Patent foramen ovale	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	<6 mm defect, or 6 months post-closure, with normal pulmonary artery pressure, no significant arrhythmia or ventricular dysfunction	All sports In patients with PFO, percutaneous closure may be considered before regular scubadiving	Yearly
VSD (closed or small unoperated)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	Restrictive defect (left-to-right gradient >64 mmHg) or 6 months post-closure, no pulmonary hypertension	All sports	Yearly
AVSD	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	No or only mild AV valve insufficiency, no significant subaortic stenosis or arrhythmia, normal maximal gas exchange measurements	All sports	Yearly. Complete reassessment every second year
Partial or complete anomalous pulmonary venous connection	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET, MRI	No significant pulmonary or systemic venous obstruction, no pulmonary hypertension or exercise-induced atrial arrhythmia	All sports	Yearly
Persistent ductus arteriosus (operated)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	6 months post-closure and no residual pulmonary hypertension	All sports	Not needed
Pulmonary stenosis (mild native or treated)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	Native or 6 months post-interventional/post-surgical; peak transvalvular gradient <30 mmHg, normal RV, normal ECG or only mild RV hypertrophy, no significant arrhythmias	All sports	Yearly
Pulmonary stenosis (moderate native or treated)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	Native or 6 months post-interventional/post-surgical; peak transvalvular gradient between 30 and 50 mmHg, normal RV, normal ECG or only mild RV hypertrophy	Low and moderate dynamic and low static sport (I A, B)	Every 6 months
Coarctation of the aorta (native or repaired)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET, MRI	No systemic hypertension; peak pressure gradient between the upper and lower limbs of <21 mmHg, a peak systolic BP during exercise of <231 mmHg, no ischaemia on exercise ECG, no LV overload.	Low and moderate dynamic and static sport (I A,B + II A, B) If interposed graft avoid sport with a risk of bodily collision	Yearly. Complete reassessment every second year
Aortic stenosis (mild)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	Mean transvalvular gradient <21 mmHg, no history of arrhythmia, no syncope, dizziness, or angina pectoris	All sports, with exception of high static, high dynamic sports	Yearly
Aortic stenosis (moderate)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET, 24 h Holter	Mean transvalvular gradient between 21 and 49 mmHg, no history of arrhythmia, no syncope, dizziness, or angina pectoris	Low dynamic and static sport (IA)	Every 6 months
Tetralogy of fallot	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET, 24 h Holter, MRI	Non or only mild RVOT obstruction, no more than mild pulmonary regurgitation, a normal or near normal biventricular function and no evidence of arrhythmia Moderate residual lesion with RV pressure <50% of systemic pressure, or residual VSD or moderate pulmonary regurgitation, but normal biventricular function	Low and moderate static and dynamic sport (I A,B + II A, B) Low static and dynamic sport (IA) Patients with conduit should avoid sport with risk of bodily collision	Yearly. Complete reassessment every second year
Transposition of the great arteries (arterial switch)	History, NYHA functional class, PE, ECG, Echo, chest X-ray, ET	No or only mild neo-aortic insufficiency, no significant pulmonary stenosis, no signs of ischaemia or arrhythmia on exercise ECG	All sports, with exception of high static, high dynamic sports	Yearly

Eur Heart J. 2005;26:1422-45

Yonsei Pediatric Cardiology

Evaluation & Follow-up

Eur Heart J. 2005;26:1422-45

✓ Evaluation

- Hx / PE / NYHA FC / ECG / CXR / Echo / ET for all PoCHD
- MRI for APVR / CoA / TOF (other disease for RV fnc)
- 24hr Holter for moderate AS / TOF

✓ Follow-up

- Yearly for most diseases
- Not needed for PDA
- F/U q 6mo for moderate PS / moderate AS
- Complete reassessment every 2nd yr for CoA / TOF

Recommendation for Eligibility (I)

Eur Heart J. 2005;26:1422-45

- ✓ **Begin exercise at 6mo postop**
- ✓ **Simple disease : PDA / ASD / VSD**
  all sports if no pulm HiBP, arrhythmia, vent dysfunction
- ✓ **AVSD : all sports if no significant AVVI, SAS, NL gas exchange**
- ✓ **APVR : all sports if no significant pulm / syst venous obstruction, no pulm HiBP, atrial arrhythmia**
- ✓ **PS, mild (dP<30mmHg) :**
  all sports if NL RV, ECG, no significant arrhythmia, mild RVH
- ✓ **PS, moderate (30<dP<50) :**
  low~mod dynamic, low static (IA, IB) if NL RV, ECG, mild RVH
- ✓ **AS, mild (mdP<21mmHg) :**
  all sports except high ststic & dynamic (III, C), if no arrhythmia, syncope, dizziness, angina
- ✓ **AS, moderate (21<mdP<49) : low dynamic & static (IA)**

Recommendation for Eligibility (II)

Eur Heart J. 2005;26:1422-45

- ✓ **CoA* : low~mod dynamic & static (IA,B + IIA,B) if dP<21mmHg, peak exBP <231mmHg, No Ex-ECG ischemia, LV overload**
- ✓ **TOF* :**

  low~mod dynamic & static (IA,B + IIA,B) if ≤ mild RVOTO, PR, no arrhythmia, (near) NL BV function

  low static & dynamic (IA) if mod residual with RVP<50% SVP, residual VSD, mod PR, but NL BV function
- ✓ **TGA :**

  all sports except high ststic & dynamic (III, C), if ≤mild neo-AI, no significant PS, no ischemia/arrhythmia on Ex-ECG

** : interposed graft or conduit should avoid sport c bodily collision*

Guideline for 'Leisure Sports' ?

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Eligibility & Recommendation for Sports

Eur J Cardiovasc Prev Rehabil 2006;13:293-9

Eligible	Not eligible
I Surgical procedure	Uncorrected or palliative corrected
Fully corrected (anatomically)	Significant lesions not operated
	Univentricular hearts
	Mustard, Senning or Rastelli corrected TGA
	Arterio-pulmonal shunts
II Medical history	
Satisfactory	Abnormal
NYHA class I	Symptoms of severe palpitations/syncope
	Exercise-induced symptoms (dyspnoea, angina, palpitations, syncope)
	NYHA class II or higher
III Physical examination	
Satisfactory	Abnormal
	Hypertension
	Hepatomegaly, raised venous pressure
IV ECG/Holter	
Satisfactory	Abnormal
	Ischemia (coronary anomaly, TGA-switch)
	QRS-duration (Fallot)
	Significant hypertrophy
	Significant arrhythmia
V Morphology/haemodynamic	
Satisfactory	Abnormal
	Significant rest-lesion
	Mean transvalvular gradient of aorta $\geq$ 20 mmHg
	Peak transvalvular gradient of the pulmonary artery of $>$50 mmHg
	Significant hypertrophy
	Significant myocardial dysfunction
	Pulmonary hypertension
VI Maximal ergospirometry	
Satisfactory	Abnormal
Values within normal range	Chest pain or syncope
	Significant arrhythmia
	Ischemia on ECG

Lesion	Recommendation
ASD (closed or non-significant or PFO)	No restrictions
	Scuba diving should be avoided in those with a remaining shunt, due to the risk of paradoxical embolism
VSD (closed or non-significant)	No restrictions
PDA (closed or non-significant)	No restrictions
AVSD (successfully repaired)	No restrictions
Moderate MVR	Low to moderate dynamic and static sports
PAPVC/TAPVC (successfully repaired)	No restrictions
Pulmonary stenosis (mild)	No restrictions
Moderate	Low to moderate dynamic and static sports
Aortic stenosis (mild)	Low to moderate dynamic and static sports
Moderate	Low dynamic and static sports
	No competitive sport if left ventricular dysfunction or symptoms
CoA (successfully repaired)	No restrictions[a]
TOF (successfully repaired)	Low to moderate dynamic and static sports[a]
Residual disease	Low dynamic and static sports[a]
TGA	
asoTGA (successfully repaired)	No restrictions
iarTGA, ccTGA	Low to moderate dynamic and low static sports[b]
Ebstein anomaly	Low to moderate dynamic and low static sports[b]
Univentricular hearts/Fontan circulation	Low to moderate dynamic and low static sports[b]
Eisenmenger's syndrome	Low dynamic sports[b]
Congenital coronary artery anomalies	No restrictions
Successfully repaired	

Recommendation for Sports Participation (I)

Eur J Cardiovasc Prev Rehabil 2006;13:293-9

Lesion	Recommendation
ASD (closed or non-significant or PFO)	No restrictions Scuba diving should be avoided in those with a remaining shunt, due to the risk of paradoxical embolism
VSD (closed or non-significant)	No restrictions
PDA (closed or non-significant)	No restrictions
AVSD (successfully repaired)	No restrictions
Moderate MVR	Low to moderate dynamic and static sports
PAPVC/TAPVC (successfully repaired)	No restrictions
Pulmonary stenosis (mild)	No restrictions
Moderate	Low to moderate dynamic and static sports
Aortic stenosis (mild)	Low to moderate dynamic and static sports
Moderate	Low dynamic and static sports No competitive sport if left ventricular dysfunction or symptoms
CoA (successfully repaired)	No restrictions[a]

a : interposed graft or conduit should avoid sport c bodily collision

Recommendation for Sports Participation (II)

Eur J Cardiovasc Prev Rehabil 2006;13:293-9

Lesion	Recommendation
TOF (successfully repaired)	Low to moderate dynamic and static sports[a]
Residual disease	Low dynamic and static sports[a]
TGA	
asoTGA (successfully repaired)	No restrictions
iarTGA, ccTGA	Low to moderate dynamic and low static sports[b]
Ebstein anomaly	Low to moderate dynamic and low static sports[b]
Univentricular hearts/Fontan circulation	Low to moderate dynamic and low static sports[b]
	Low dynamic sports[b]
Eisenmenger's syndrome	No restrictions
Congenital coronary artery anomalies	
Successfully repaired	

a : interposed graft, conduit or on anticoagulants should avoid sport with bodily collision, b : No competitive sports

What's different?

Eur J Cardiovasc Prev Rehabil 2006;13:293-9

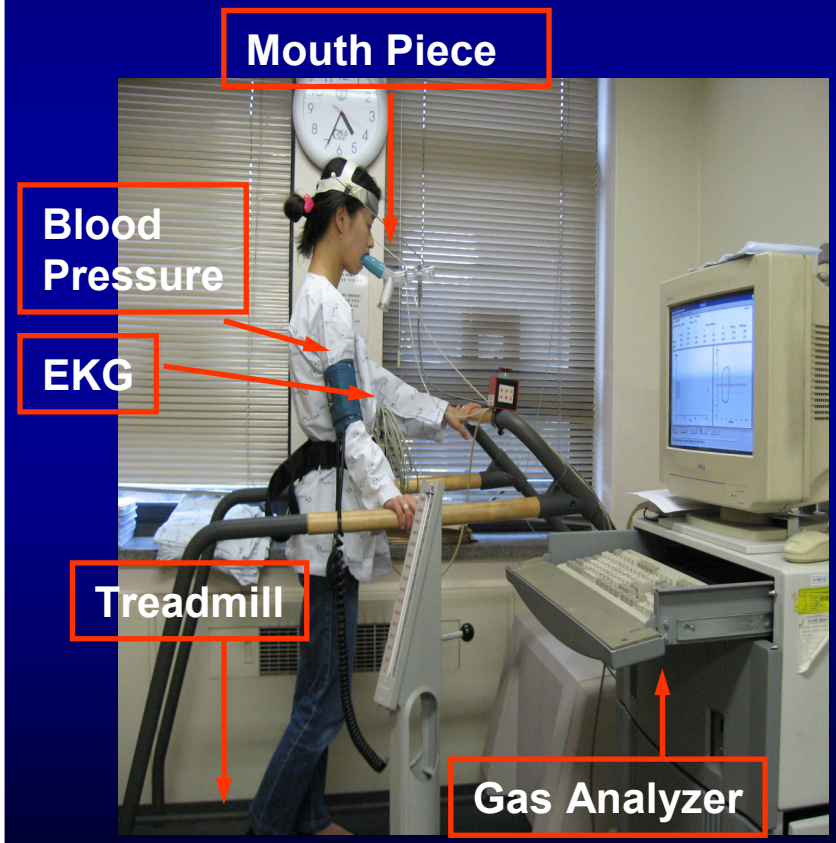
- ✓ **All pt c CHD should be followed on a regular basis**
  → but no need for specific F/U in pts only participating in leisure sports
  → for competitive sports, structured reassessment every year

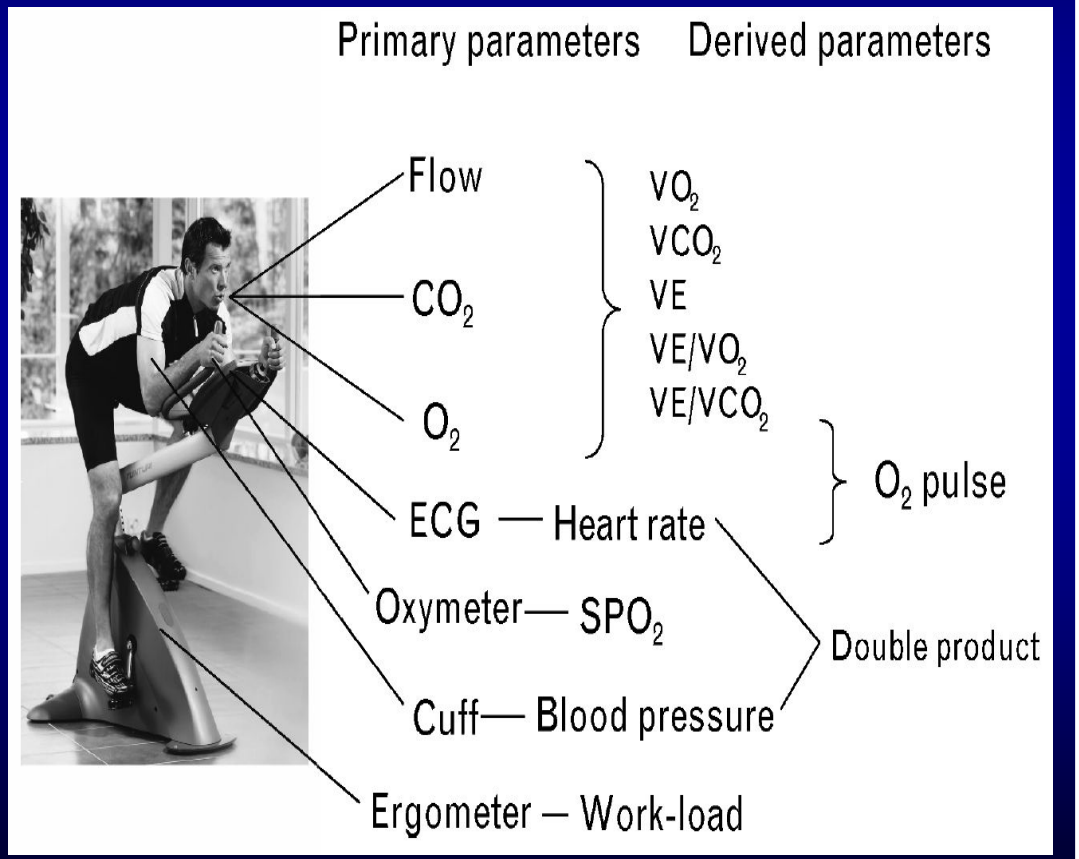
- ✓ **Prepubertal children need no restrictions in physical activity**

- ✓ **Regular exercise at a recommended level should be encouraged**
  → tailored advice to each individual is needed

How to make a tailored recommendation ?

Cardiopulmonary Exercise Test (CPX)






Conduits
Vascular function
Dysfunction of the Valves

Conclusion

- Exercise has positive effect on both physical and mental health, and exercise should be restricted in only those patients who are likely to carry risk from exercise.
- It is impossible to state recommendations that are valid in all patient after operation of CHD.
- Examining physician should tailor the recommendations to each individual patient on the appropriate basis.


Thank you
for your attention !!