



PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

**ROMA**

Centro Congressi  
di Confindustria

Auditorium  
della Tecnica

9<sup>a</sup> Edizione

30 Settembre  
1 Ottobre  
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## Minicorso di Cardiologia dello Sport

É vero che lo sport può peggiorare le valvulopatie?

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I have no conflict of interest.



# Partiamo dalle certezze...

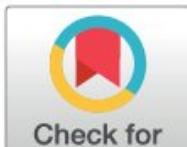
- La sedentarietà non fa bene



## A. Healthy individuals

## RESEARCH ARTICLE

# Dose-response association between moderate to vigorous physical activity and incident morbidity and mortality for individuals with a different cardiovascular health status: A cohort study among 142,493 adults from the Netherlands



Esmée A. Bakker <sup>1,2</sup>, Duck-chul Lee <sup>3</sup>, Maria T. E. Hopman <sup>1</sup>, Eline J. Oymans <sup>1</sup>, Paula M. Watson <sup>2</sup>, Paul D. Thompson <sup>4</sup>, Dick H. J. Thijssen <sup>1,2</sup>, Thijs. M. H. Eijsvogels <sup>1\*</sup>

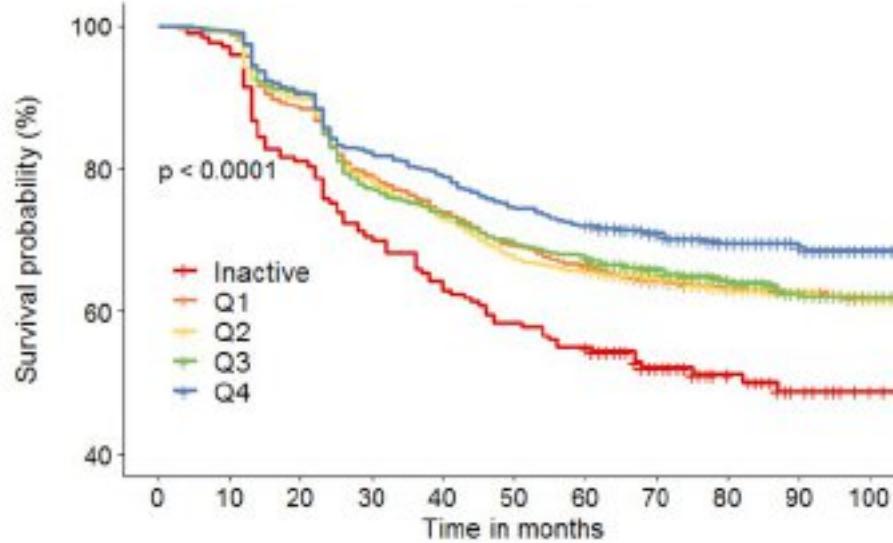


Time in months

Bakker Plos Medicine 2021



### C. Individuals with cardiovascular diseases



|          | Number at risk |     |     |     |     |     |     |     |     |     |     |
|----------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|          | 0              | 10  | 20  | 30  | 40  | 50  | 60  | 70  | 80  | 90  | 100 |
| Inactive | 173            | 168 | 140 | 122 | 111 | 101 | 95  | 64  | 49  | 27  | 14  |
| Q1       | 795            | 787 | 705 | 630 | 589 | 551 | 528 | 381 | 271 | 167 | 100 |
| Q2       | 702            | 695 | 631 | 552 | 514 | 477 | 461 | 344 | 233 | 144 | 84  |
| Q3       | 784            | 779 | 713 | 605 | 579 | 548 | 532 | 402 | 258 | 138 | 62  |
| Q4       | 605            | 601 | 548 | 498 | 479 | 452 | 435 | 332 | 231 | 143 | 85  |

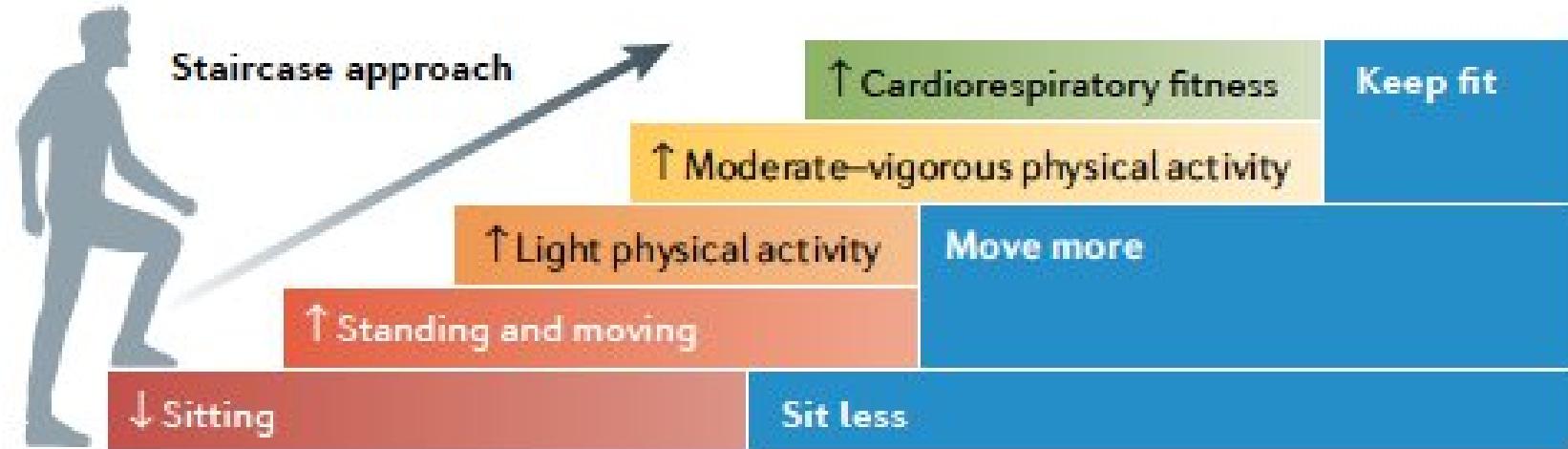
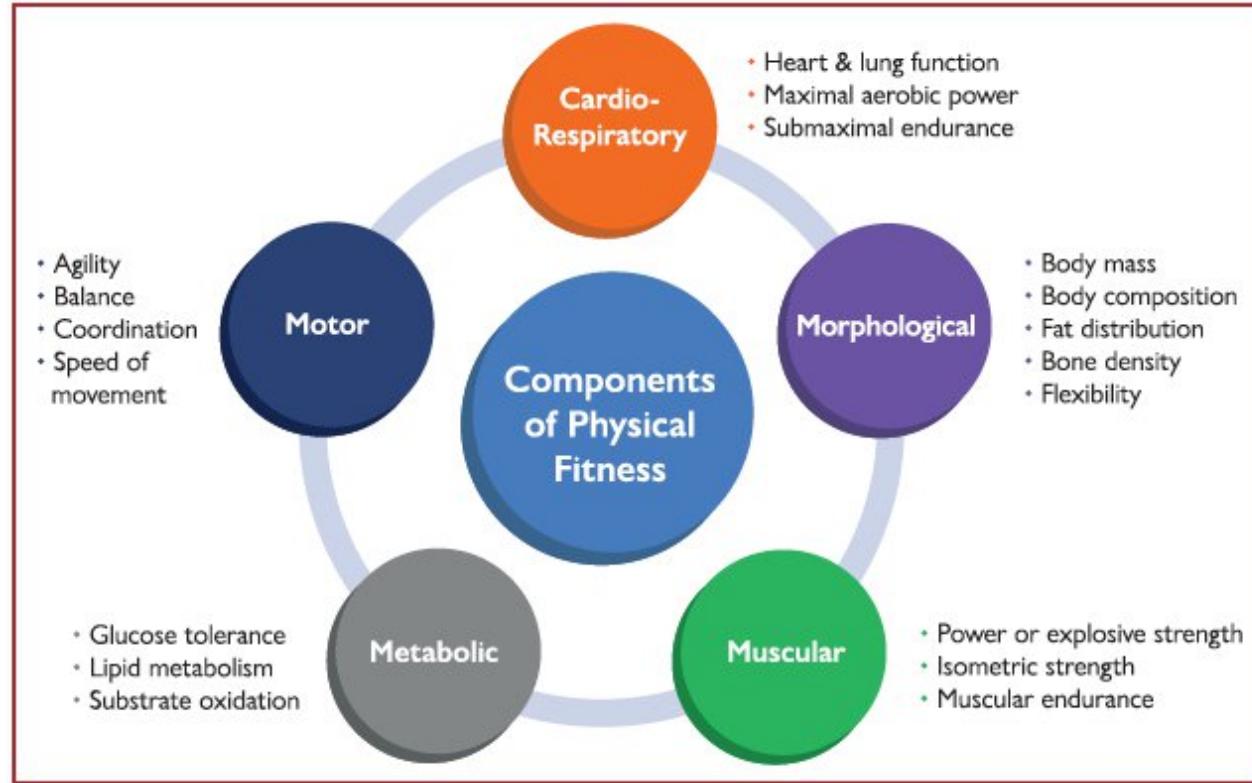


Fig. 5 | The 'sitting less and moving more' strategy. Sitting less and moving more might

Dunstan, Nat Rev  
Cardiol 2021



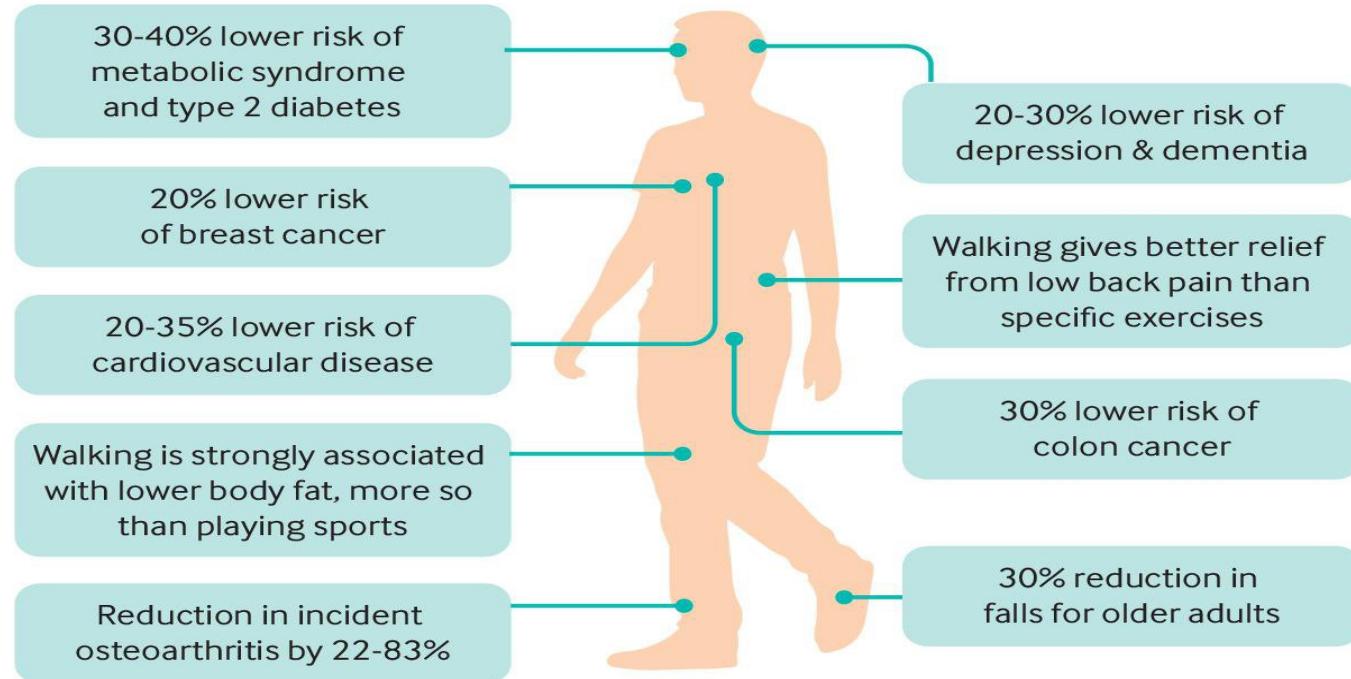
©ESC 2020

Pelliccia EHJ 2020



## PHYSICAL ACTIVITY: SOME OF THE POTENTIAL BENEFITS

30% lower all-cause mortality comparing most active individuals with least active.  
Even 10 minutes of brisk walking a day is likely to reduce mortality  
by up to 15%, irrespective of baseline fitness





# Sedentarietà e esercizio fisico

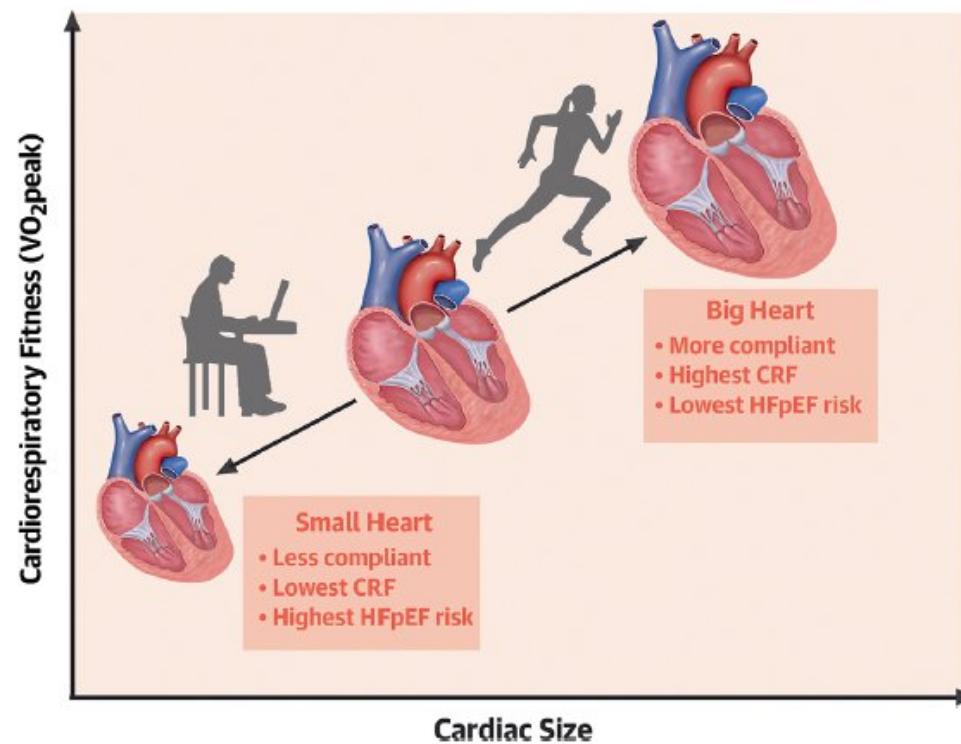
|  | <b>Mitochondrial</b>   | <b>Skeletal Muscle</b>   | <b>Cardiac Muscle</b>   | <b>Conduit Arteries</b>   |
|--|--|--|---|---|
| <b>Sedentary</b><br>         | <ul style="list-style-type: none"> <li>↑ mitochondrial DNA deletions and mutations<sup>71</sup></li> <li>Electron transport chain abnormalities<sup>72</sup></li> <li>↑ mitochondrial fission<sup>73</sup></li> <li>↓ mitochondrial content<sup>74</sup></li> <li>↓ respiration<sup>4</sup></li> </ul>                       | <ul style="list-style-type: none"> <li>↑ IL-6 and CRP<sup>80</sup></li> <li>Activation of proteolytic systems<sup>81</sup></li> <li>Inactivation of the PI3K/Akt/mTOR pathway<sup>82</sup></li> <li>↓ lean muscle mass<sup>83</sup></li> <li>Greater proportion of hybrid fibers possibly due to dysregulation in MHC isoform expression<sup>84</sup></li> </ul> | <ul style="list-style-type: none"> <li>↑ AGE accumulation indicative of collagen cross-linking<sup>87</sup></li> <li>↑ Left ventricular stiffness<sup>88</sup></li> <li>β-adrenergic receptor desensitization resulting in impaired inotropic and chronotropic responses to adrenergic stimulation<sup>89, 90</sup></li> <li>↓ SERCA2a contributes to prolonged calcium transients<sup>91</sup></li> </ul>          | <ul style="list-style-type: none"> <li>↓ sympathetic baroreflex sensitivity and ↓ sympathetic activation<sup>94</sup></li> <li>↑ NOS uncoupling, ↓ NO bioavailability, thereby ↑ oxidative stress<sup>94</sup></li> <li>Extracellular matrix remodeling through elastin degradation by MMPs and formation of AGEs<sup>95</sup></li> <li>Endothelial dysfunction<sup>96</sup></li> </ul>                     |
| <b>Physical Activity</b><br> | <ul style="list-style-type: none"> <li>↑ mitochondrial protein turnover through degradation of damaged proteins and de novo synthesis of new functional proteins<sup>76</sup></li> <li>↑ expression of PGC-1α<sup>76, 77</sup></li> <li>↑ SIRT3 content<sup>78</sup></li> <li>↑ mitochondrial volume<sup>79</sup></li> </ul> | <ul style="list-style-type: none"> <li>↑ metabolic enzymes profile: citrate synthase, β-HAD, glycogen phosphorylase<sup>85</sup></li> <li>↓ catabolic mRNA expression (FOXO3a, MuRF-1, Atrogin-1, myostatin)<sup>86</sup></li> <li>↑ capillary-to-fiber ratio<sup>85</sup></li> <li>↑ insulin sensitivity<sup>78</sup></li> </ul>                                | <ul style="list-style-type: none"> <li>↑ SERCA2a mRNA &amp; protein expression<sup>92</sup></li> <li>↑ phosphorylation of threonine-17 residue of phospholamban allowing for faster reuptake of cytoplasmic calcium<sup>92</sup></li> <li>↑ contractility and relaxation due to faster systolic rise and diastolic decay time of calcium<sup>93</sup></li> <li>↓ Left ventricular stiffness<sup>88</sup></li> </ul> | <ul style="list-style-type: none"> <li>Lower expression of the transcription factor p53 which is associated with senescence compared to sedentary counterparts<sup>97</sup></li> <li>Lower markers of senescence (p21 and p16)<sup>97</sup></li> <li>↓ expression of nitrotyrosine and NADPH oxidase (prooxidant)<sup>98</sup></li> <li>↑ expression of manganese SOD (antioxidant)<sup>98</sup></li> </ul> |

# Heart Function Ejection Fraction Exercise Capacity

## JACC Focus

Andre La Gerche, MD  
Benjamin D. Levine, MD

### CENTRAL ILLUSTRATION The Spectrum of Physical Activity, Cardiorespiratory Fitness, and Cardiac Remodeling



La Gerche A, et al. J Am Coll CardioL 2022;80(12):1177-1191.



ABIM  
MOC  
ACCREDITED



# Attività fisica vs esercizio fisico

Attività fisica o motoria



comprende tutti i movimenti del corpo che comportano un dispendio energetico. Sono comprese le attività quotidiane come le faccende domestiche, la spesa, il lavoro

Esercizio fisico



comprende i movimenti ripetitivi programmati e strutturati specificamente destinati al miglioramento della forma fisica e della performance

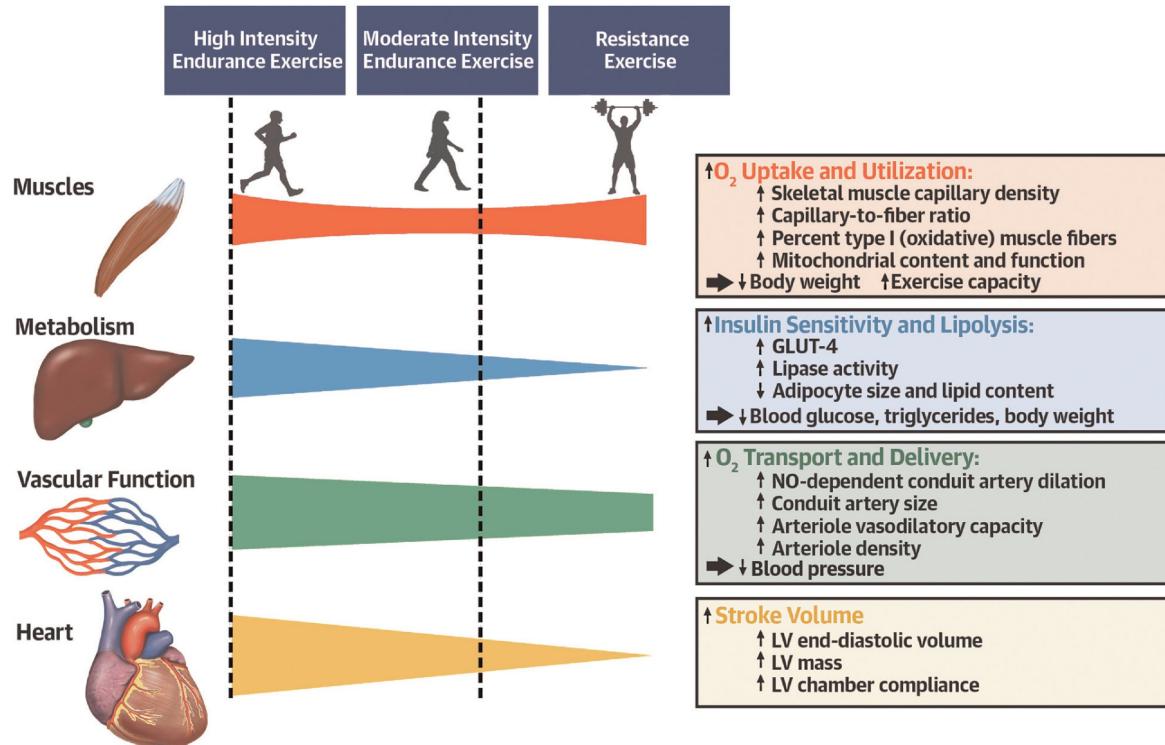


C'è sport e sport...





## CENTRAL ILLUSTRATION: Differing Forms of Exercise Trigger Differing Physiological Adaptations



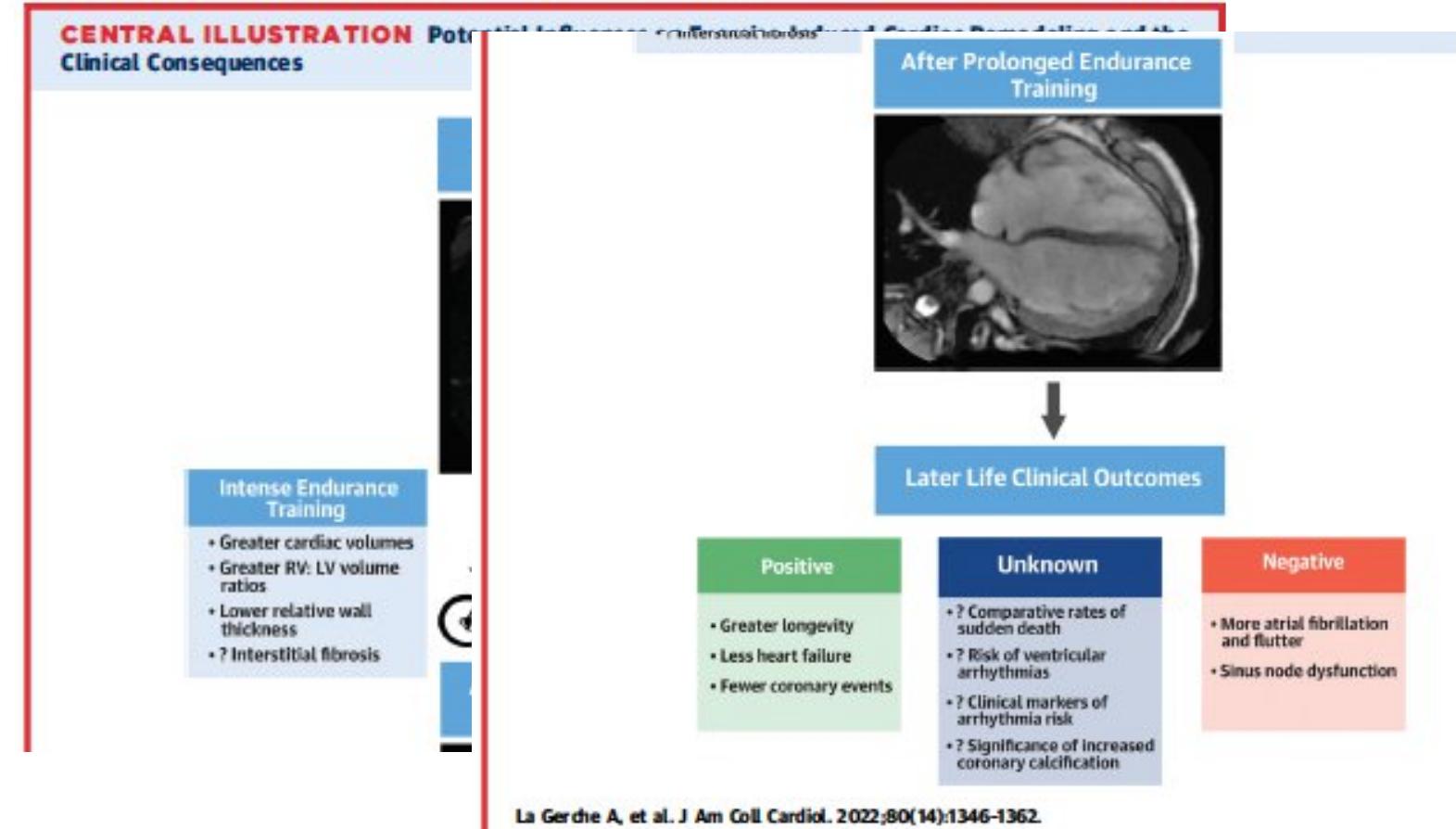
Tucker WJ, et al. J Am Coll Cardiol. 2022;80(11):1091-1106.

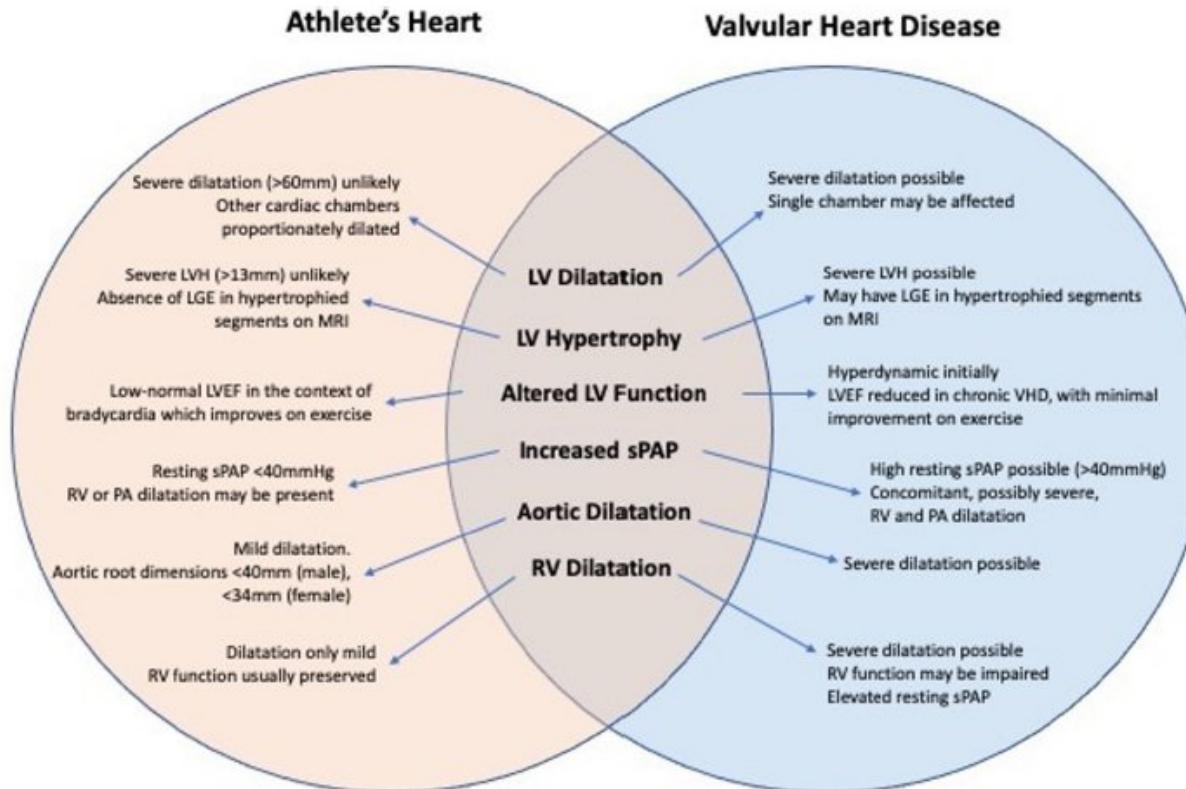
# Sport Disciplines

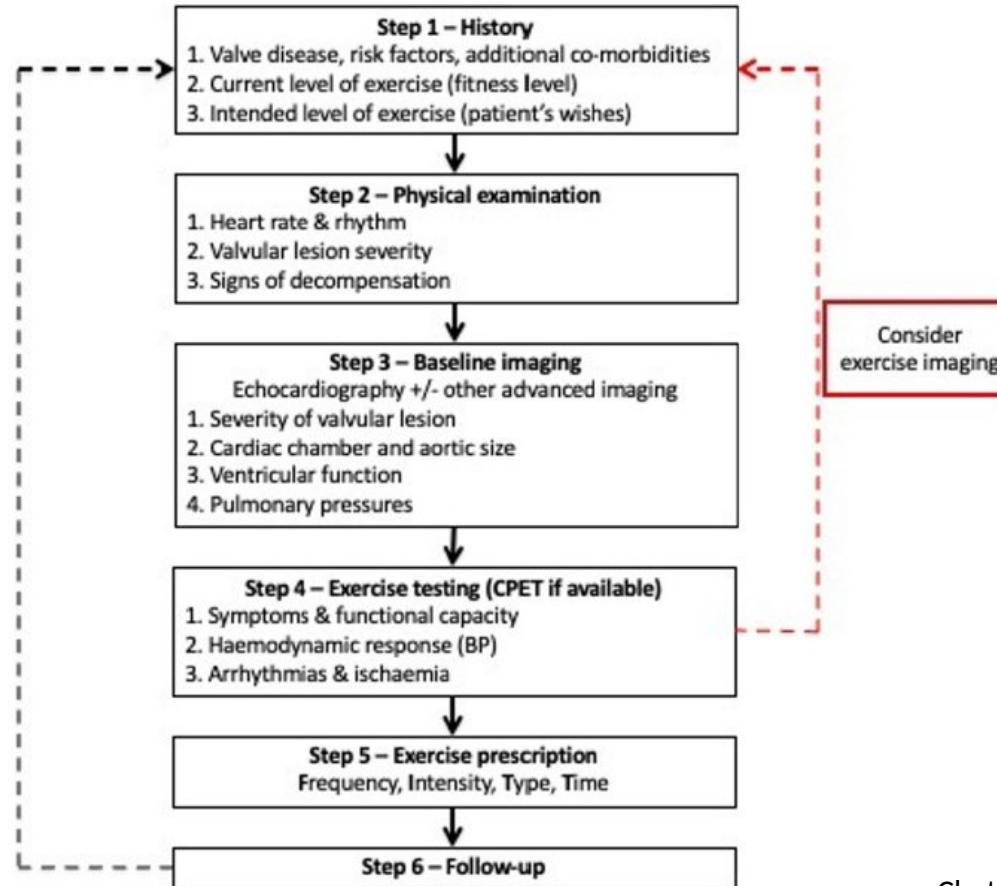


|                    |     |                    |          |                    |        |                    |          |
|--------------------|-----|--------------------|----------|--------------------|--------|--------------------|----------|
| Isometric          | +/- | Isometric          | +++/++++ | Isometric          | ++/+++ | Isometric          | ++/+++   |
| Isotonic           | +/- | Isotonic           | +/++     | Isotonic           | +/++   | Isotonic           | +++/++++ |
| Cardiac remodeling | +/- | Cardiac remodeling | +/++     | Cardiac remodeling | +/++   | Cardiac remodeling | ++++     |

- |  |   |   |  |
|--|---|---|--|
| <ul style="list-style-type: none"> <li>• Golf</li> <li>• Archery</li> <li>• Sailing</li> <li>• Table Tennis</li> <li>• Equestrian</li> <li>• Karate</li> <li>• Shooting/Rifle</li> <li>• Curling</li> <li>• Sled disciplines</li> <li>• Ski Jumping</li> </ul> | <ul style="list-style-type: none"> <li>• Weightlifting</li> <li>• Wrestling / Judo</li> <li>• Boxing</li> <li>• Short distance running</li> <li>• Shot-putting</li> <li>• Discus / Javelin</li> <li>• Artistic gymnastics</li> <li>• Bobsleigh</li> <li>• Short-track skating</li> <li>• Alpine skiing</li> <li>• Snowboarding</li> </ul> | <ul style="list-style-type: none"> <li>• Soccer</li> <li>• Basketball</li> <li>• Volleyball</li> <li>• Waterpolo</li> <li>• Badminton</li> <li>• Tennis</li> <li>• Fencing</li> <li>• Handball</li> <li>• Rugby</li> <li>• Hockey / Ice-hockey</li> </ul> | <ul style="list-style-type: none"> <li>• Cycling</li> <li>• Rowing</li> <li>• Mid/long distance swimming</li> <li>• Mid/long distance running</li> <li>• Canoeing</li> <li>• Triathlon</li> <li>• Pentathlon</li> <li>• X-country skiing</li> <li>• Biathlon</li> <li>• Long distance skating</li> </ul> |
|--|---|---|--|









## VALVOLE DEL CUORE

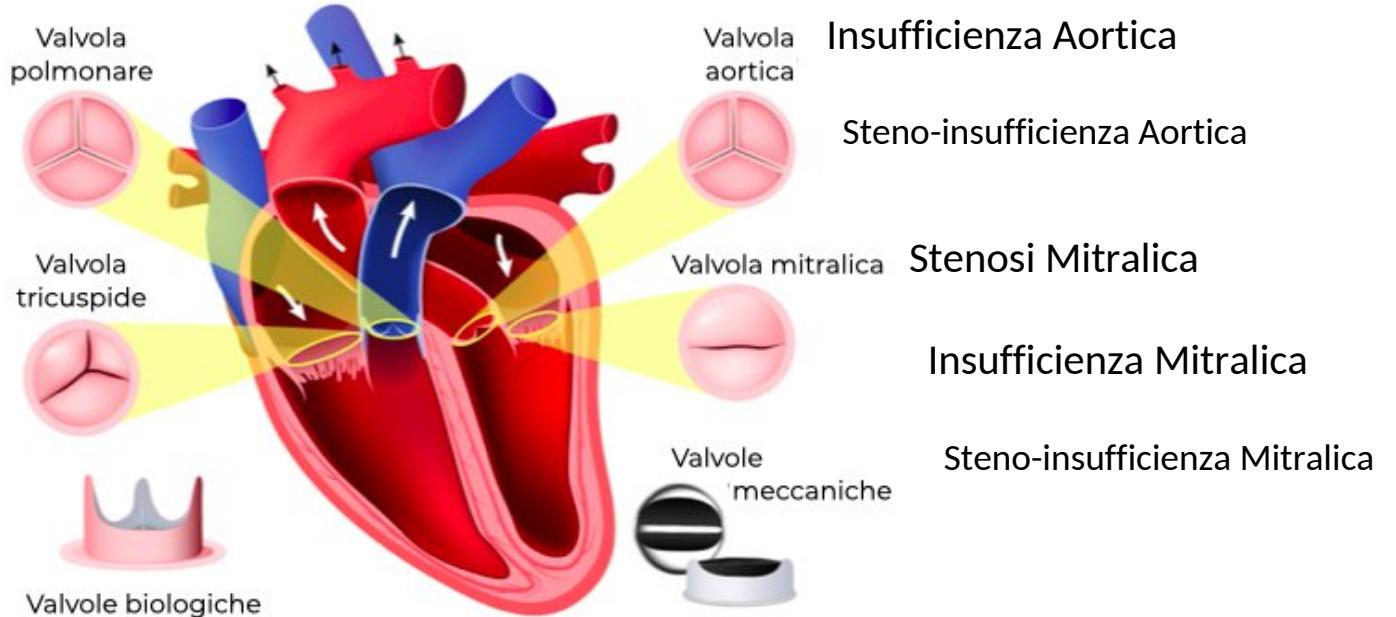
Stenosi Polmonare

Insufficienza Polmonare

Steno-insufficienza  
Polmonare

Insufficienza Tricuspide

Steno-insufficienza  
Tricuspide



Normale funzionamento di  
protesi/plastica

Stenosi Aortica

Insufficienza Aortica

Steno-insufficienza Aortica

Valvola  
aortica

Valvola mitralica

Stenosi Mitralica

Insufficienza Mitralica

Valvole  
meccaniche

Steno-insufficienza Mitralica

Malfunzionamento di  
protesi/plastica

## Mitral Stenosis

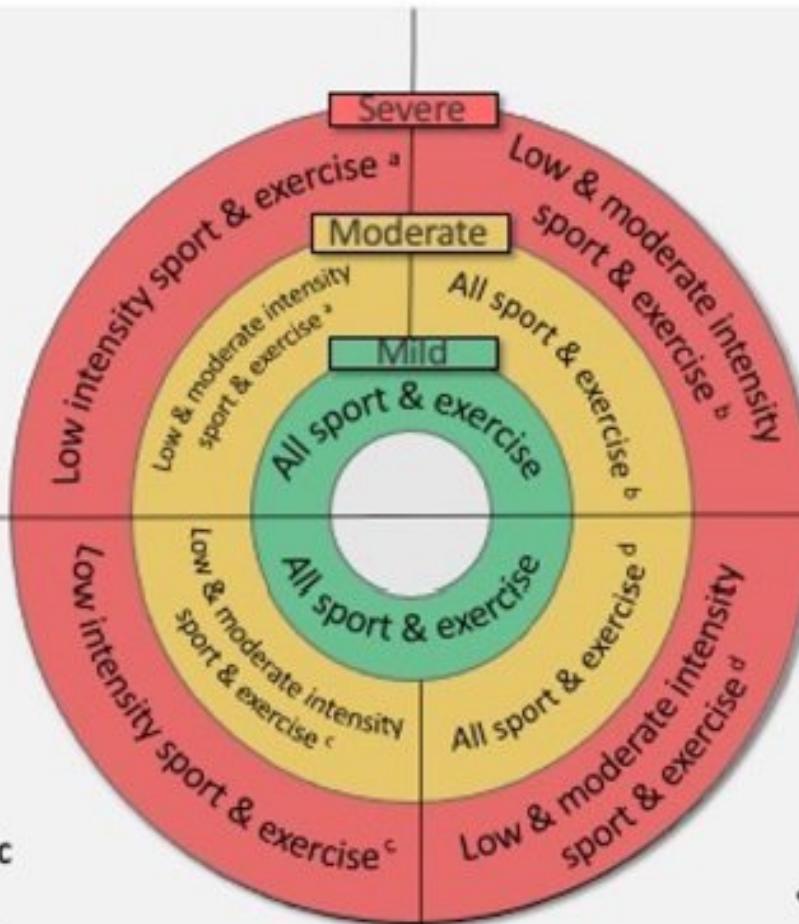
<sup>a</sup> Parameters to be fulfilled:

- Resting sPAP <40mmHg
- Sinus rhythm
- Normal exercise test

## Aortic Stenosis

<sup>c</sup> Parameters to be fulfilled:

- LVEF ≥50%
- Normal/mildly dilated aortic root
- Normal BP response during exercise test



## Mitral Regurgitation

<sup>b</sup> Parameters to be fulfilled:

- Non-dilated LV\*
- LVEF ≥60%
- Resting sPAP <50mmHg
- Normal exercise test

## Aortic Regurgitation

<sup>d</sup> Parameters to be fulfilled:

- Non-dilated LV\*
- LVEF >50%
- Normal/mildly dilated aortic root
- Normal exercise test



E' la valvulopatia più diagnosticata nel mondo industriale

E' la più frequente causa primaria di disfunzione valvolare che richiede la riparazione o la sostituzione.

Sconosciuto 28/06/2001 (18 aa) Sconosciuto

Altezza: 0 cm Peso: 0 kg PNI: 0/0 mmHg

HR: 49 bpm

R<sub>VR-VL</sub>: 2.81/0.93 mV

\*REPORT NON CONFERMATO\*

PR: 148 ms

Sok-Lyon: 3.74 mV

QRS: 96 ms

Assi: 17/75/41 °

Med: QT/QTcH: 452/433 ms

QTcB: 408 ms

QTcF: 422 ms

- Mr. PN
- Since 2
- No fam
- Physic
- ECG



29/12/2020 13:24:40

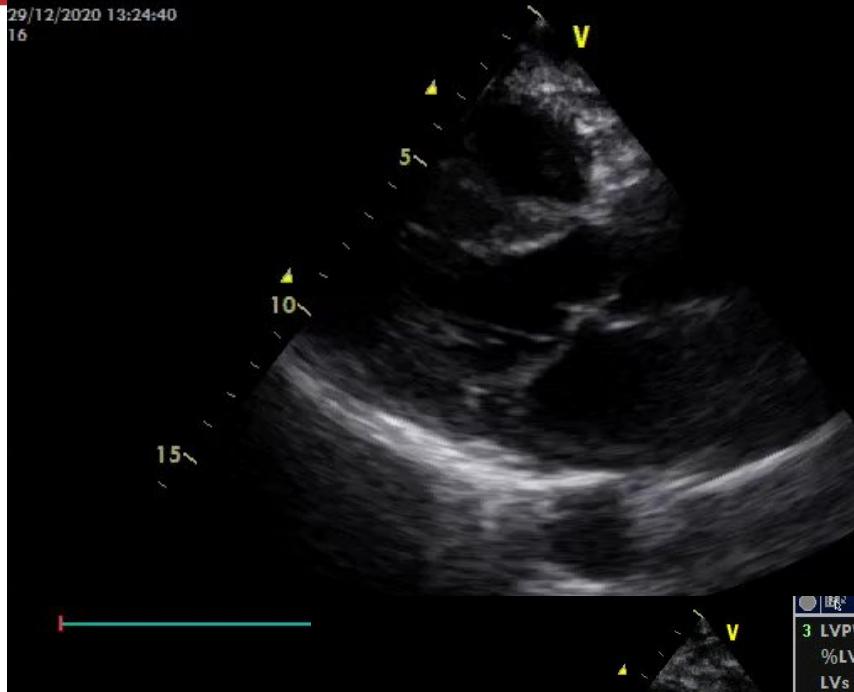
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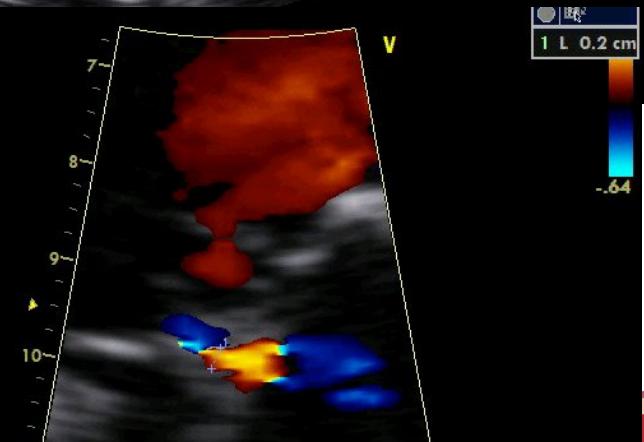
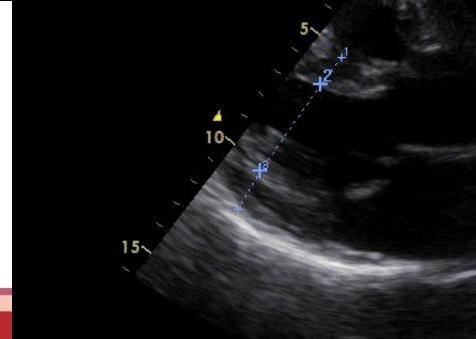
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.64

-.64



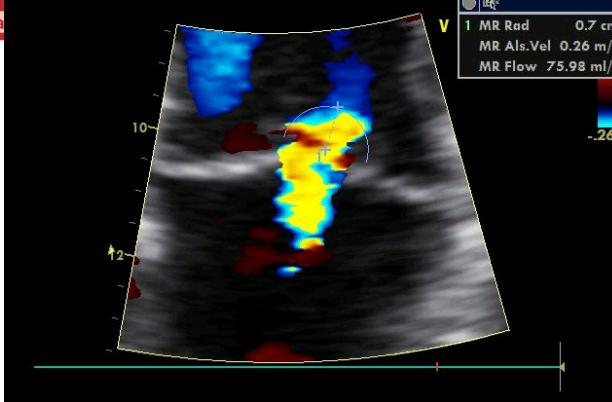
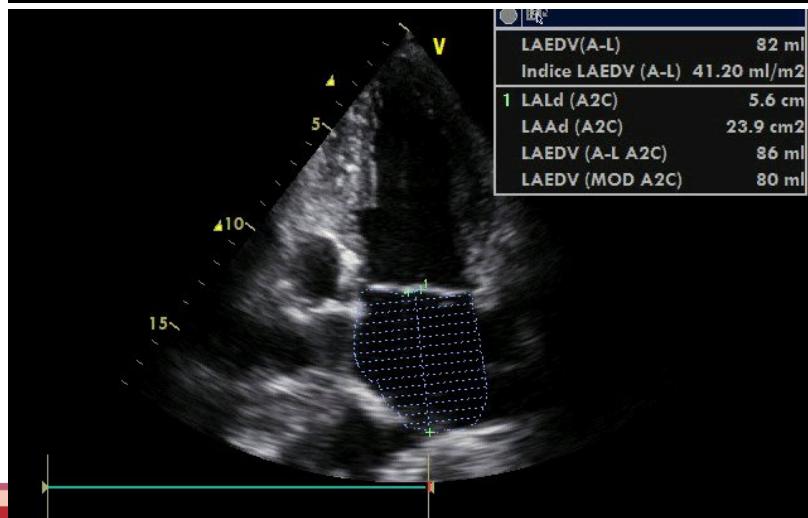
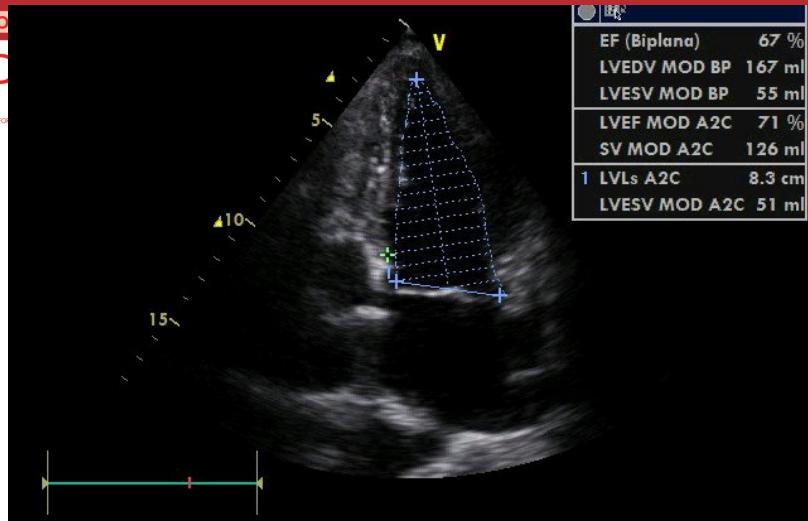
| 3 LVPWs            | 1.6 cm                  |
|--------------------|-------------------------|
| %LVPW Thck         | 66 %                    |
| LVs Mass           | 232.05 g                |
| LVs Mass Index     | 116.02 g/m <sup>2</sup> |
| LVs Mass (ASE)     | 197.12 g                |
| LVs Mass Ind (ASE) | 98.56 g/m <sup>2</sup>  |
| 2 LVIDs            | 3.8 cm                  |
| ESV(Teich)         | 62 ml                   |
| EF(Teich)          | 64 %                    |
| ESV(Cube)          | 55 ml                   |
| EF(Cube)           | 73 %                    |
| %FS                | 35 %                    |
| SV(Teich)          | 108 ml                  |
| SI(Teich)          | 53.89 ml/m <sup>2</sup> |
| SV(Cube)           | 145 ml                  |
| SI(Cube)           | 72.54 ml/m <sup>2</sup> |



RO

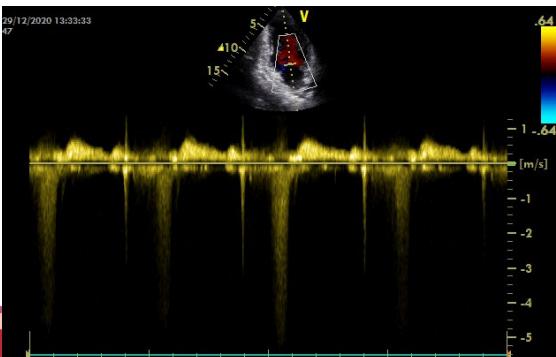
P

PATIENT



Normal exercise test  
No arrhythmias

- LV end-diastolic diameter 61mm (30.5mm/m<sup>2</sup>, 2.0 BSA)
- LV end-systolic diameter 39 (19.5 mm/m<sup>2</sup>)  
Resting PAPs 25 mmHg
- LVEF 67%  
Mild/Mild to moderate MR
- LAVi 40 ml/m<sup>2</sup>
- VC 0.2cm
- EROA 0.2cm<sup>2</sup>





T-wave Inversion in Inferior Leads



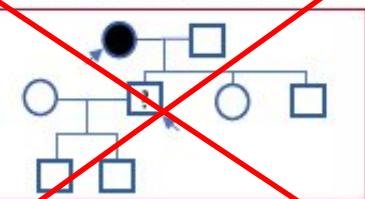
Long QT



Bi-leaflet MV prolapse



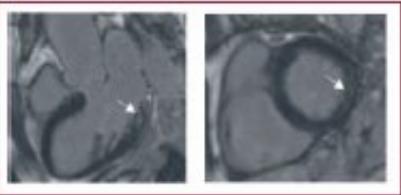
Family History of SCD



Documented Arrhythmias



Basal inferolateral wall fibrosis



Severe MR



Severe LV Dysfunction

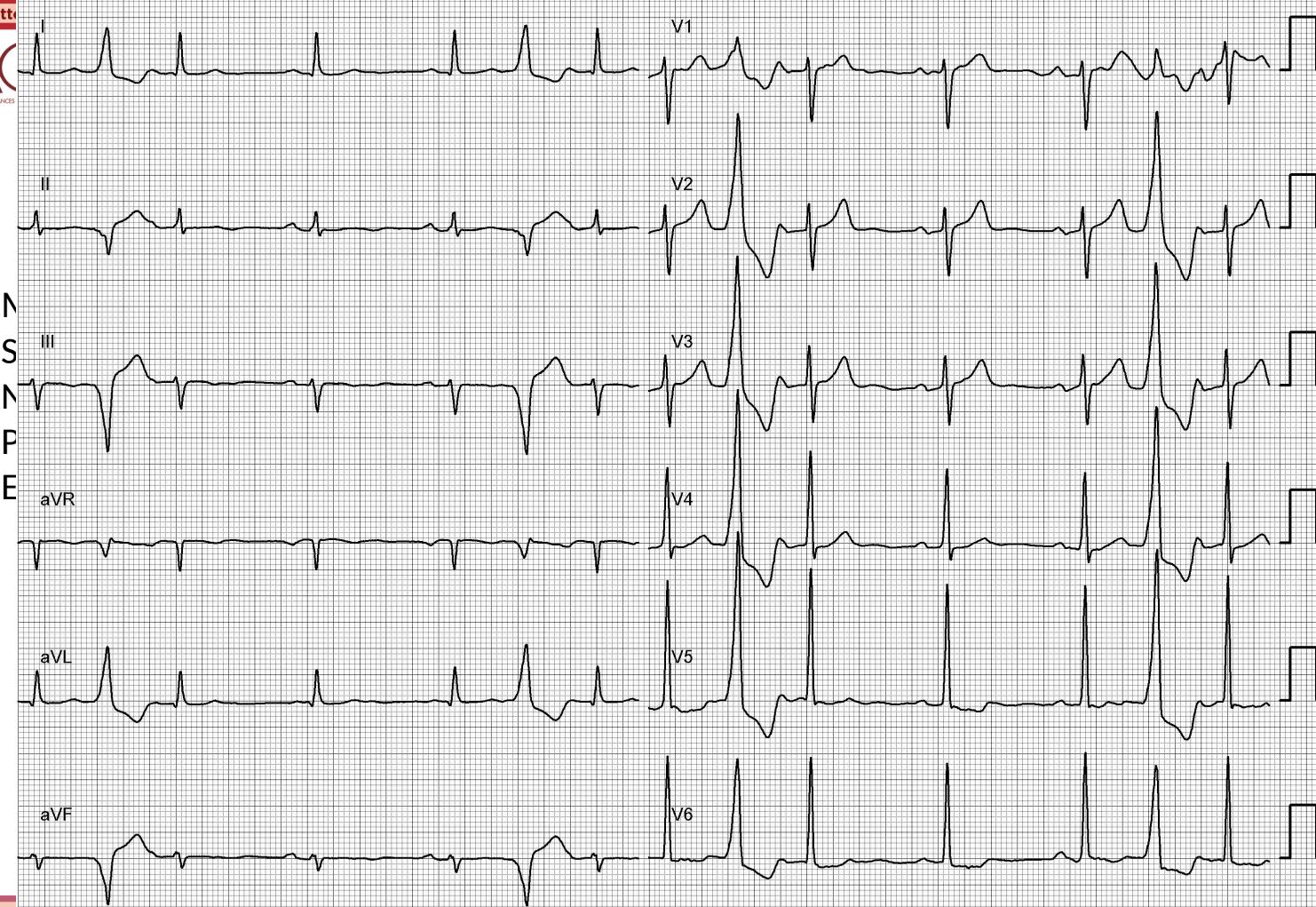


## Recommendations for participation in competitive sports in asymptomatic individuals with mitral regurgitation

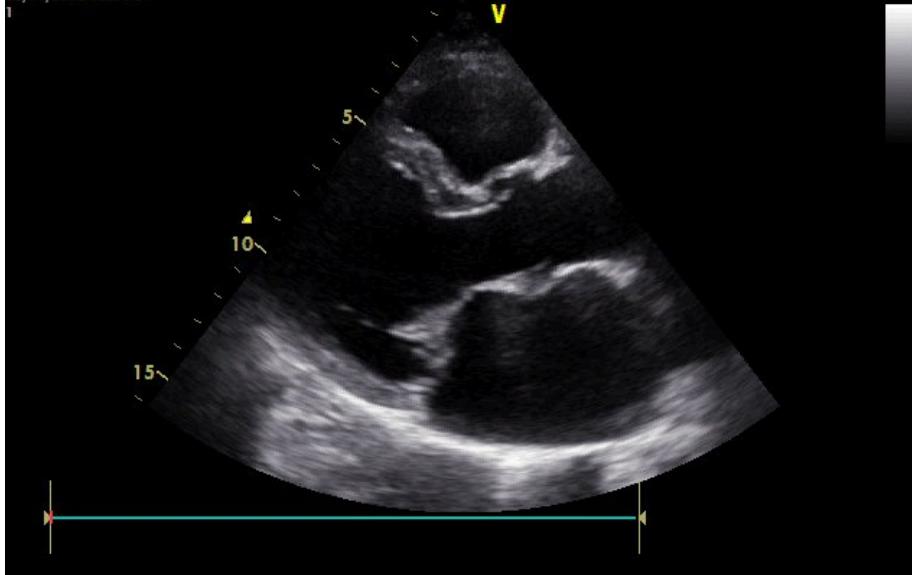
|                 | Mitral regurgitation <sup>c,d</sup>   | Class <sup>a</sup> | Level <sup>b</sup> |
|-----------------|---|--------------------|--------------------|
|                 | Recommendation  |                    |                    |
| <b>Mild</b>     | Participation in all competitive sports, if desired, is recommended.  | I                  | C                  |
| <b>Moderate</b> | Participation in all competitive sports, if desired, should be considered in individuals fulfilling the following:<br><ul style="list-style-type: none"> <li>● LVEDD&lt;60 mm<sup>327</sup> or &lt;35.3 mm/m<sup>2</sup> in men and &lt;40 mm/m<sup>2</sup> in women</li> <li>● LVEF<math>\geq</math>60%</li> <li>● Resting sPAP&lt;50 mmHg</li> <li>● Normal exercise test</li> </ul>  | IIa                | C                  |
| <b>Severe</b>   | Participation in competitive sports involving low exercise intensity, if desired, may be considered in individuals fulfilling the following:<br><ul style="list-style-type: none"> <li>● LVEDD&lt;60 mm<sup>327</sup> or &lt;35.3 mm/m<sup>2</sup> in men and &lt;40 mm/m<sup>2</sup> in women</li> <li>● LVEF<math>\geq</math>60%</li> <li>● Resting sPAP&lt;50 mmHg</li> <li>● Normal exercise test</li> </ul><br>Participation in competitive sports is not recommended in individuals with a LVEF<60% | IIb                | C                  |
|                 |   | III                | C                  |



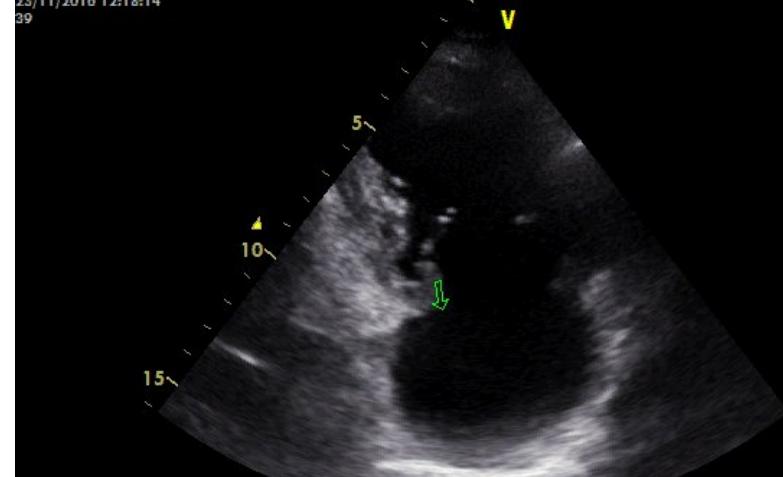
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• S  
• M  
• P  
• E



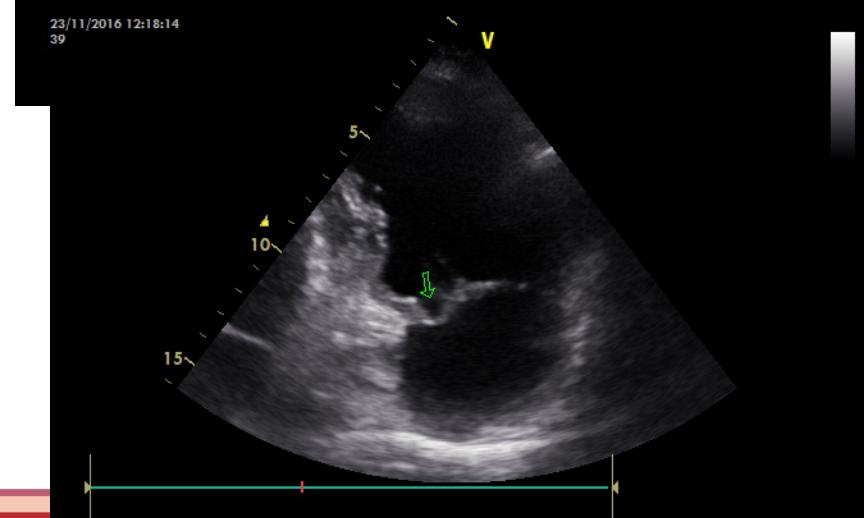
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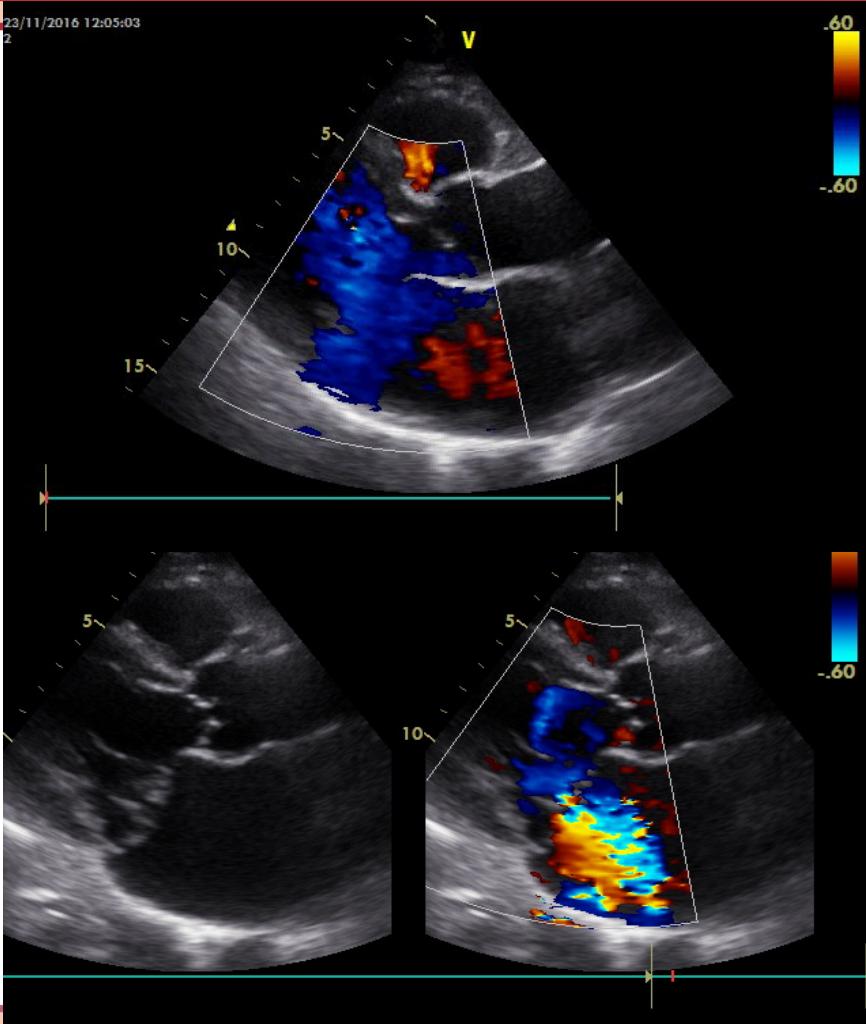


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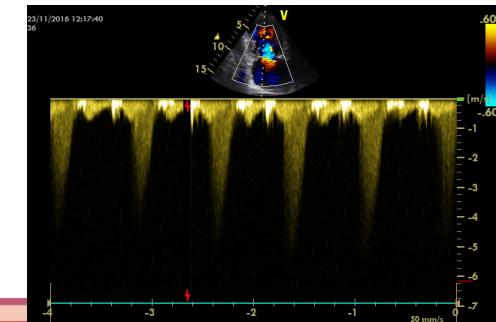


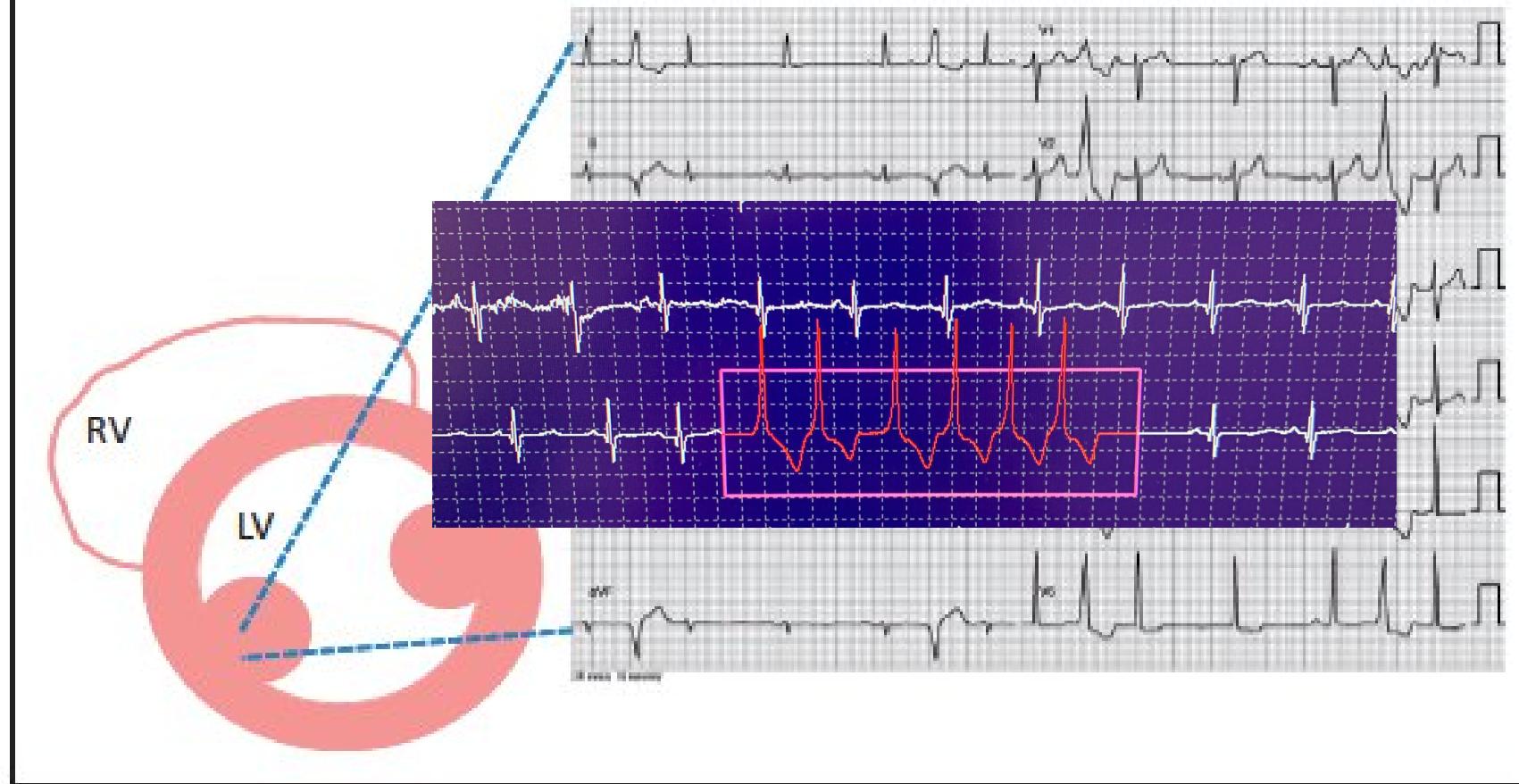
23/11/2016 12:18:14  
39





- LV end-diastolic diameter 62mm (34.4mm/m<sup>2</sup>, 1.8 BSA)
  - LV end-systolic diameter 38 (21.1 mm/m<sup>2</sup>)
  - LVEF 68%
  - LAVi 43 ml/m<sup>2</sup>
  - VC 0.3cm
  - EROA 0.3cm<sup>2</sup>
- Resting PAPs 35 mmHg  
Moderate to severe MR







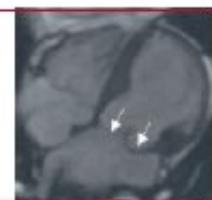
T-wave Inversion in Inferior Leads



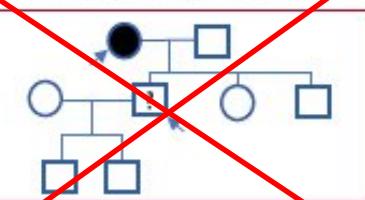
Long QT



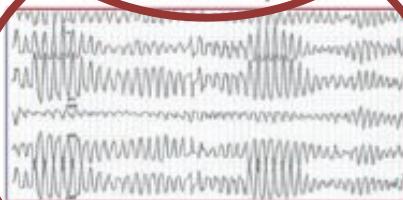
Bi-leaflet MV prolapse



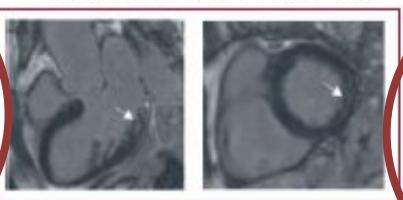
Family History of SCD



Documented Arrhythmias



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Severe MR



Severe LV Dysfunction



## Recommendations for participation in competitive sports in asymptomatic individuals with mitral regurgitation

|                 | Mitral regurgitation <sup>c,d</sup>   | Class <sup>a</sup> | Level <sup>b</sup> |
|-----------------|---|--------------------|--------------------|
|                 | Recommendation  |                    |                    |
| <b>Mild</b>     | Participation in all competitive sports, if desired, is recommended.  | I                  | C                  |
| <b>Moderate</b> | Participation in all competitive sports, if desired, should be considered in individuals fulfilling the following:<br><ul style="list-style-type: none"> <li>● LVEDD&lt;60 mm<sup>327</sup> or &lt;35.3 mm/m<sup>2</sup> in men and &lt;40 mm/m<sup>2</sup> in women</li> <li>● LVEF<math>\geq</math>60%</li> <li>● Resting sPAP&lt;50 mmHg</li> <li>● Normal exercise test</li> </ul>  | IIa                | C                  |
| <b>Severe</b>   | Participation in competitive sports involving low exercise intensity, if desired, may be considered in individuals fulfilling the following:<br><ul style="list-style-type: none"> <li>● LVEDD&lt;60 mm<sup>327</sup> or &lt;35.3 mm/m<sup>2</sup> in men and &lt;40 mm/m<sup>2</sup> in women</li> <li>● LVEF<math>\geq</math>60%</li> <li>● Resting sPAP&lt;50 mmHg</li> <li>● Normal exercise test</li> </ul><br>Participation in competitive sports is not recommended in individuals with a LVEF<60% | IIb                | C                  |
|                 |   | III                | C                  |

# Recommendations on indications for intervention in severe primary mitral regurgitation



## Recommendations

Mitral valve repair is the recommended technique when the results are durable.<sup>293–296</sup>

Surgery is recommended in patients who are operable at low risk.<sup>293–296</sup>

Surgery is recommended in patients with LV dysfunction and/or LVEF  $\leq 60\%$ ).<sup>277,284</sup>

Surgery should be considered in patients with preserved LVEF ( $<40\text{ mm}$  and LVEF  $>60\%$ ) and AF secondary to mitral regurgitation or pulmonary hypertension<sup>c</sup> (SPAP at rest  $>50\text{ mmHg}$ ).<sup>285,289</sup>

Surgical mitral valve repair should be considered in low-risk asymptomatic patients with LVEF  $>60\%$ , LVESD  $<40\text{ mm}^d$  and significant LA dilatation (volume index  $\geq 60\text{ mL/m}^2$  or diameter  $\geq 55\text{ mm}$ ) when performed in a Heart Valve Centre and a durable repair is likely.<sup>285,288</sup>

TEER may be considered in symptomatic patients who fulfil the echocardiographic criteria of eligibility, are judged inoperable or at high surgical risk by the Heart Team and for whom the procedure is not considered futile.<sup>299–302</sup>

IIa

B

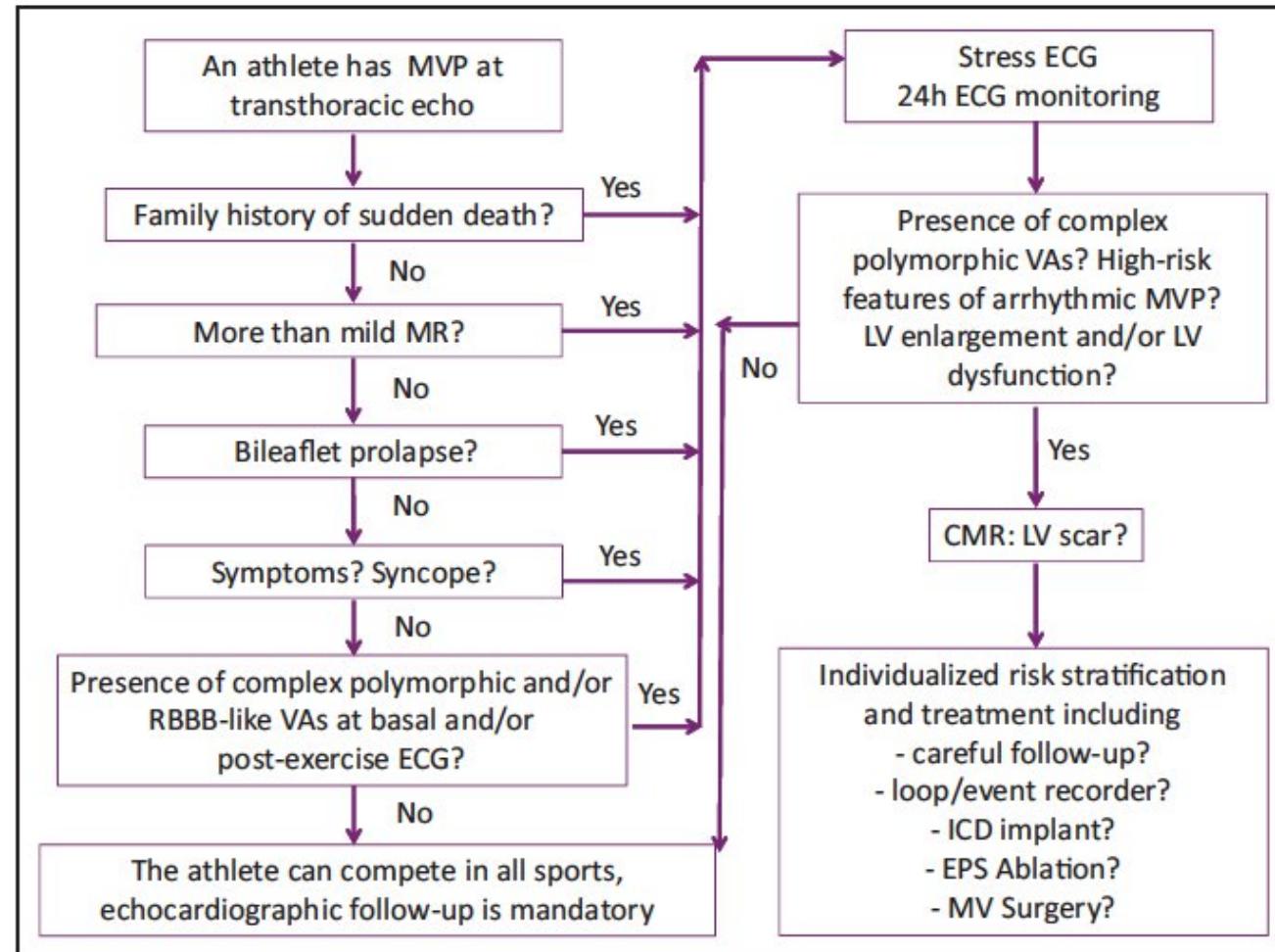
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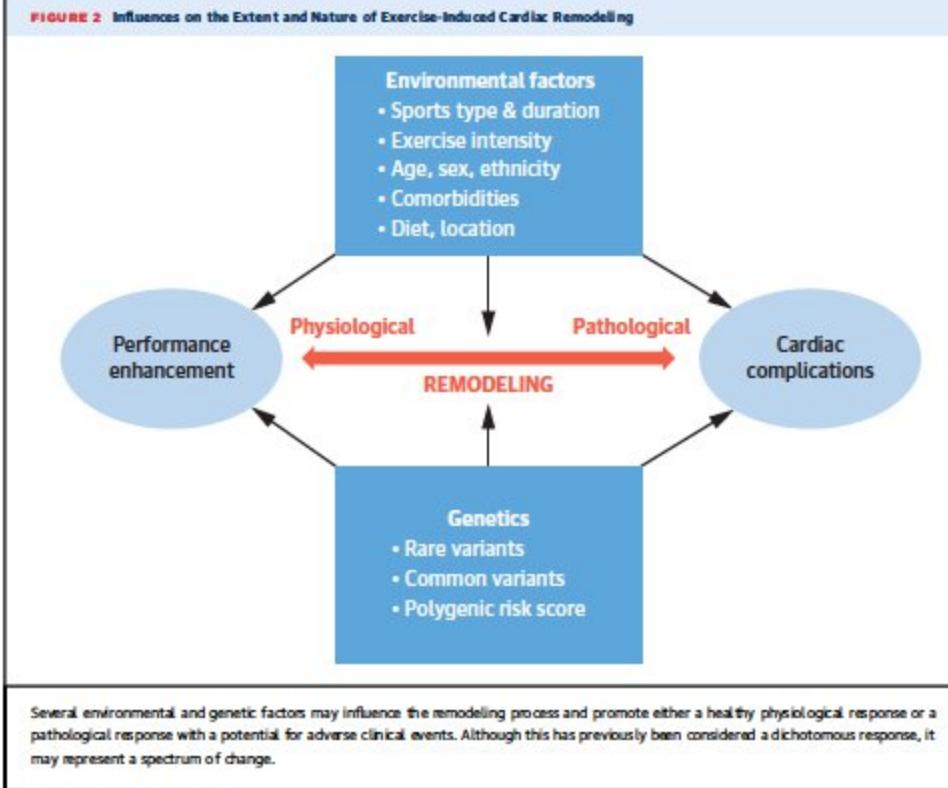
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Vahanian 2021 ESC/EACTS valvular heart diseases guidelines

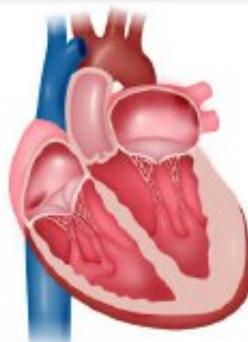


**FIGURE 2** Influences on the Extent and Nature of Exercise-Induced Cardiac Remodelling



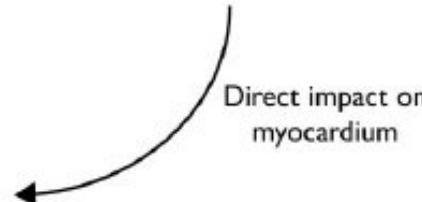
Volume and/or pressure overload

### Myocardium



### Concomitant diseases

- Coronary artery disease
- Diabetes mellitus
- Amyloidosis
- Genetic abnormalities
- Others



### Myocardial alterations

- Increase in wall tension and changes in myocardial mechanics
- Chamber remodeling (dilation and hypertrophy)
- Subendocardial ischaemia
- Reactive fibrosis and extracellular matrix expansion
- Replacement fibrosis and myocardial cell death
- Overt LV systolic and diastolic dysfunction

### Imaging parameters

- Myocardial strain measurements
- Mass and volumetric measures
- Myocardial perfusion
- T1 mapping / ECV
- LGE
- LV ejection fraction or stroke volume

kka<sup>4</sup>,

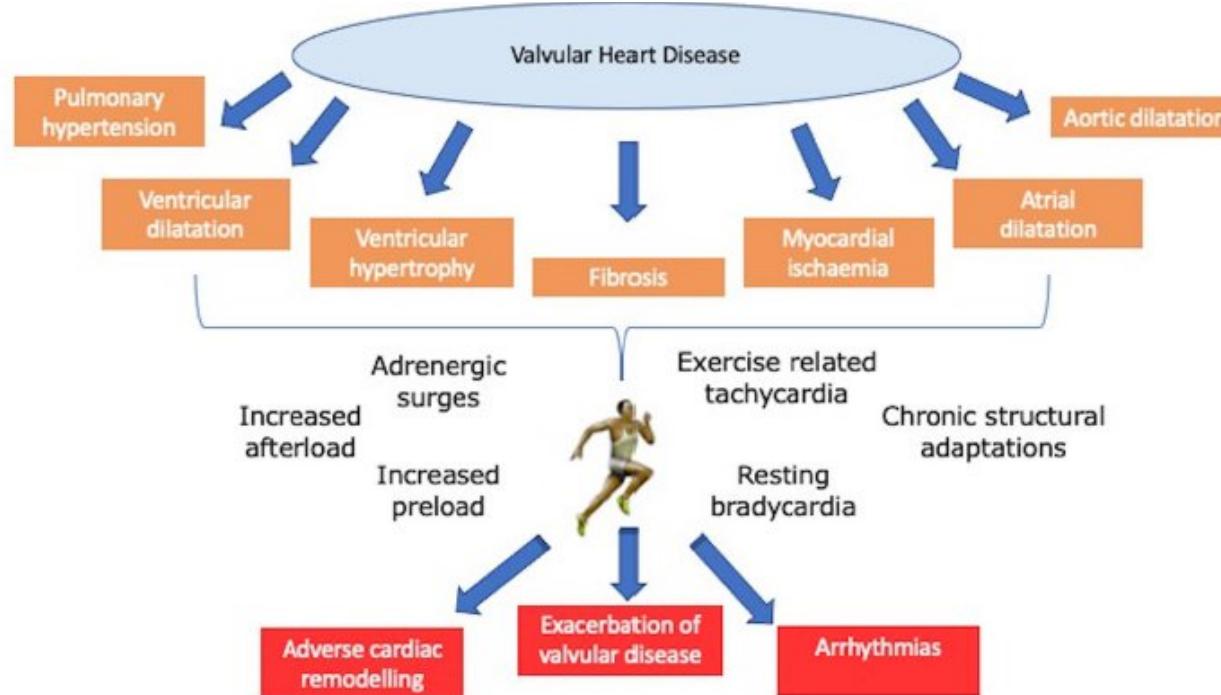
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**Table 1 Standard and novel myocardial imaging biomarkers that showed diagnostic and prognostic value in the management of patients with degenerative valvular heart disease**

| Myocardial imaging biomarker        |   |  |
|-------------------------------------|---|--|
|                                     |   |  |
| Echocardiography                    |   |  |
|                                     |   |  |
| <b>Primary mitral regurgitation</b> |   |  |
| Standard                            | <ul style="list-style-type: none"> <li>• LVEDD</li> <li>• LVEF</li> <li>• LA diameter</li> <li>• LA volume</li> <li>• PAPs</li> <li>• RV dimension and function (TAPSE, FAC)</li> </ul> | <ul style="list-style-type: none"> <li>• LVEDD</li> <li>• LV volumes and EF</li> <li>• LV hypertrophy/mass</li> <li>• RV volumes and function</li> </ul>                   |
| New                                 | <ul style="list-style-type: none"> <li>• LV GLS</li> <li>• LV mechanical dispersion</li> <li>• LA reservoir strain</li> <li>• 3D LV volumes</li> </ul>                                  | <ul style="list-style-type: none"> <li>• LGE (replacement fibrosis)</li> <li>• Extent</li> <li>• Location</li> <li>• ECV (interstitial fibrosis)</li> <li>• GLS</li> </ul> |
| <b>Aortic regurgitation</b>         |   |  |
| Standard                            | <ul style="list-style-type: none"> <li>• LVEDD and LVESD</li> <li>• LVEF</li> <li>• Stress echocardiography</li> </ul>  | <ul style="list-style-type: none"> <li>• LV volumes and EF</li> <li>• LV hypertrophy/mass</li> <li>• LV diameters</li> </ul>   |
| New                                 | <ul style="list-style-type: none"> <li>• LV GLS</li> <li>• LV myocardial work indices</li> <li>• 3D LV volumes</li> </ul>   | <ul style="list-style-type: none"> <li>• LGE</li> <li>• ECV</li> <li>• GLS</li> </ul>  |
| <b>Tricuspid regurgitation</b>      |   |  |
| Standard                            | <ul style="list-style-type: none"> <li>• RV dimension/area</li> <li>• TAPSE</li> <li>• FAC</li> </ul>   | <ul style="list-style-type: none"> <li>• RV volumes and EF</li> <li>• RV mass</li> <li>• RA area and volume</li> </ul>   |
| New                                 | <ul style="list-style-type: none"> <li>• RV-PA coupling</li> <li>• 3D RV volume and EF</li> <li>• RV strain</li> </ul>  | <ul style="list-style-type: none"> <li>• LGE</li> <li>• ECV</li> <li>• RV strain</li> </ul>  |

ECV, extracellular volume; EDD, end-diastolic volume; EF, ejection fraction; FAC, fractional area change; GLS, global longitudinal strain; LA, left atrium; LGE, late gadolinium enhancement; LV, left ventricle; PAPs, pulmonary artery pressure; RA, right atrium; TAPSE, tricuspid annulus plane systolic excursion.



**Figure 1** Figure depicting the potential sequelae of valvular heart disease (VHD) which may be exacerbated by the acute and chronic effects of exercise. In the absence of long-term, prospective studies in individuals with VHD who participate in regular exercise, most of these concerns remain unproven.

Chatrath Papadakis Heart 2022



**FIGURE 2 Intrinsic and Extrinsic Risk Factors for Sudden Cardiac Death**

INTRINSIC FACTORS

Abnormal substrate  
Adrenergic surges  
Genetic predisposition

EXTRINSIC FACTORS

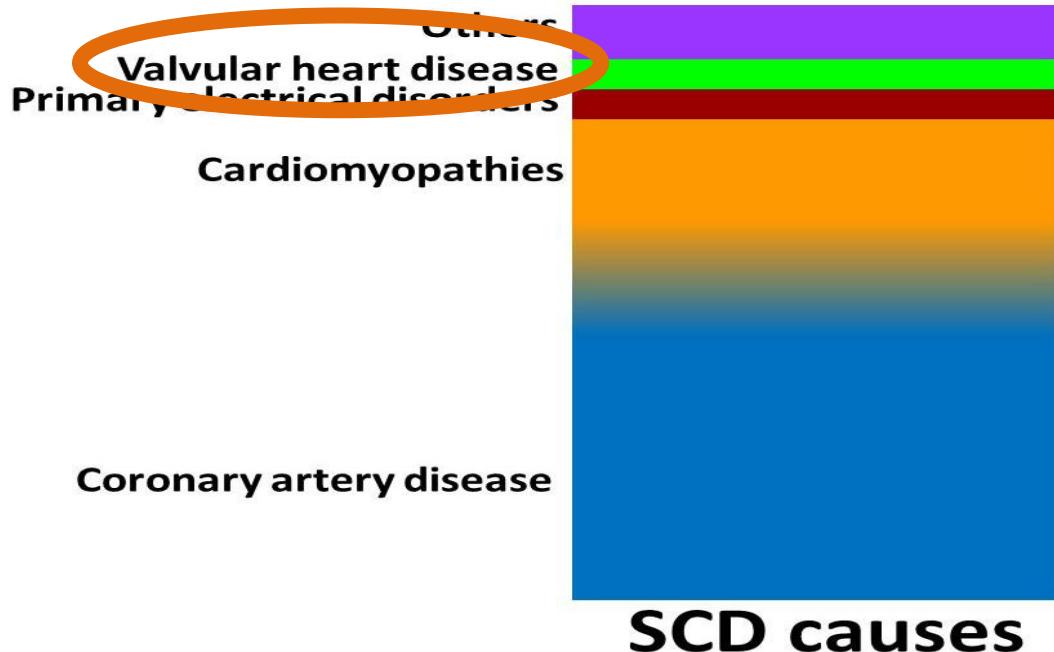
Dehydration  
Anabolic steroids  
Environment

SUDDEN CARDIAC  
DEATH RISK

Sudden cardiac death is often the result of the confluence of both intrinsic and extrinsic factors, as depicted here.



# Causes of Sudden Cardiac Death



## Myocardial substrates:

- Fibrosis
- Hypertrophy
- Ion channel dysfunction
- Abnormal calcium handling

## Triggers:

- Heart failure/stretch
- Ischemia
- Myocardial inflammation
- Sympathetic innervation abnormality
- Electrolyte disturbances

## Predisposing factors and risks:

- Repolarization abnormalities
- Parasympathetic nerve dysfunction
- Genetics
- Co-morbidities: diabetes, renal dysfunction

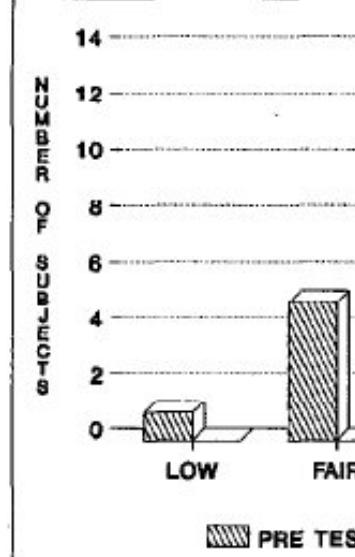
## Effects of Aerobic Exercise Training on Symptomatic Women with Mitral Valve Prolapse

Kristine A. Scordo, PhD, RN

**The effects of a 12-week aerobic exercise training protocol on 32 symptomatic women with mitral valve prolapse were studied. Subjects were randomly assigned to control or exercise groups. Exercise subjects completed a 12-week (3 times per week) exercise training program based on guidelines established by the American Heart Association for phase II cardiac rehabilitation programs; control group subjects maintained normal activities. Before and after training, subjects underwent maximal multistage treadmill testing, and measurements were obtained for**

**A**lthough exercise is an accepted adjunct treatment for other forms of cardiac conditions, it has not been studied to any extent for symptomatic mitral valve prolapse (MVP). Recent evidence suggests that autonomic dysfunction, a hyperadrenergic state, metabolic disturbances, or combinations thereof, are a potential explanation for the constellation of symptoms often associated with MVP.<sup>1-8</sup> Theoretically, the physiologic and psychologic adaptations<sup>9-18</sup> associated with aerobic exercise should be of benefit in reducing the frequency and severity of the symptoms.

Despite the prevalence of MVP and the voluminous amount of literature on this subject, published studies

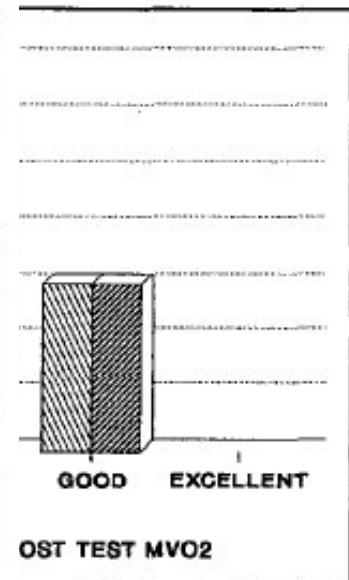


**FIGURE 3. Comparison of test estimated maximal oxygen uptake (kg·min<sup>-1</sup>).**

**TABLE II** Observed Post-Test (Mean  $\pm$  Standard Deviation) and Multivariate Analysis of Variance for the Dependent Measures General Well-Being Schedule, State and Trait Anxiety\*

| Variables                   | SD          | Mean Scores<br>Between Groups | Univariate Analysis<br>F (df, 1,31) | p Value |
|-----------------------------|-------------|-------------------------------|-------------------------------------|---------|
| General Well-Being Schedule |             | 3,319                         | 12                                  | <0.001  |
| Control group               | 53 $\pm$ 16 |                               |                                     |         |
| Exercise group              | 72 $\pm$ 16 |                               |                                     |         |
| State Anxiety Inventory     |             | 4,300                         | 8                                   | <0.006  |
| Control group               | 44 $\pm$ 11 |                               |                                     |         |
| Exercise group              | 33 $\pm$ 12 |                               |                                     |         |
| Trait Anxiety Inventory     |             | 4,317                         | 6                                   | <0.017  |
| Control group               | 48 $\pm$ 11 |                               |                                     |         |
| Exercise group              | 37 $\pm$ 12 |                               |                                     |         |

\* Wilks'  $\lambda$  0.64, F = 6; df = 3,30; p <0.004.  
df = degrees of freedom; SD = standard deviation.



**group pretest-post-test in (MVO<sub>2</sub>) (ml/kg·min).**

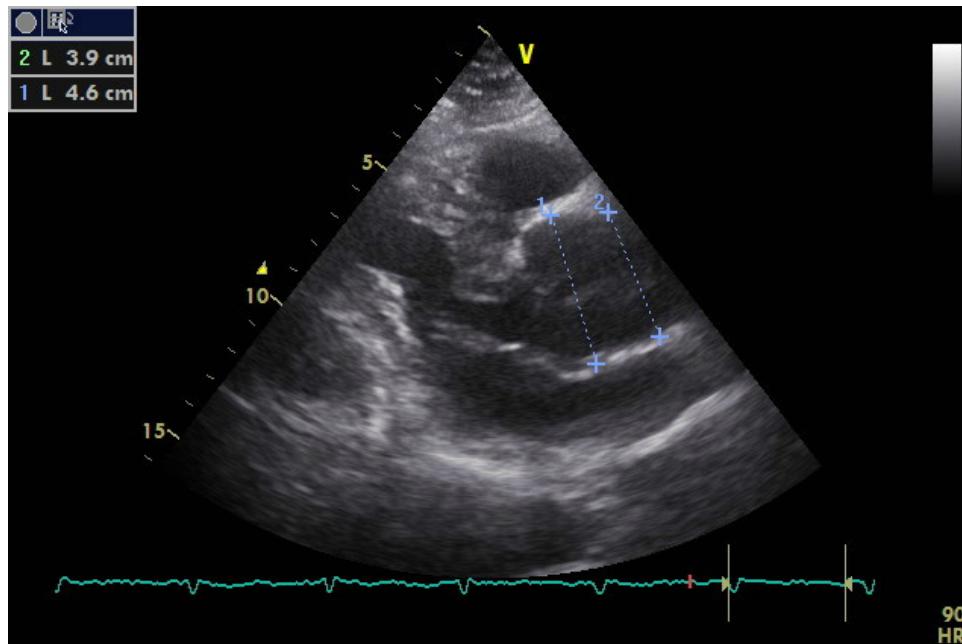
## Clinical Case



- PG, male 40 yo
- High-level athlete for 10 years, Aikido (japanese martial art), level dan (black belt)
- No symptoms
- Routine cardiac evaluation
- No significant heart murmurs, BP 120/75 mmHg
- ECG: no abnormal pathological findings, HR 60 bpm, normal AV and IV conduction, normal axis, no repolarization abnormalities

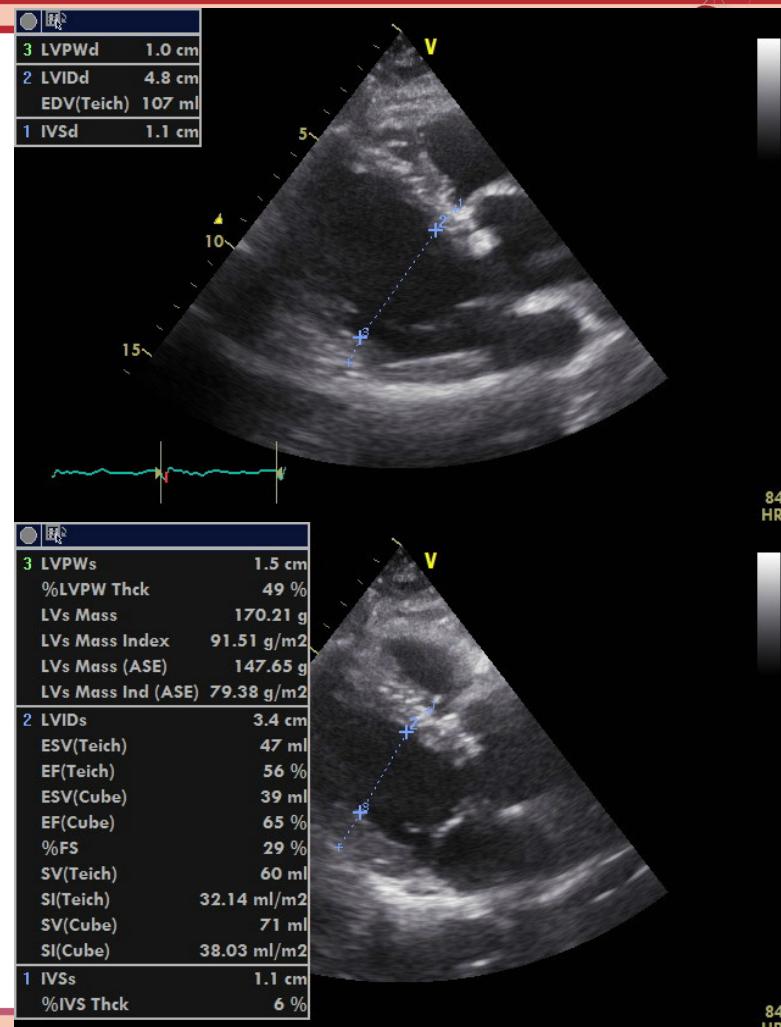
**PLACE**  **ECHOCARDIOGRAPHY**

9<sup>a</sup> Edizione

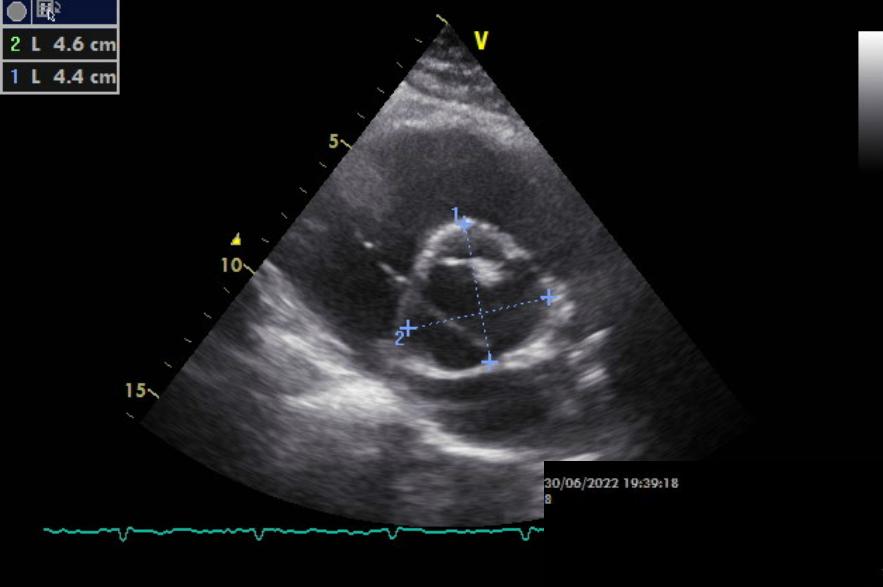


Aortic bulb 46mm

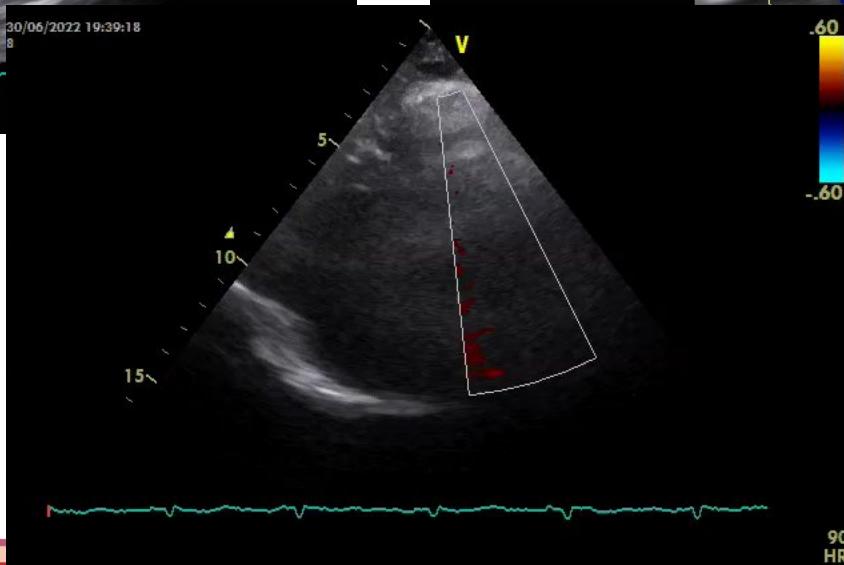
AO/height 25.8 mm/m AO/BSA 24.7 mm/m<sup>2</sup>



2 L 4.6 cm  
1 L 4.4 cm



1 L 0.3 cm



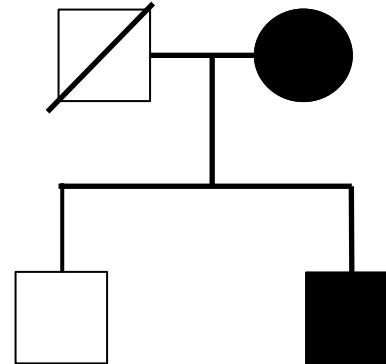


## PHYSICAL EXAM





## Genetic testing:



c.2952G>A p.(Gly485Arg) variant  
in heterozygosis, FBN1 gene.



Table 14 Classification of risk to perform sports in patients with aortic pathology

|           | Low risk   | Low-intermediate risk   | Intermediate risk  | High risk   |
|-----------|--|---|--|---|
| Diagnosis | <ul style="list-style-type: none"> <li>Aorta &lt;40 mm in BAV or tricuspid valve</li> <li>Turner syndrome without aortic dilatation</li> </ul> | <ul style="list-style-type: none"> <li>MFS or other HTAD syndrome without aortic dilatation</li> <li>Aorta 40–45 mm in BAV or tricuspid valve</li> <li>After successful thoracic aorta surgery for BAV or other low risk situation</li> </ul> | <ul style="list-style-type: none"> <li>Moderate aortic dilatation (40–45 mm in MFS or other HTAD; 45–50 mm in BAV or tricuspid valve, Turner syndrome ASI 20–25 mm/m<sup>2</sup>, tetralogy of Fallot &lt;50 mm)</li> <li>After successful thoracic aorta surgery for MFS or HTAD</li> </ul> | <ul style="list-style-type: none"> <li>Severe aortic dilatation (&gt;45 mm in MFS or other HTAD, &gt;50 mm in BAV or tricuspid valve, Turner syndrome ASI &gt;25 mm/m<sup>2</sup>, tetralogy of Fallot &gt;50 mm)</li> <li>After surgery with sequelae</li> </ul> |
| Advice    | <ul style="list-style-type: none"> <li>All sports permitted with preference for endurance over power sports</li> </ul>                         | <ul style="list-style-type: none"> <li>Avoid high and very high intensity exercise, contact, and power-sports.</li> <li>Preference for endurance over power sports</li> </ul>   | <ul style="list-style-type: none"> <li>Only skill sports or mixed or endurance sports at low intensity</li> </ul>  | <ul style="list-style-type: none"> <li>Sports are (temporarily) contra-indicated</li> </ul>   |
| Follow-up | Every 2–3 years  | Every 1–2 years   | Every 6 months to 1 year   | Re-evaluation after treatment   |



# 2021 ESC/EAC management o

**Developed by the Task Force on Aortic Root Disease of the European Association of Cardiovascular Prevention and Rehabilitation**

**Authors/Task Force Members**  
**Friedhelm Beyersdorf<sup>\*1</sup> (Editor-in-Chief, ESC Task Force Coordinator) (Serbia), Stefano Sartori (Chair, ESC Task Force Coordinator) (Italy), Davide Capodanno (Italy), Ruggero De Paulis<sup>1</sup> (Italy), (United Kingdom), Martin Anders Jeppsson<sup>1</sup> (Sweden), Bernard D. Prendergast (UK), Christophe Tribouilloy (France), Scientific Document Group**

Ascending aortic surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter:

- $\geq 55$  mm in all patients.
- $\geq 45$  mm in the presence of Marfan syndrome and additional risk factors<sup>d</sup> or patients with a TGFBR1 or TGFBR2 mutation (including Loeys–Dietz syndrome).<sup>e</sup>
- $\geq 50$  mm in the presence of a bicuspid valve with additional risk factors<sup>d</sup> or coarctation.

When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when  $\geq 45$  mm.<sup>f</sup>

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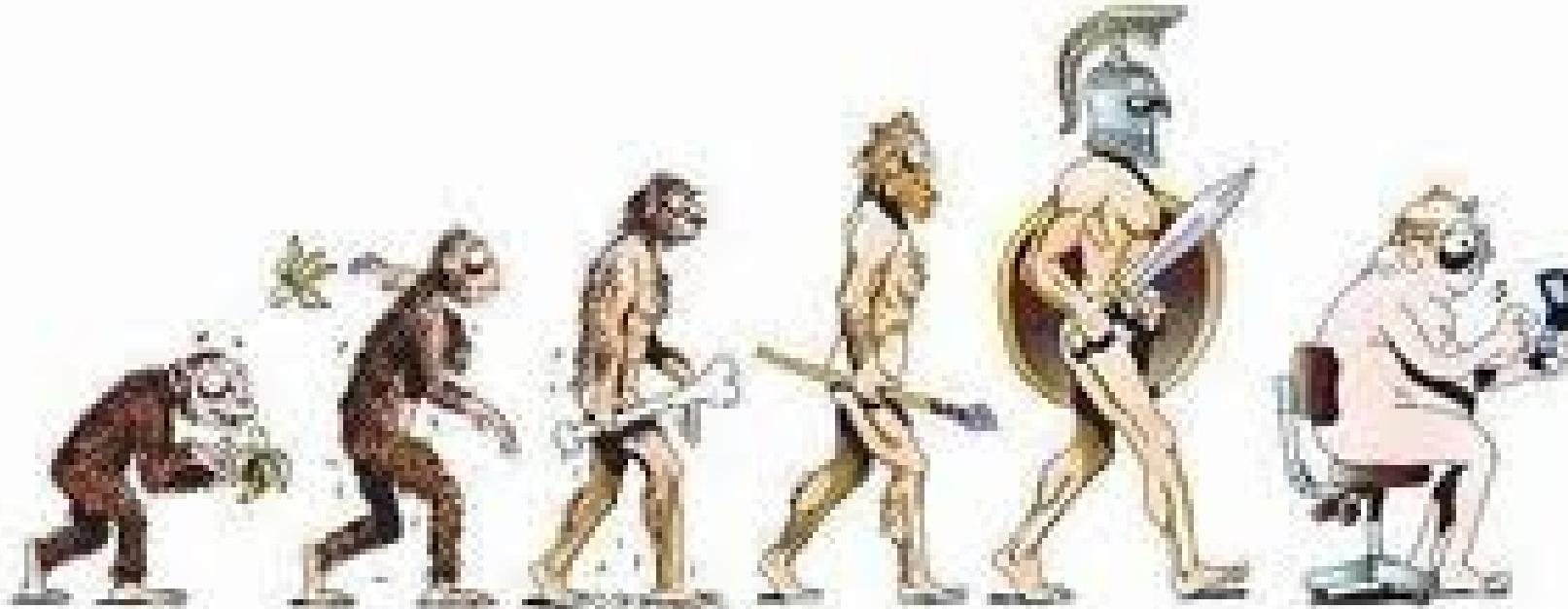


## Additional Risk Factors in the presence of Marfan Syndrome

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- Family history of aortic dissection (or personal history of spontaneous vascular dissection)
- Severe aortic or mitral regurgitation
- Desire for pregnancy
- Uncontrolled systemic arterial hypertension
- Aortic size increase >3 mm/year

Vahanian EHJ 2021

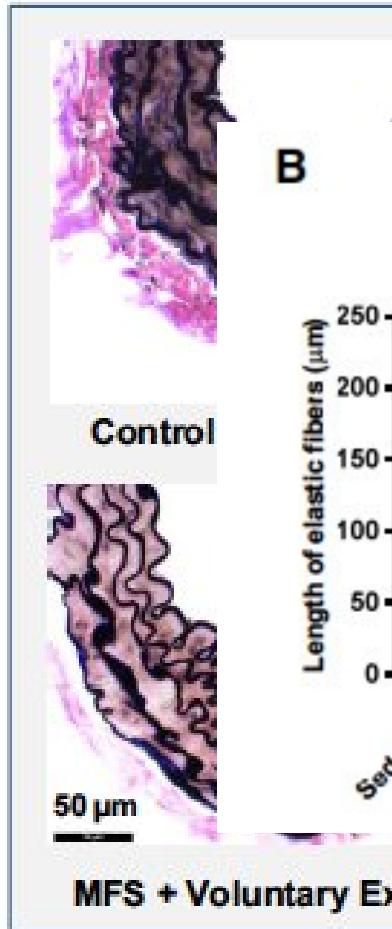




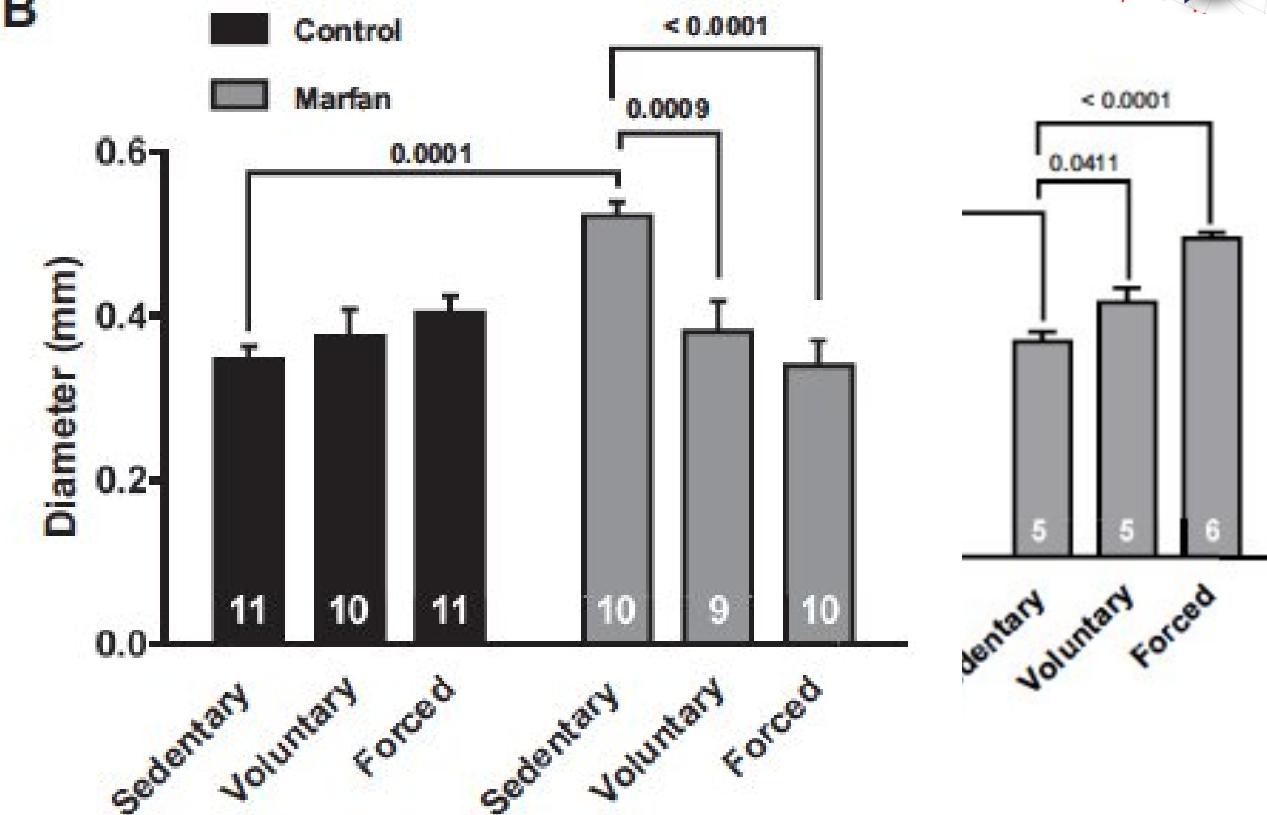
## Follow-up

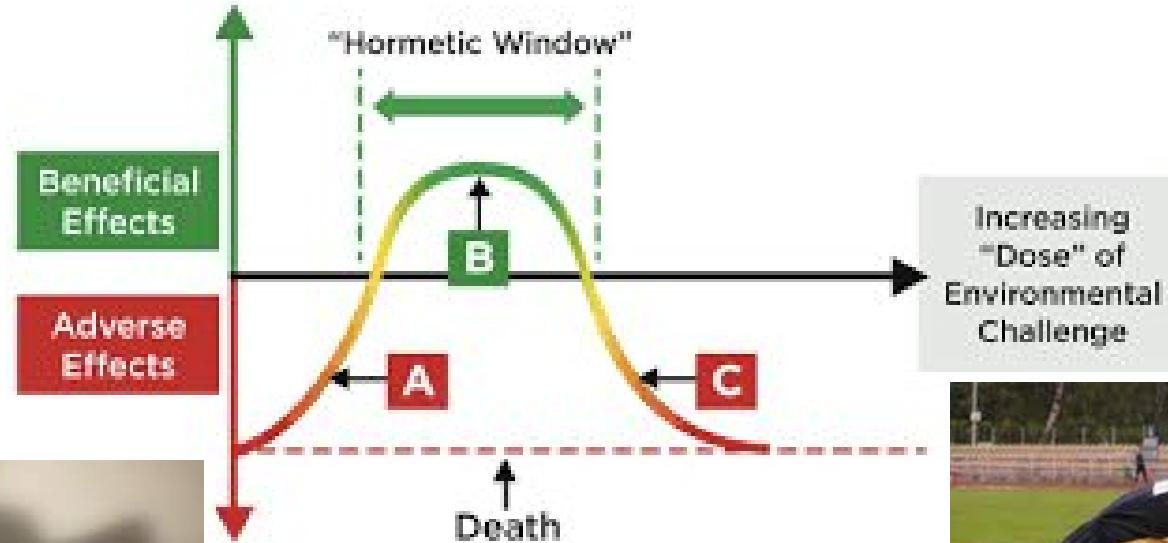
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- Daily intake of Losartaan 50mg 1 tbl per day
- No HTN
- No increase of the Ascending aorta diameter at a 3-year follow-up (echo every 6 months)
- 10000 steps per day, low intensity running/brisk walking
- At ECG stress test, no arrhythmias, no pathological increase of the BP



**B**

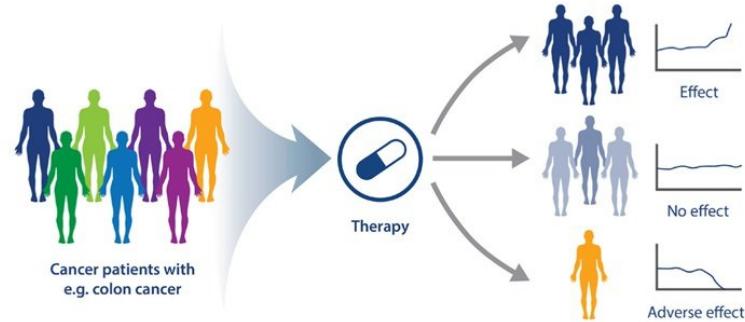






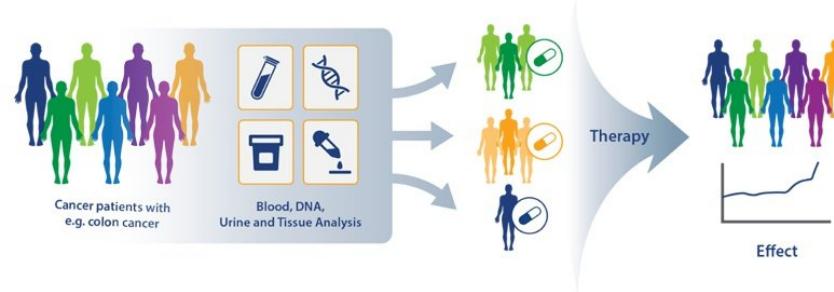
## Current Medicine

### One Treatment Fits All



## Future Medicine

### More Personalized Diagnostics





## In conclusion

- The adverse effects of sedentary behavior are well established and probably overcome the potential adverse effect of exercise
- Registries and longitudinal studies, clinical trials and translational research are needed to clarify the role of sports in speeding up the natural history of heart valve diseases
- In presence of heart valve disease, a personalized approach is mandatory and a longitudinal follow-up can highlight the presence of a pathological remodelling
- Exercise prescription is an additional therapy in the treatment of the patient affected by heart valve disease and should be prescribed



## GRAZIE PER LA VOSTRA ATTENZIONE

