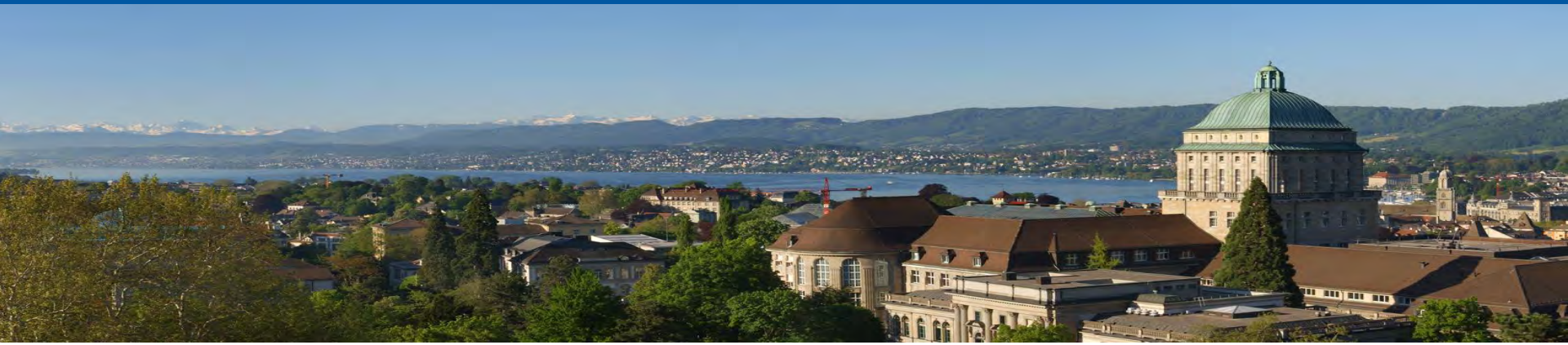


Ist Sport wirklich Mord?
Einschätzung eines Kardiologen

Kardiologische Abendfortbildung Basel
2. Juni 2016

PD Dr. med. Christian Marc Schmied
Klinik für Kardiologie, Universitäres Herzzentrum Zürich
Leiter Ambulatorium
Leiter Sportkardiologie

swiss olympic APPROVED

UniversitätsSpital Zürich

INTERNATIONAL ICE HOCKEY FEDERATION

F-MARC FOOTBALL FOR HEALTH FIFA

Agenda

Einleitung – Das «Sport-Paradoxon»

Bedeutung und Prävention des plötzlichen Herztods im Sport

Physiologisches vs. Pathologisches Sportherz

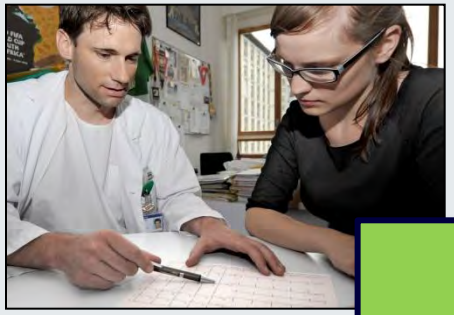
- *Gibt es eine Obergrenze für gesunden Sport?*

Trainingsempfehlungen bei bekannter Herzerkrankung

Konklusionen und Diskussion

Sportkardiologie/Sportmedizin UniSpital Zürich

swiss olympic APPROVED




christian.schmied@usz.ch

044/255 34 78

Spezial-Sprechstunde

Konsiliardienst

Core Lab

Ambulante Reha

re und
schung

Masterarbeiten und
ssertationen
nd 60 Publikationen

Mantelstudium Sportmedizin

F-MARC FOOTBALL FOR HEALTH
FIFA MEDICAL CENTRE OF EXCELLENCE

IIHF INTERNATIONAL ICE HOCKEY FEDERATION

Schweizerische Gesellschaft für Sportmedizin
Société Suisse de Médecine du Sport
Società Svizzera di Medicina dello Sport

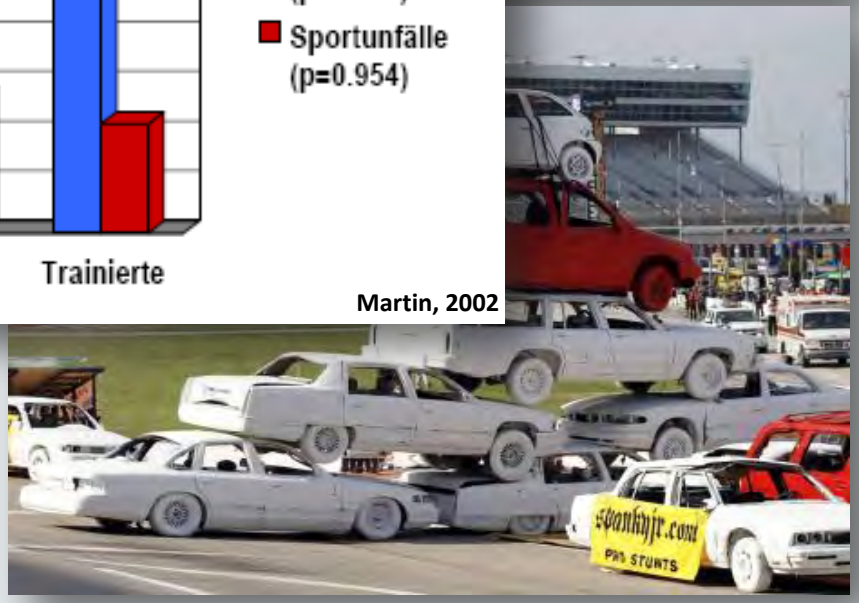
UniversitätsSpital Zürich

ASVZ

Universität Zürich[UZH]

Ist Sport gesund?


FRANIC
18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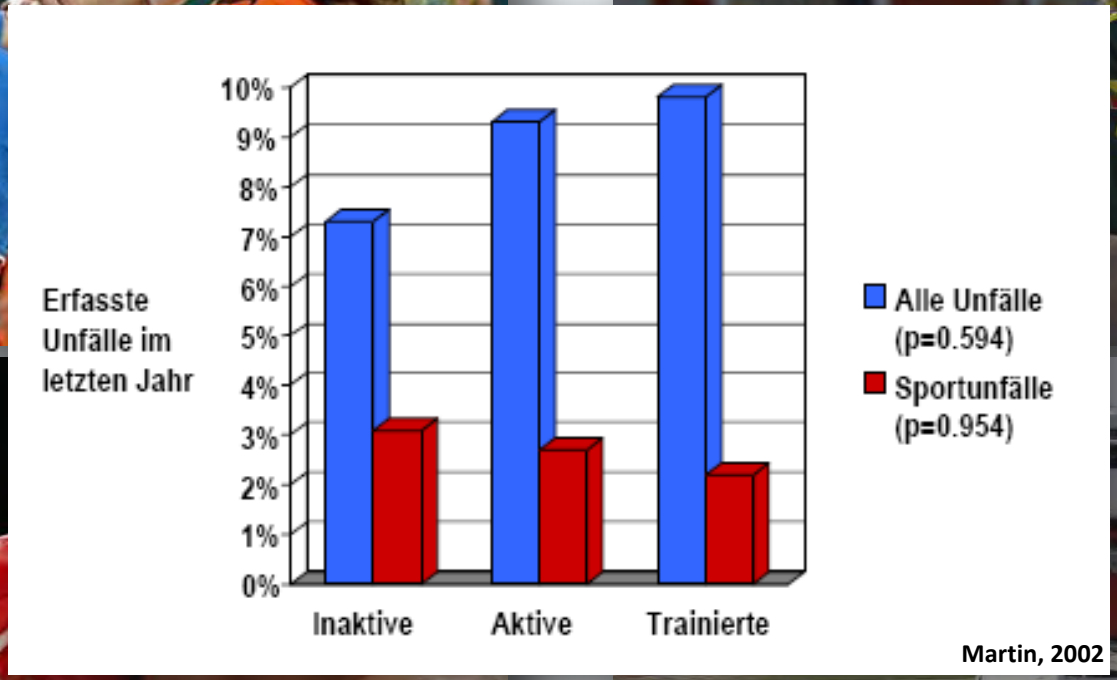
PRO STUNTS

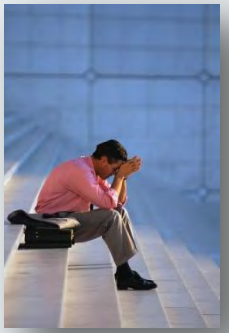

Erfasste Unfälle im letzten Jahr
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
Inaktive
Aktive
Trainierte
Alle Unfälle (p=0.594)
Sportunfälle (p=0.954)

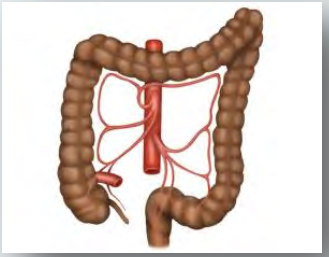
Martin, 2002

Gesundheitlicher Nutzen von Sport

Starke Evidenz

- Überleben
- Risiko für KHK/Stroke
- Risiko für arterielle Hypertonie, Dyslipidämie, Diabetes mellitus Typ 2
- Kolon-, Mamma-Karzinom
- Risiko für Stürze
- Depression, kognitive Dysfunktion





Mässige Evidenz

- Übergewicht
- Pflegebedürftigkeit im Alter
- Bronchus-, Endometrium-Karzinom
- Erneute Gewichtszunahme («Jo-Jo-Effekt»)
- Osteoporose
- Dyssomnie

Der Benefit von Sport zur Prävention der Koronaren Herzkrankheit…

…wurde bereits vor langer Zeit erkannt.

THE LANCET] ORIGINAL ARTICLES [NOV. 21, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

J. N. MORRIS M.A. Glasg., M.R.C.P., D.P.H. — J. A. HEADY M.A. Oxfd

OF THE SOCIAL MEDICINE RESEARCH UNIT, MEDICAL RESEARCH COUNCIL

P. A. B. RAFFLE M.D. Lond., D.P.H., D.I.H.

OF THE MEDICAL DEPARTMENT, LONDON TRANSPORT EXECUTIVE

C. G. ROBERTS B.A., M.D. Camb. — J. W. PARKS M.B.E., M.D. Camb., D.C.H.

OF THE TREASURY MEDICAL SERVICE

absences of any duration are so examined. All diagnoses are coded by the international three-figure code.* Details of all deaths and of all retirements due to ill health are also recorded and the medical causes are similarly coded. Copies of the death certificates were available, as were the diagnoses of the London Transport medical officers for ill-health retirements. Routine checks are imposed in the Central Record of Staff Statistics to ensure accuracy of data.

By special arrangement for the present inquiry, all absences, ill-health retirements, and deaths, the diagnoses of which were assigned to any code number from 420 to 434 (inclusive) were reported to the medical department for detailed scrutiny; and cases of coronary heart-disease, presumptively atherosclerotic, and doubtful cases for consideration, were then "notified" to the unit. (It is, of course, to be appreciated that all clinical presentations of the disease, whether occurring on or off duty, were included.)

From the Central Record of Staff Statistics population

Morris addressing the 1954 World Conference of Cardiology in Washington DC

Collection of London Transport Museum

The Telegraph, 02.11.2009

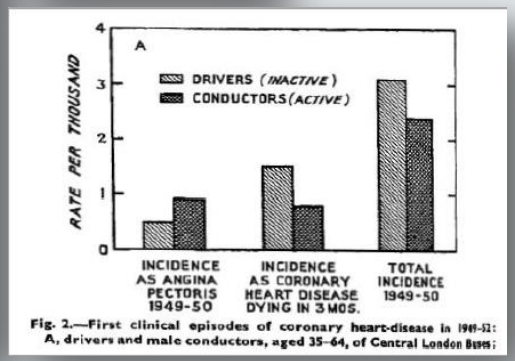


Fig. 2.—First clinical episodes of coronary heart-disease in 1949-52: A, drivers and male conductors, aged 35–64, of Central London Buses;

"Harvard Alumni" study

Physical activity 1962/66 [kcal per week]	Relative risk of death
<500	1.00
500-999	0.78
1000-1499	0.73
1500-1999	0.63
2000-2499	0.62
2500-2999	0.52
3000-3499	0.46
>=3500	0.62

Paffenbarger R, et al. N Engl J Med 1986;314:605-613

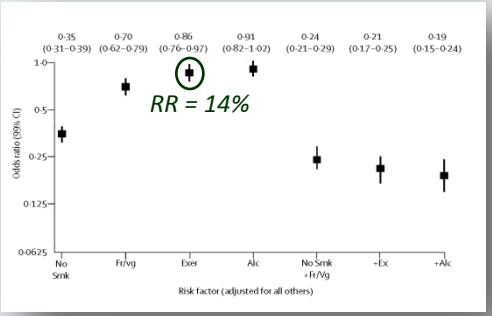
"Nurses' Health" study

TABLE 1. DISTRIBUTIONS OF INDIVIDUAL MODIFIABLE RISK FACTORS AND RELATIVE RISK OF CORONARY EVENTS IN THE NURSES' HEALTH STUDY, 1980 TO 1994.

FACTOR	RELATIVE RISK (95% CI)*	PERCENTAGE IN EACH CATEGORY†
Exercise (hr/wk)§		
<1.0	1.41 (1.15–1.75)	20
1.0–2.2	1.23 (0.99–1.53)	15
2.3–3.5	1.18 (0.94–1.47)	18
3.6–5.5	1.05 (0.82–1.34)	18
>5.5	1.0 (reference)	17

Stampfer MJ, et al. N Engl J Med 2000;343:16-22

"INTERHEART" study



Yusuf S, et al. Lancet 2004;364(9438):937-52

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Universität Zürich[UZH]

Globale Unterschiede (INTERHEART Studie)

Risiko in Abhängigkeit des Geschlechts

	Both sexes	Men	Women
Odds ratios for rela			
Lifestyle factors			
Smoking			-3·39)
Fruit and vegetabl			-0·80)
Exercise			-1·22)
Alcohol			-1·42)
All four lifestyle fact			-0·41)
Hypertension			-2·38)
Diabetes			-3·78)
Abdominal obesit			-1·70)
Psychosocial			-4·39)
High ApoB/ApoA			-3·83)
All risk factors other			–2·12·90)
All nine risk factors i			–381·12)
Population attribut			
Lifestyle factors			
Smoking			o 15·7)
Fruit and vegetabl			to 32·1)
Exercise			o 67·8)
Alcohol			o 84·6)
All four lifestyle fact			to 80·3)
Hypertension			to 35·8)
Diabetes			o 18·5)
Abdominal obesit			
Psychosocial			
High ApoB/ApoA			
All risk factors other than smoking	89·4% (84·7 to 92·7)	81·7% (76·4 to 86·1)	85·
All nine risk factors including smoking	93·8% (90·9 to 95·8)	87·9% (84·1 to 90·8)	93·

Frauen:

Erhöhtes Risiko hinsichtlich Hypertonie, Diabetes

Erhöhte Protektion durch Sport und moderaten Alkoholkonsum

Empfehlungen für präventives Sporttreiben *(„Gesundheits-Sport“)*

Leicht:

<75 Watt/3-4 METS,

<4 kcal/min, <54% Hfmax.

langsames Gehen, leichte Hausarbeit

Moderat:

75-100 Watt/4-6 METS,

4-7kcal/min, 55-68% HFmax.

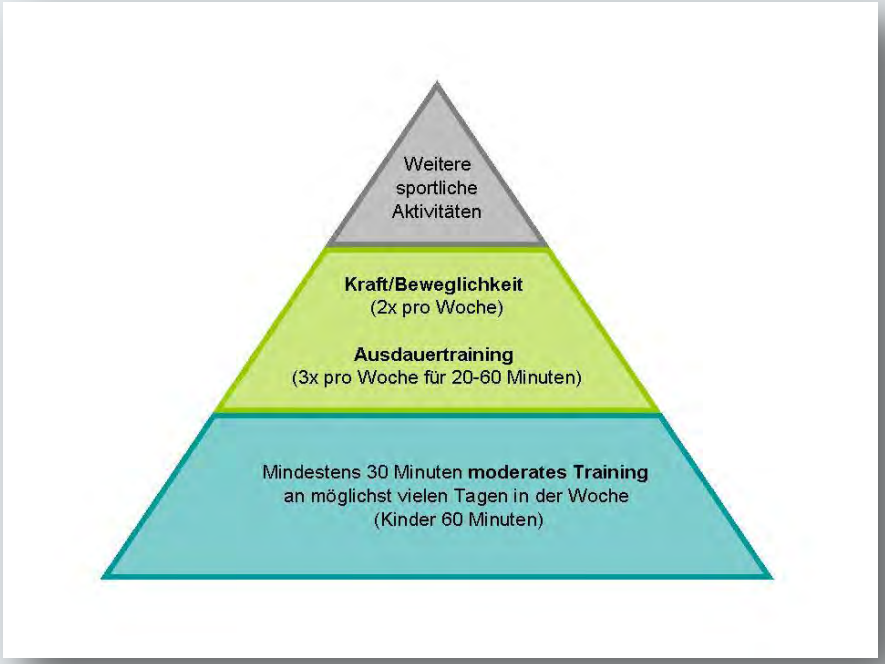
schnelleres Gehen, „Velotour“, Rasenmähen, „etwas ausser Atem“, leichtes Schwitzen

Intensiv:

>100 Watt/ab 6 METS,

>7 kcal/min, >70% HFmax.

Schwitzen, keine Unterhaltung mehr möglich



Reduktion der Sterblichkeit bei erhöhtem Bewegungsumfang

in Taiwanesicher Kohortenstudie mit n=416‘175

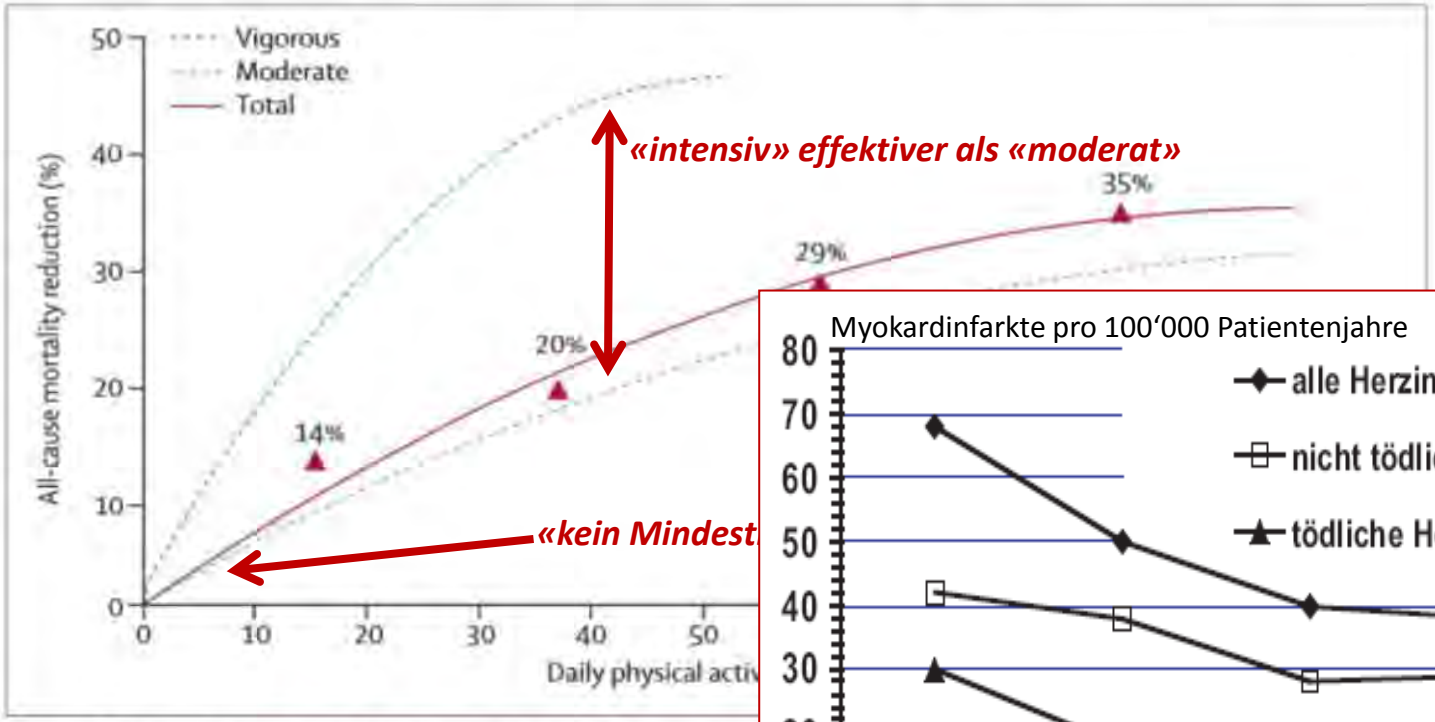
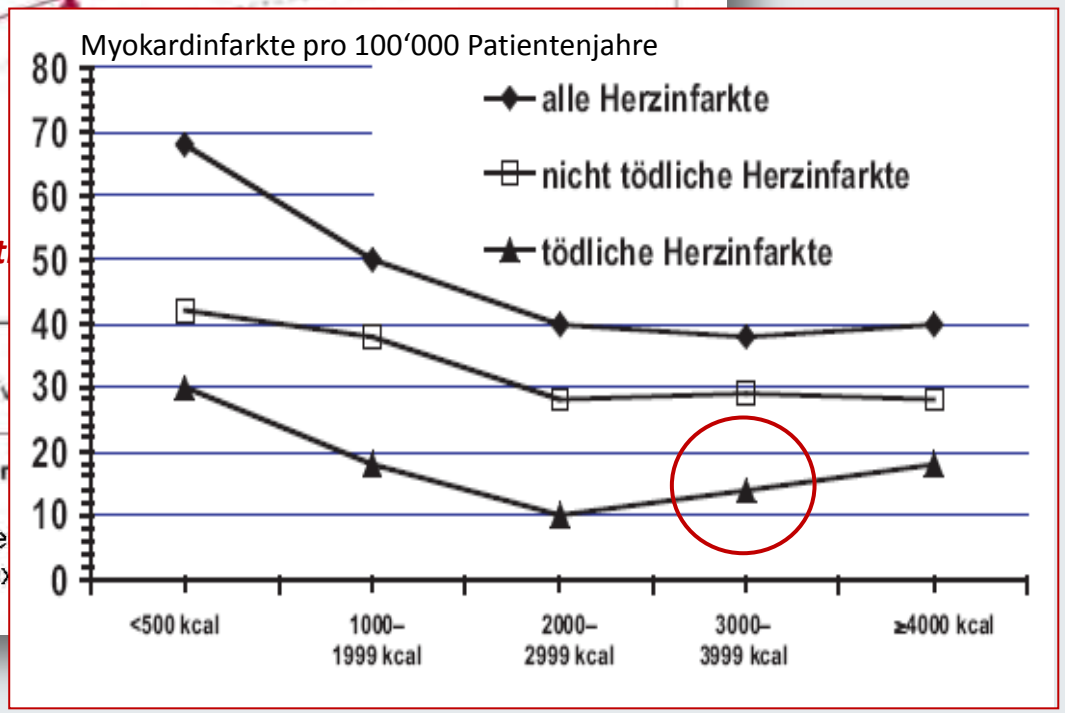


Figure 2: **Daily physical activity duration and all-cause mor**

Wen CP, Wai JP, Tsai MK, Yang YC, Cheng TY, Le
amount of physical activity for reduced mortality and ex



Paffenbarger et.al, Am J Epidemiol 1978; 108: 106-75

Plötzlicher Herztod im Sport

In etwa ***90%*** der Fälle liegt eine Herzerkrankung zugrunde, welche durch (einfache) Vorsorgeuntersuchungen hätte diagnostiziert werden können.

Jährliche Inz
ca. ***2-3/100'000***
bei jungen, kompetitiven Sportlern.

Bei älteren Sportlern bis 15/100'000 (?)

"Geschlechter-Verteilung": *1 : 9 (♀:♂)*

			Incidence
			1:9,000
			1:25,000
US Adolescents (age 12-19)	Atkins (2009)	Prospective EMS	1:27,000
US Children (age 10-14)	Chugh (2009)	Prospective EMS/Hospitals	1:58,000
US Athletes (age 12-35)	Maron (2009)	Retrospective Public media reports	1:160,000

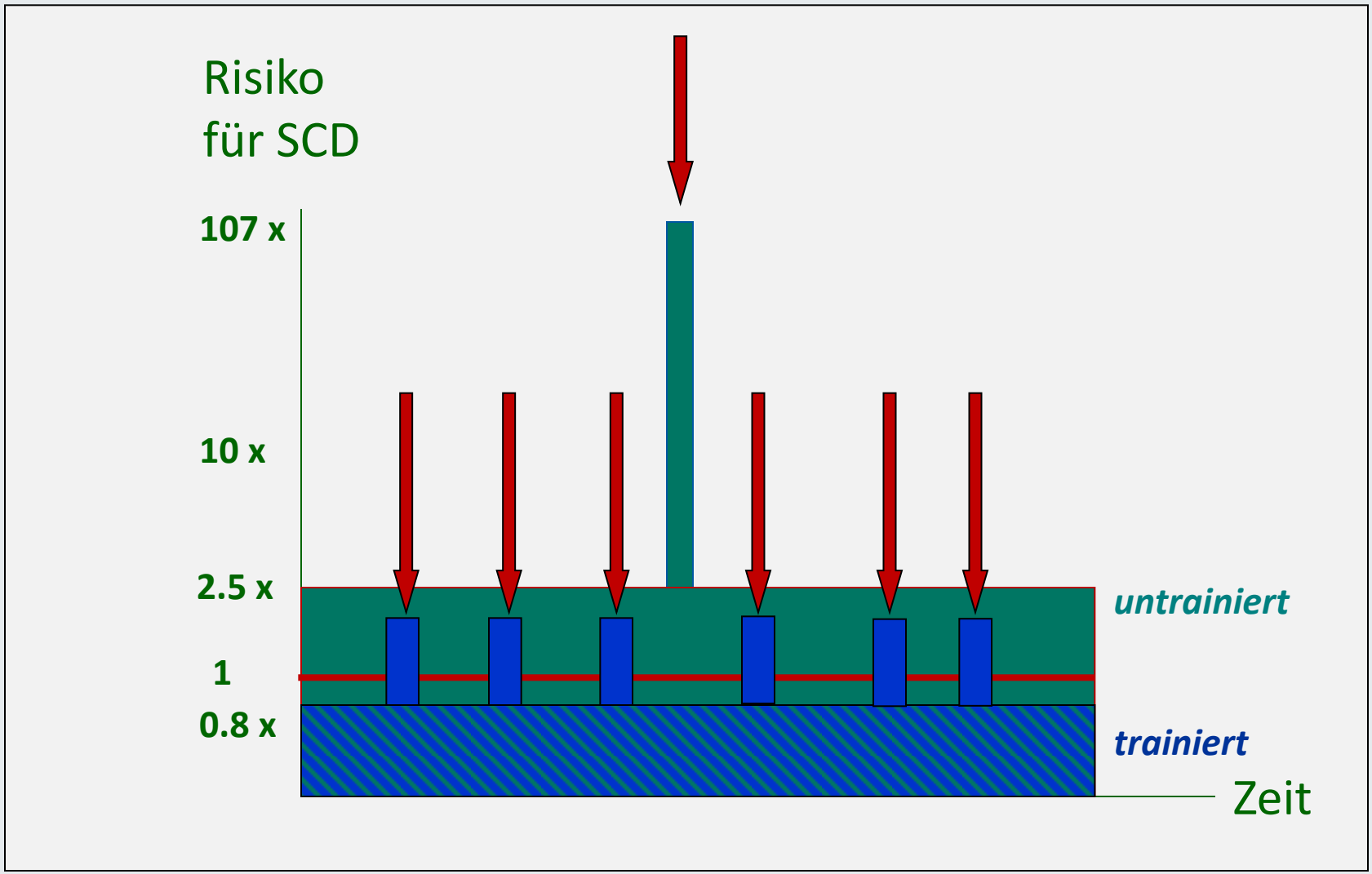
Gesundheitlicher Nutzen
durch regelmässiges körperliches Training
und Sport

Ein „Paradoxon“…?!

Sport als Trigger
für den plötzlichen Herztod

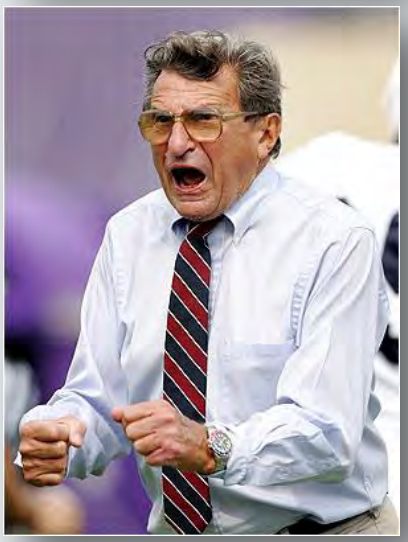
Mittleman et al. 1993: innerhalb 26 Std. gehäuft (Faktor 3 bis 107)

Ist der Begriff „Sport - Paradox“ korrekt?



„All Ding' sind Gift und nichts ohn' Gift; allein die Dosis macht, dass ein Ding kein Gift ist."

Theophrastus Bombast von Hohenheim („Paracelsus")



«The will to win is important, but the will to prepare is vital.»

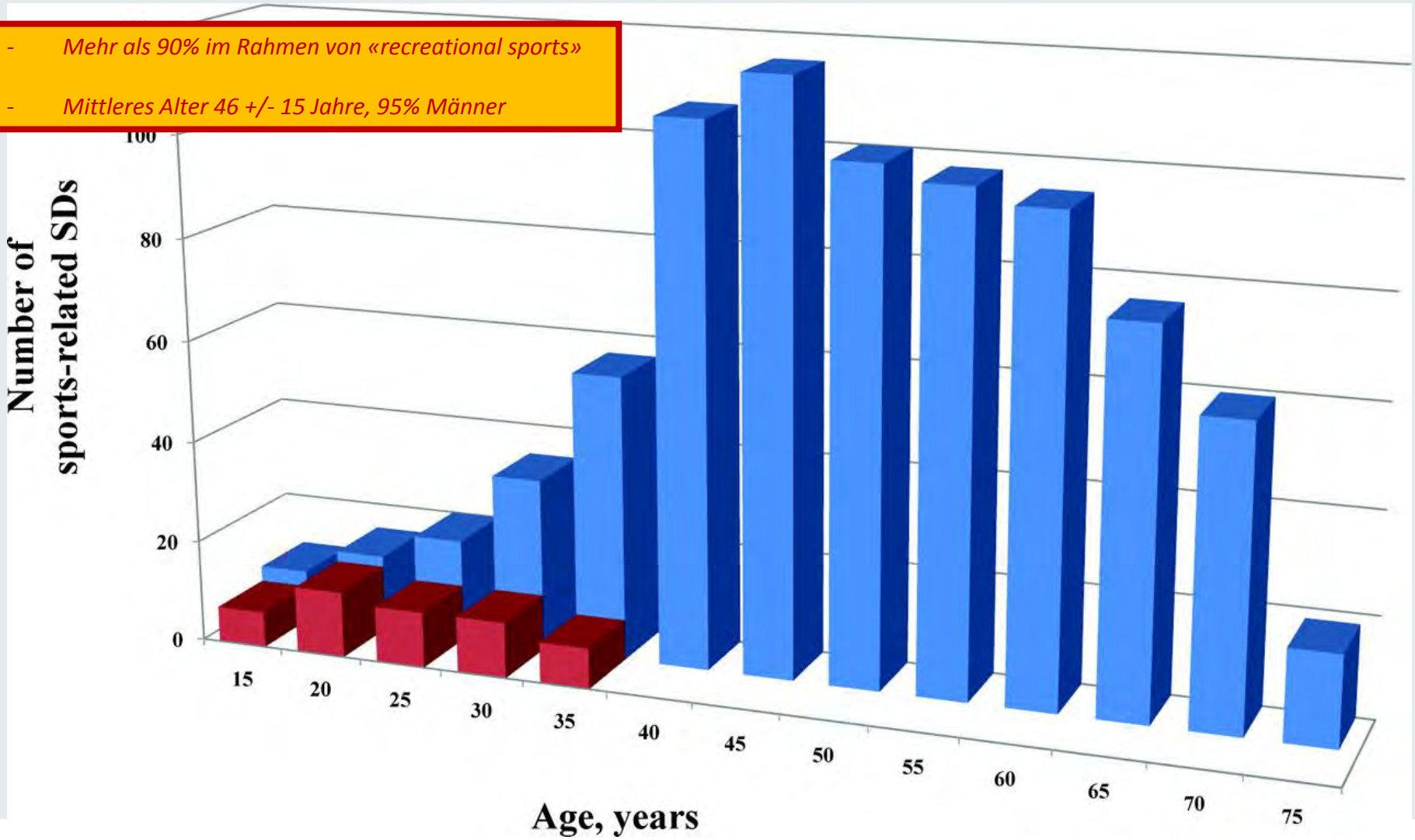
Joe Paterno (Football Coach)

Welchen Einfluss hat das «Ausmass des Sports»?

Gibt es die/den (ungefährdeten) nicht-kompetitiven «Hobby-Sportler»?

Altersverteilung von sport-assoziierten plötzlichen Todesfällen in der Allgemeinbevölkerung (blau) und bei jungen kompetitiven Athleten (rot)

- *Mehr als 90% im Rahmen von «recreational sports»*
- *Mittleres Alter 46 +/- 15 Jahre, 95% Männer*



Marijon E et al. Circulation 2011;124:672-681

Established in 1871

SMW Swiss Medical Weekly

Formerly: Schweizerische Medizinische Wochenschrift

The European Journal of Medical Sciences

Original article | Published 31 May 2012, doi:10.4414/smw.2012.13575

Cite this as: Swiss Med Wkly. 2012;142:w13575

Cardiac pre-competition screening in Swiss athletes

Current situation in competitive athletes and short follow-up assessment of an exemplary local screening programme

Christian Schmied[a], Sara Notz[a], Marco Cribari[a], Roman Gähwiler[a], Dagmar I. Keller[b], Thomas F. Lüscher[a]

Methoden:

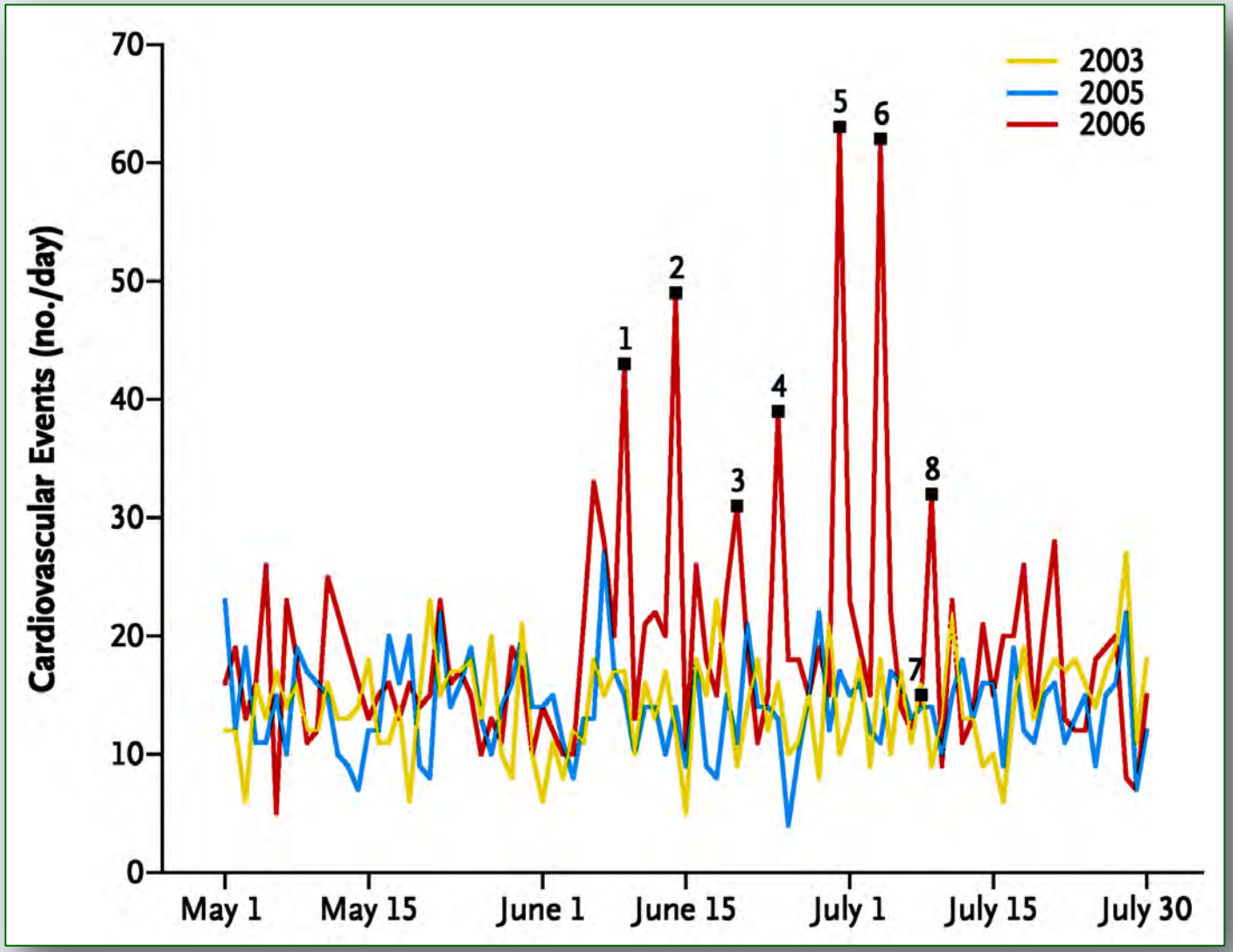
- 1047 kompetitive Breitensportler (Fragebogen)

Ergebnisse:

- nur 9% wurden bisher jemals kardial untersucht

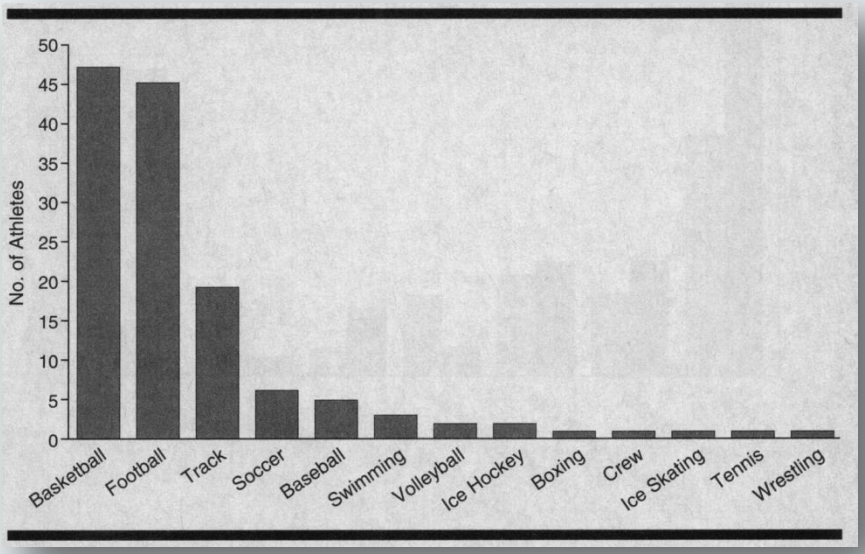
(lediglich 47% waren an Screening interessiert; v.a. Männer, ältere Sportler)

Häufigkeit der Herzinfarkte im Grossraum München

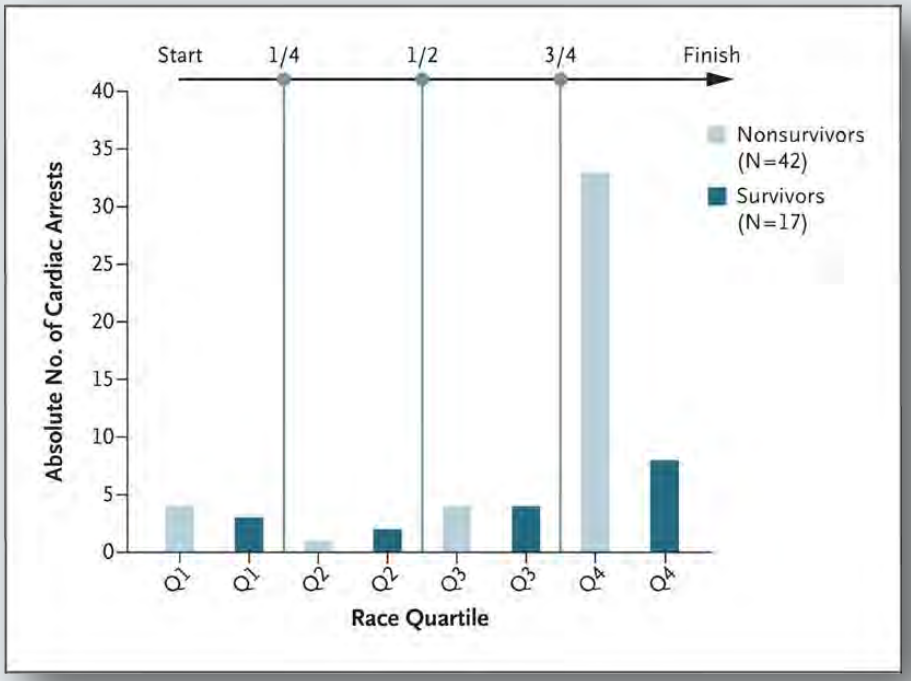


Wilbert-Lampen U, et al. N Engl J Med 2008; 358:475-483

SCD Risiko in Abhängigkeit von Sportintensität/Emotionaler Belastung



Maron BJ, et al. Sudden death in young competitive athletes. Clinical, demographic, and pathological profiles. JAMA. 1996 Jul 17;276(3):199-204.



Kim JH et al. N Engl J Med 2012;366:130-140.

Der plötzliche Herztod im Sport

Ursachen, Pathophysiologie und Prävention

Auslöser/“Trigger“

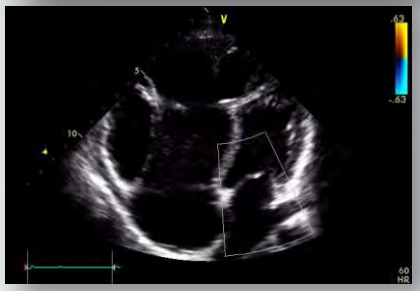
Sport

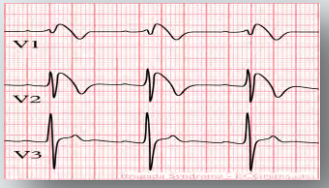
Kardiales Substrat/ Risikokonstellation

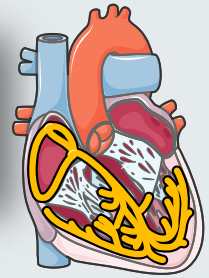
Strukturelle Herzerkrankung
Reizleitungsstörung
Bindegewebsschwäche

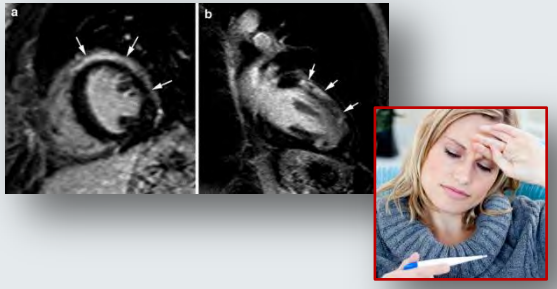
Ursachen des plötzlichen Herztods:

- **<u>«jüngere Sportler» (< 30-35 Jahre):</u>**
  - Angeborene Herzmuskelerkrankungen
  - Abgangsanomalien der Herzkranzgefässe
  - Herzerregungsstörungen
  - Commotio cordis
  - Marfan/Rupturiertes Aortenaneurysma
  - Myokarditis









Commotio Cordis

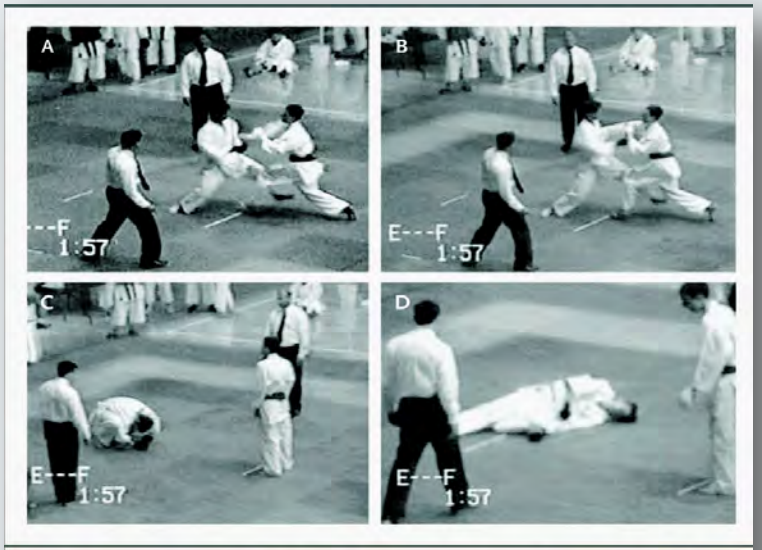
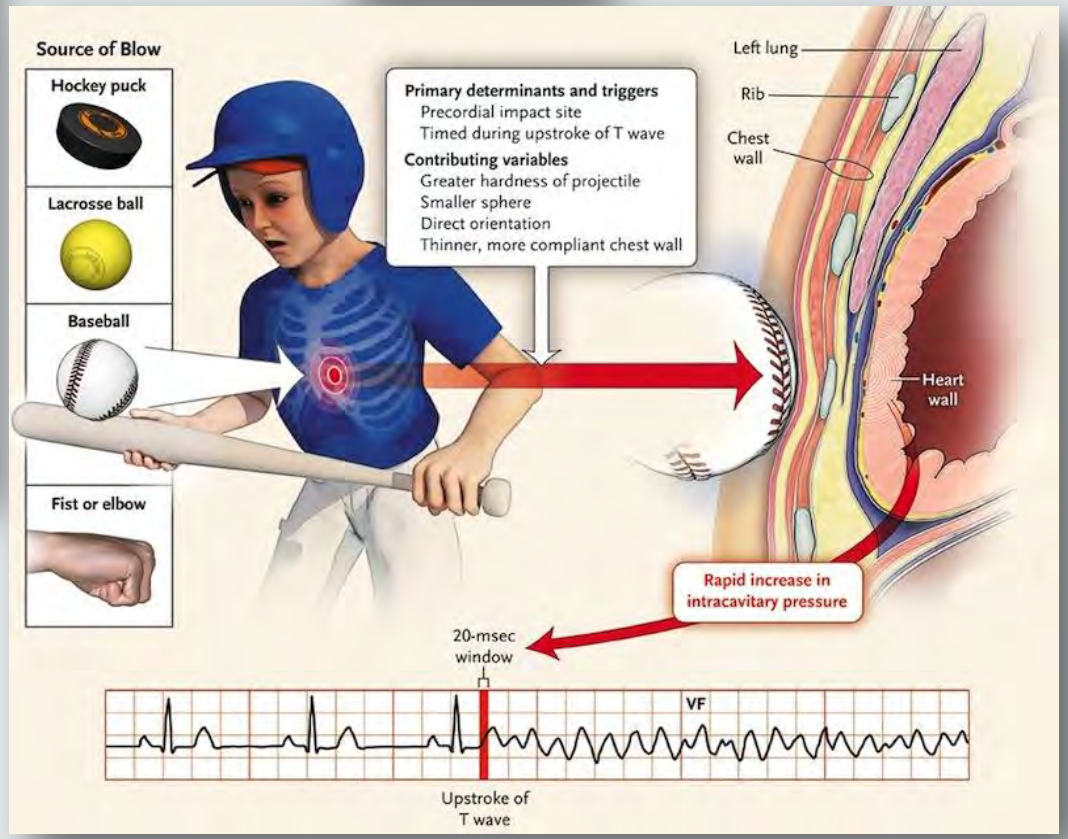


Figure 3. Stop-Frame Images of a Fatal Commotio Cordis Event in a 14-Year-Old-Boy during a Karate Match in Which the Unprotected Precordium Represented a Prescribed Scoring Target.

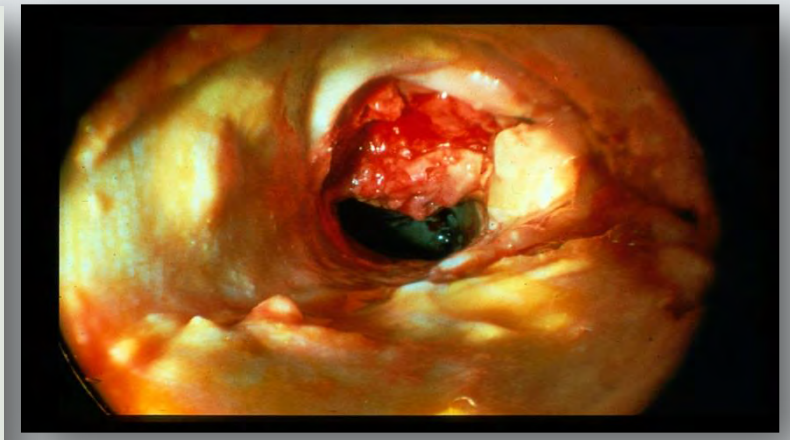
Panel A shows the fatal blow to the chest just before impact. Panel B shows the blow striking the left side of the boy's chest over his heart. Within a few seconds (after taking several steps), the boy falls to his knees (Panel C), presumably because of ventricular tachyarrhythmia, and then collapses (Panel D). Cardiopulmonary resuscitation was unsuccessful. Film provided by Cathy Hasipas.

Maron BJ, Estes, III N, N Engl J Med 2010; 362:917-927



Ursachen des plötzlichen Herztods:

- **«ältere Sportler» (>30-35 Jahre):** > 80% Koronare Herzkrankheit



Koronare Plaques und Plaque-Rupturen

«Automatischer Externer Defibrillator (AED)»

Überlebensraten bei plötzlichem Herzstillstand (US High School/College athletes):

64% mit AED Intervention
10% ohne AED Intervention

(Drezner et al. Circ 2009/Heart Rhythm 2008)

Cardiac events in football and strategies for first-responder treatment on the field

Christian Schmied,[1] Jonathan Drezner,[2] Efraim Kramer,[3] Jiri Dvorak[4]

Br J Sports Med. 2013 Aug 12. doi: 10.1136/bjsports-2013-092767

Verfügbarkeit eines "AED":

- offizielle Liga-/Länderspiele: ***68%***
- Trainings (Liga/Nationalteam): ***35%***

Vorhandensein eines "medical action plans" (Länderspiele): ***64.1%***

Angebot von regelmässigen BLS/ACLS Trainings: ***59.2%***

Table 1 Basic life support skills of different staff positions

Staff function	CPR skills	AED skills
Team physician	103 (100%)	100 (97.1%)
Medical attendant	71 (68.9%)	63 (61.2%)
Physiotherapist	66 (64.1%)	49 (47.6%)
Athletic trainer	27 (26.1%)	13 (12.6%)
Coach	23 (22.3%)	13 (12.6%)
Groundkeeper	7 (6.8%)	8 (7.8%)
Referee	13 (12.6%)	9 (8.7%)

AED, automated external defibrillators; CPR, cardiopulmonary resuscitation.

Effekte eines regelmässigen Trainings auf das Herz-Kreislaufsystem

«physiologisches Sportherz» vs. «echte Kardiopathie»

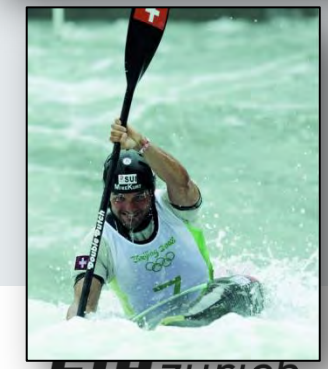
Kreislaufverhalten in Abhängigkeit von der Trainingsform

Dynamisches Training

(~ isotonisches Training)
(~ «aerobes» Training)
«endurance training»

Statisches Training

(~ isometrisches Training)
(~ «anaerobes» Training)
«strength training»



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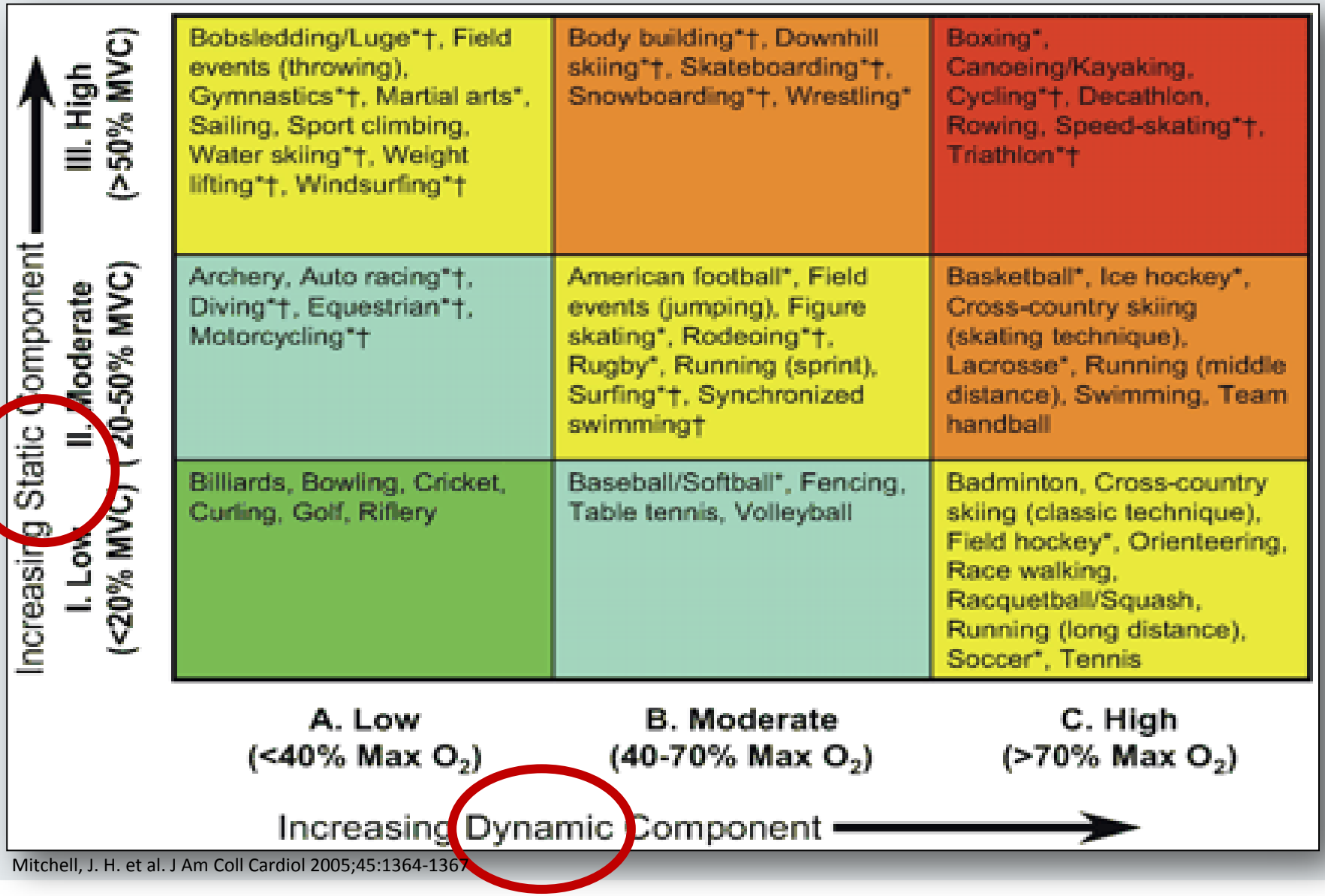
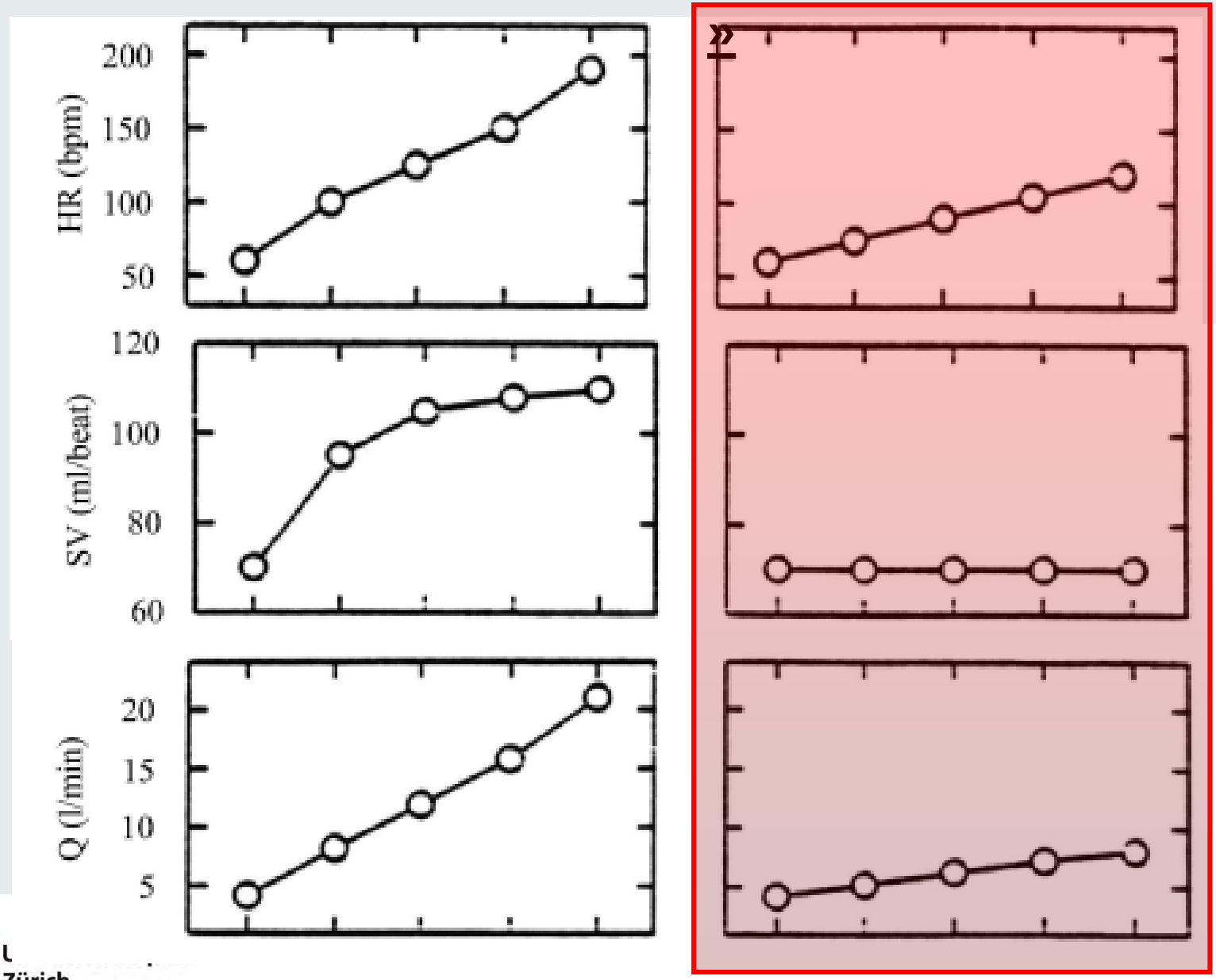


Mitchell, J. H. et al. J Am Coll Cardiol 2005;45:1364-1367

Dynamisch

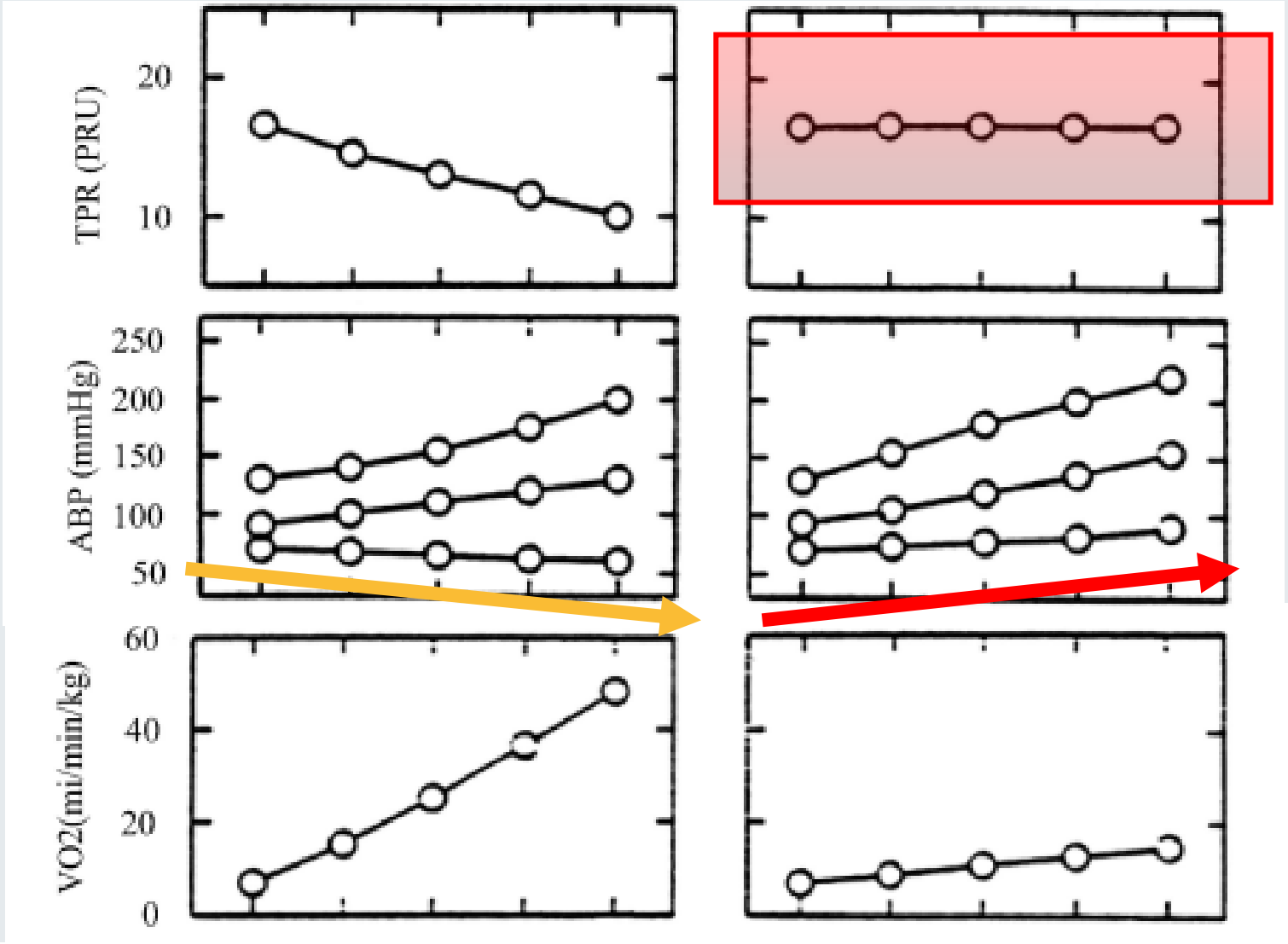
Statisch/»isometrisch



Mitchell, J. H. et al. J Am Coll Cardiol 2005;45:1364-1367

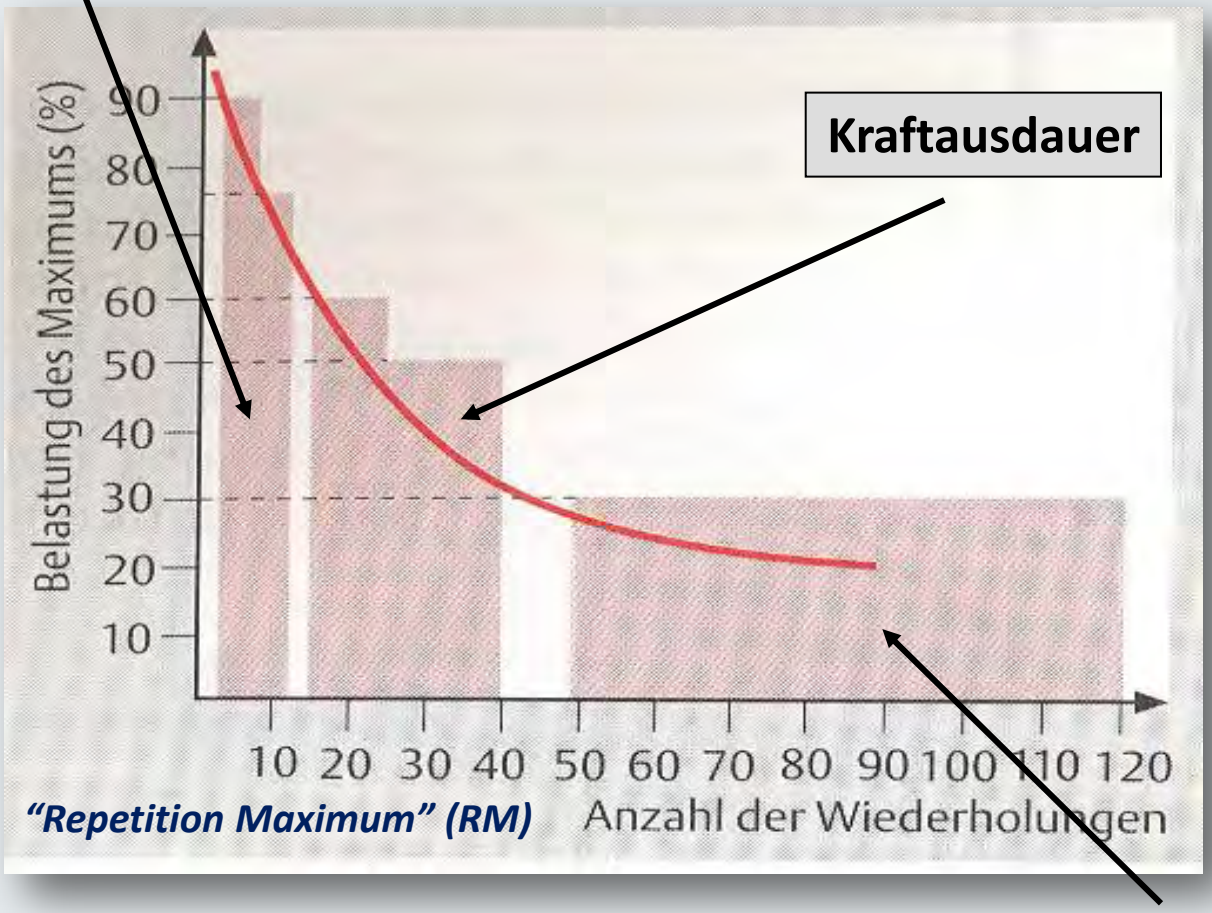
Dynamisch

Statisch/»isometrisch»



Belastungsformen – Kraft (Maximalkraft, Schnellkraft, Kraftausdauer)

Neuromuskuläre Koordination/ Hypertrophietraining



Kraftausdauer

Lokale aerobe Ausdauer

Das “physiologische” Sportherz

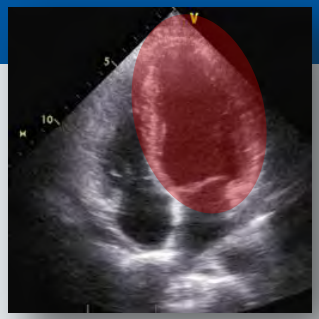
Weitere adaptive Veränderungen nach Überschreiten einer gewissen (individuellen, genetisch festgelegten) Schwelle:

„Herzhypertrophie“

60-70km Lauftraining pro Woche

- Erreicht im Mittel ab ca. 3-4x/Woche Mindesttrainingsbelastung
- Alle 4 „Herzhöhlen“ beteiligt (leichte Betonung des RV)
- Im Gegensatz zur pathologischen Hypertrophie: Innenvolumina immer parallel zur Wanddickenzunahme (Erhaltung systolische Wandspannung)

Laplace-Gesetz: Spannung = p x r / 2 x Wanddicke



(dynamisches) Ausdauer-Training

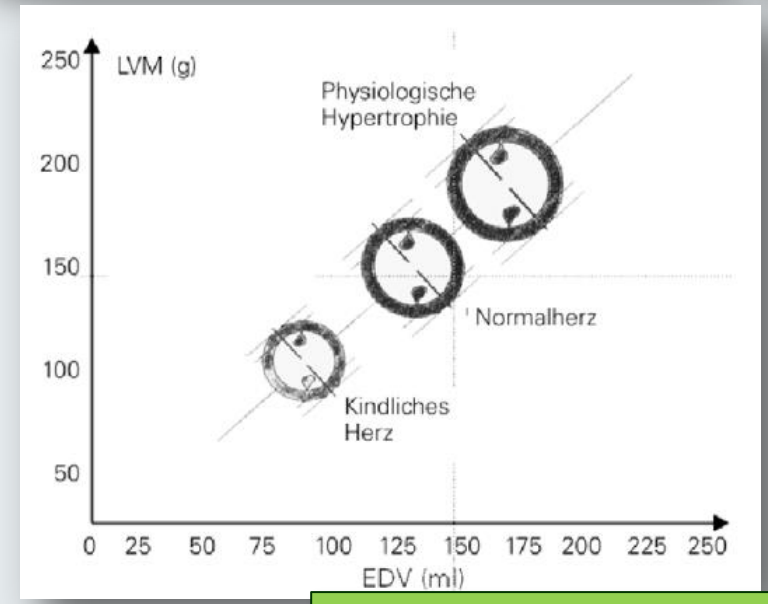
(statisches) Kraft-Training

Exzentrische Hypertrophie

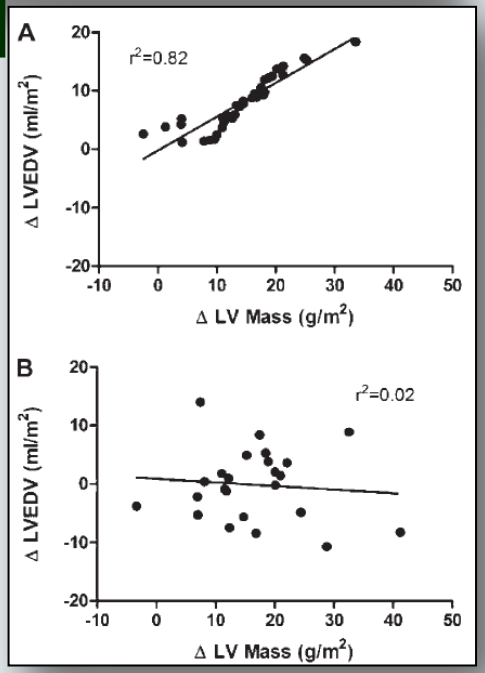
Konzentrische Hypertrophie

«Morganroth Hypothesis»

?



Laplace:
Wandspannung = p x r / 2x Wanddicke



Baggish AL. *J Appl Physiol* 104: 1121–28, 2008

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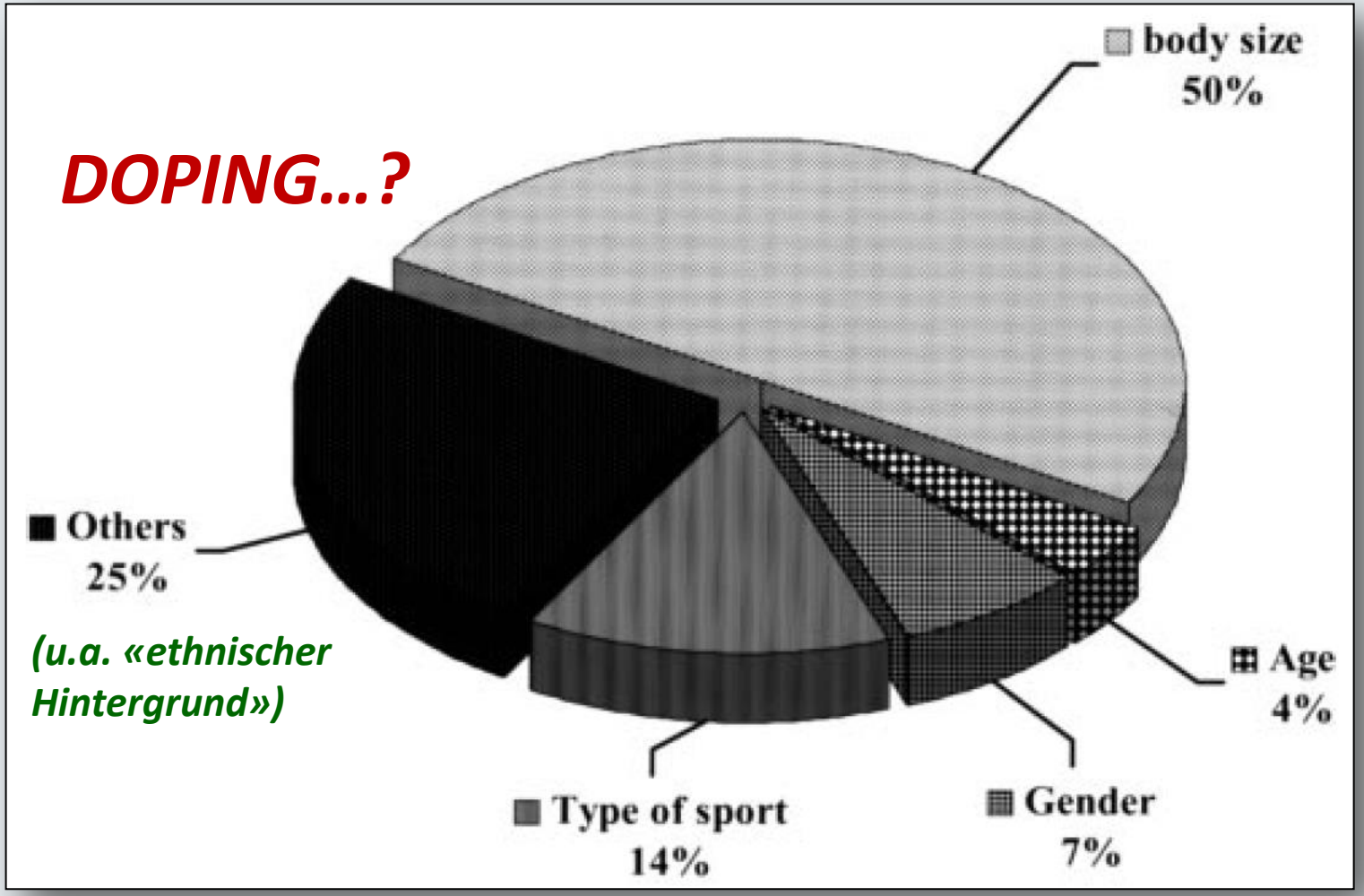
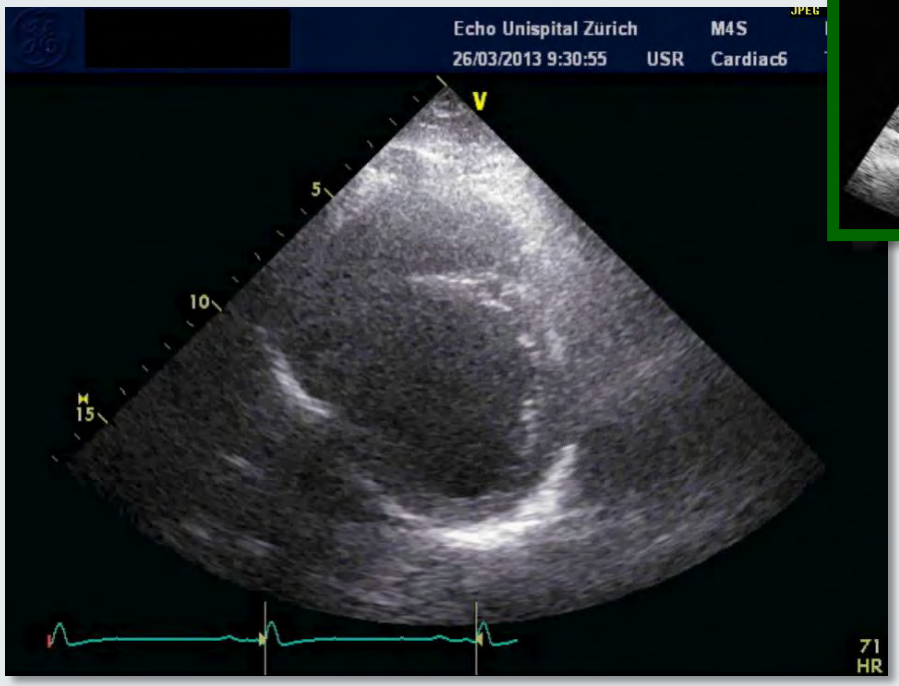
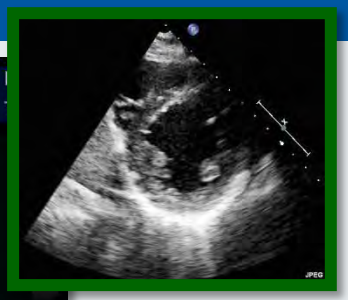
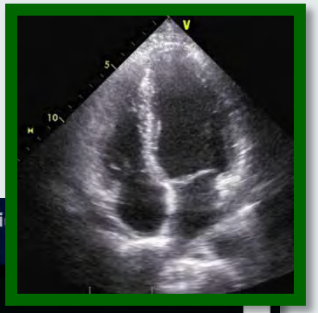
Einfluss von klinischen Variablen auf end-diastolische LV-Dimensionen

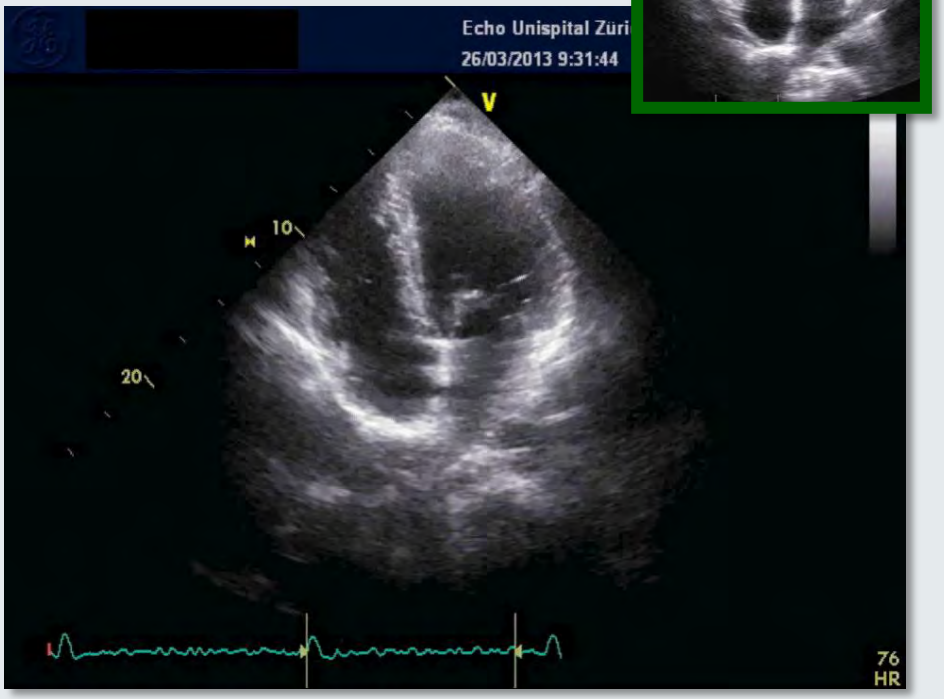


Barry J. Maron and Antonio Pelliccia. Sudden Death The Heart of Trained Athletes: Cardiac Remodeling and the Risks of Sports, Including. *Circulation.* 2006;114:1633-1644









Das «Sportlerherz»

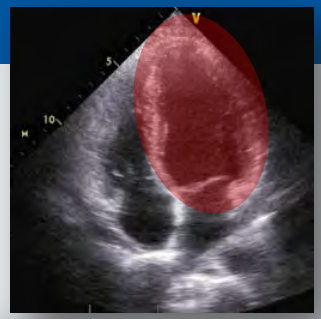
SALOMON EBERHARD HENSCHEN

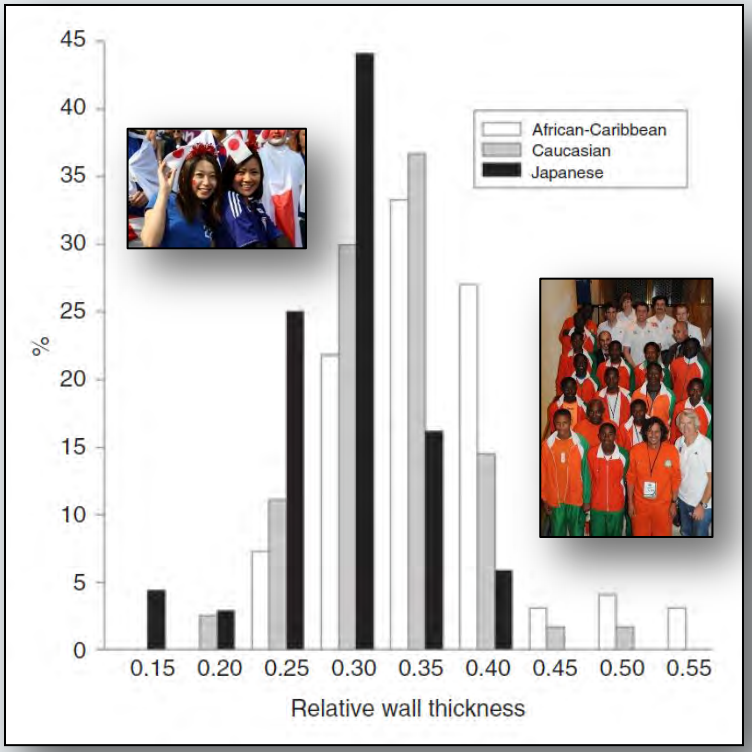
IN MEMORIAM.

83-jährig verschied am 4. Dezember Salomon Eberhard Henschen ehemaliger Professor für Medizin am Karolinischen Institut zu Stockholm. Damit fand eine erfolgreiche, begeisterte For-

Salomon E. Henschen
(*1847-1930)

Einfluss des ethnischen Hintergrundes auf das «Sportherz»





Kervio G, Pelliccia A. et al. Eur J Prev Cardiol 2013;20(5):880-8

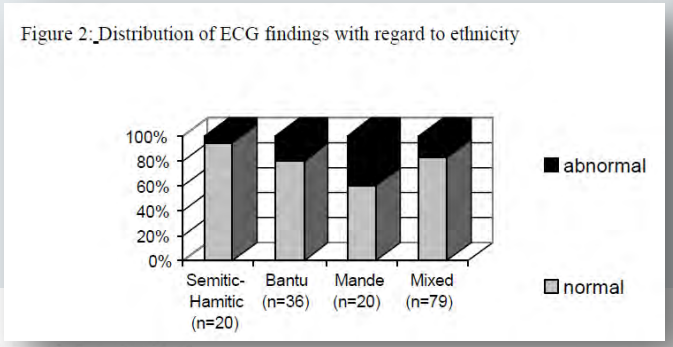
Br J Sports Med 2009;**43**:716-721 doi:10.1136/bjsm.2009.064196

Original article

Cardiac findings in the precompetition medical assessment of football players participating in the 2009 African Under-17 Championships in Algeria

C Schmied[1], Y Zerguini[2], A Junge[3], P Tscholl[3], A Pelliccia[4], B M Mayosi[5], J Dvorak[3]

CAF



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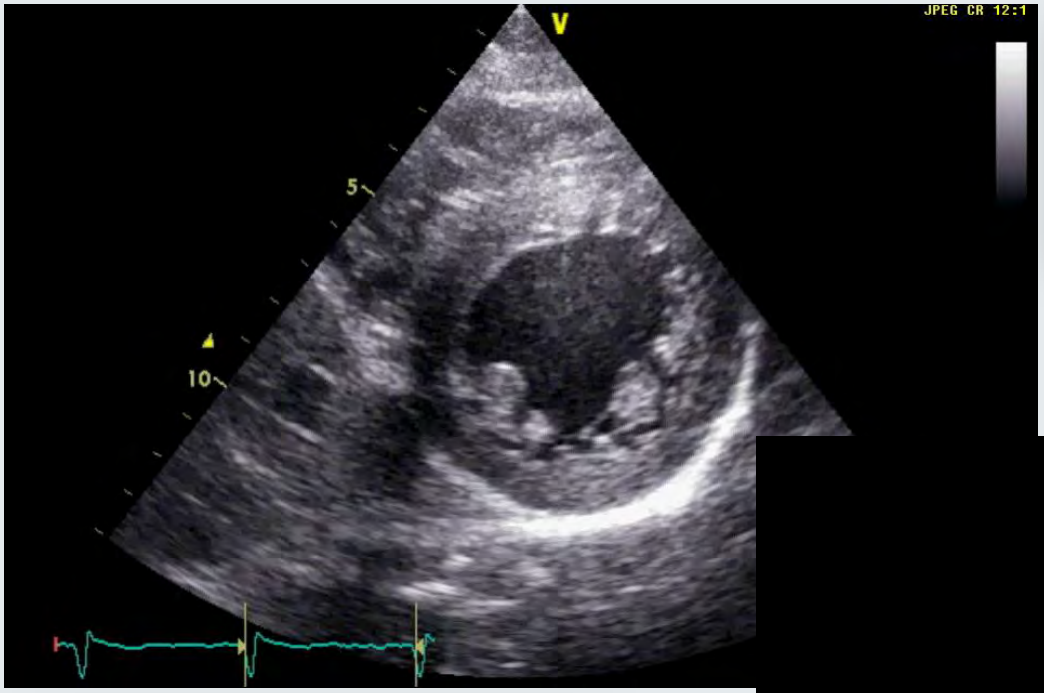


The Athlete's Heart in Adolescent Africans

An Electrocardiographic and Echocardiographic Study

Fernando M. Di Paolo, MD,* Christian Schmied, MD,† Yacine A. Zerguini, MD,‡ Astrid Junge, PHD,§ Filippo Quattrini, MD,* Franco Culasso, PHD,¶ Jiri Dvorak, MD,§ Antonio Pelliccia, MD*

Rome, Italy; Zurich, Switzerland; and Algiers, Algeria

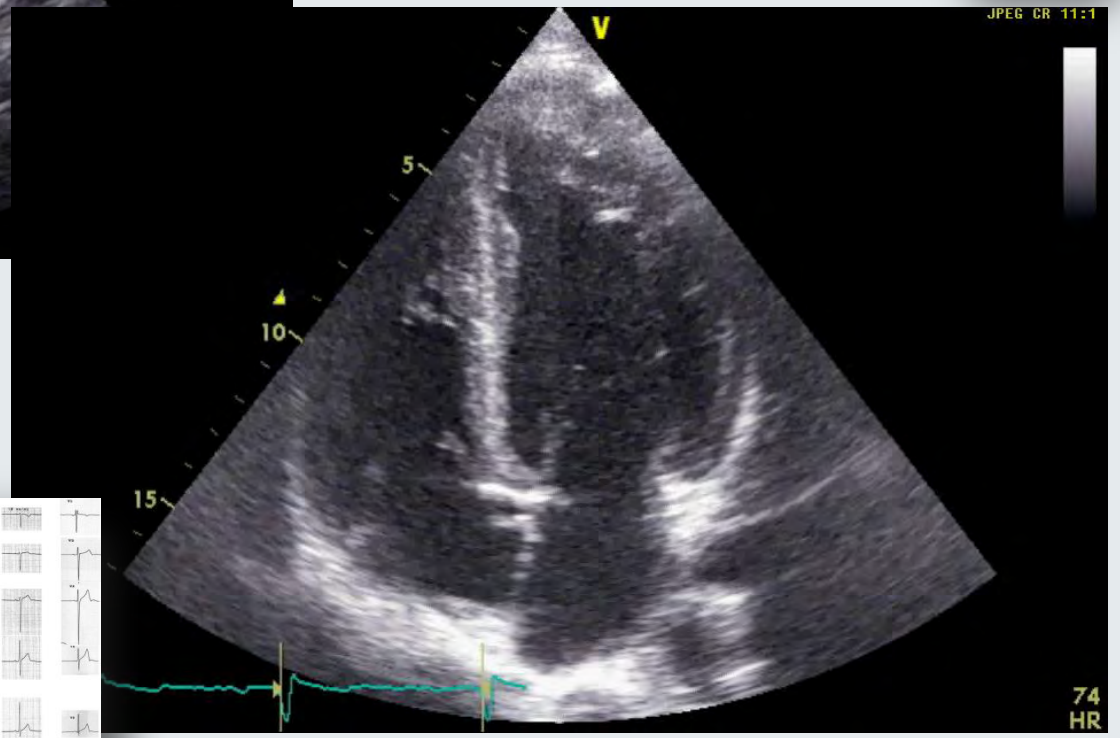
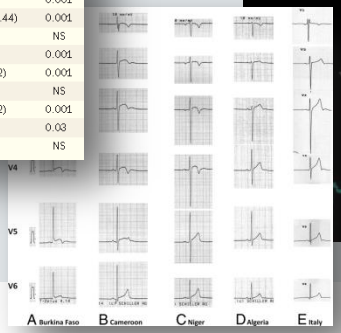


Table 2 Cardiac Dimensions in Adolescent African and Caucasian Soccer Players

	African Players (n = 154)	Caucasian Players (n = 62)	p Value
LV end-diastolic dimensions (mm)	51.0 ± 3.6 (42–62)	51.9 ± 2.6 (48–58)	NS
Normalized LV end-diastolic dimensions (mm/m²)	28.3 ± 2.3 (24–39)	28.0 ± 1.6 (24–33)	NS
LV end-systolic dimensions (mm)	32.7 ± 3.5 (22–42)	33.1 ± 3.3 (26–40)	NS
Normalized LV end-systolic dimensions (mm/m²)	18.1 ± 2.2 (13–26)	17.9 ± 1.8 (14–23)	NS
Ventricular septum (mm)	9.7 ± 1.3 (6–13)	9.2 ± 1.0 (7–12)	0.001
Normalized ventricular septum (mm/m²)	5.4 ± 0.8 (3.2–7.0)	5.0 ± 0.5 (3.4–6.1)	0.001
Posterior free wall (mm)	9.6 ± 1.4 (6–13)	9.0 ± 0.8 (7–11)	0.001
Normalized posterior free wall (mm/m²)	5.3 ± 0.8 (4.0–7.4)	4.8 ± 0.5 (3.4–6.0)	0.001
h/r ratio	0.38 ± 0.05 (0.24–0.56)	0.35 ± 0.03 (0.25–0.44)	0.001
Aortic root (mm)	30.0 ± 3.9 (25–38)	29.2 ± 2.6 (24–37)	NS
Left atrium (mm)	35.5 ± 4.5 (30–44)	32.3 ± 2.9 (28–39)	0.001
LV mass/BSA (g/m²)	101.4 ± 18.7 (60–181)	92.4 ± 13.2 (65–122)	0.001
LVEF (%)	65 ± 6 (50–78)	64 ± 5 (55–72)	NS
E wave (cm/s)	77.2 ± 13.2 (44–120)	90.1 ± 16.5 (55–132)	0.001
A wave (cm/s)	40.3 ± 9.3 (20–70)	43.1 ± 6 (30–67)	0.03
E/A ratio	2.0 ± 0.6 (1.1–4.5)	2.1 ± 0.5 (1.2–3.3)	NS



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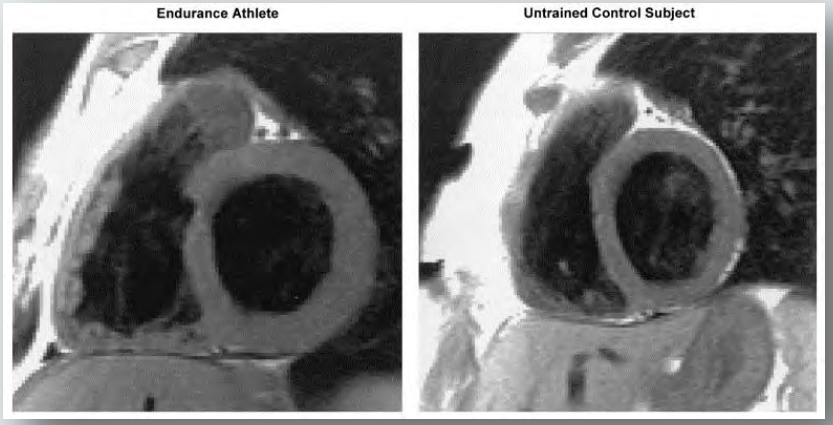
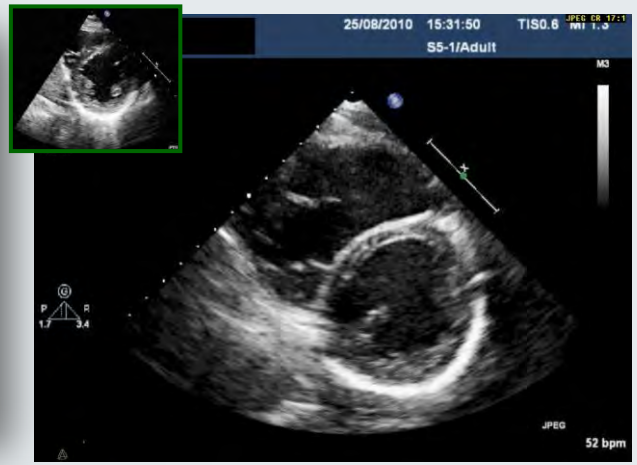
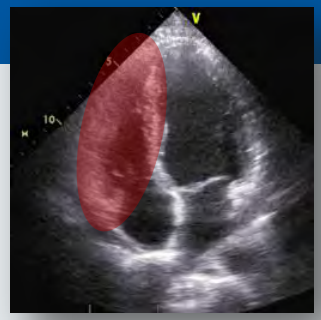
Der rechte Ventrikel – «Achillesferse» der Ausdauersportler



Scharhag J, et al. J Am Coll Cardiol 2002;40(10):1856-63





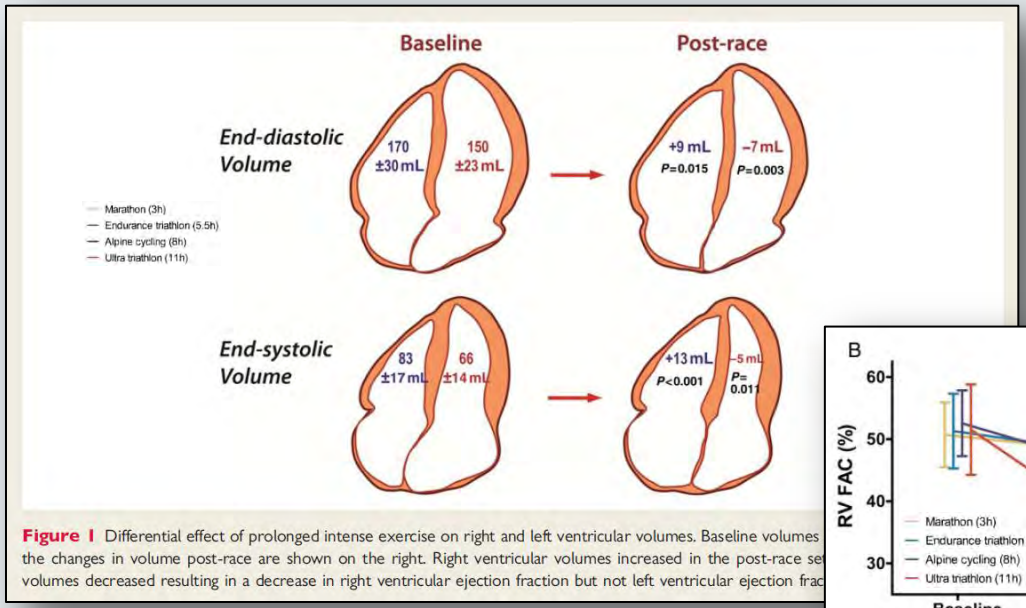
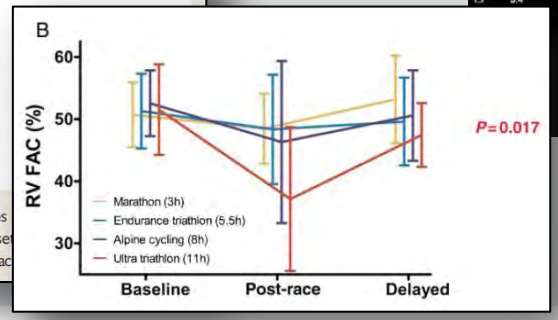
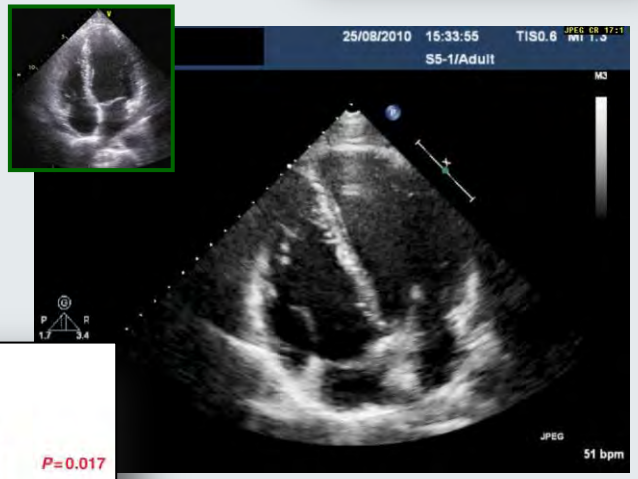


Figure 1 Differential effect of prolonged intense exercise on right and left ventricular volumes. Baseline volumes
the changes in volume post-race are shown on the right. Right ventricular volumes increased in the post-race se
volumes decreased resulting in a decrease in right ventricular ejection fraction but not left ventricular ejection frac





«right ventricular fatigue»

La Gerche, et al. Eur Heart J 2012;33:998-1006

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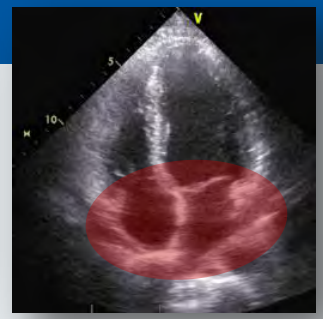
Die Vorhöfe

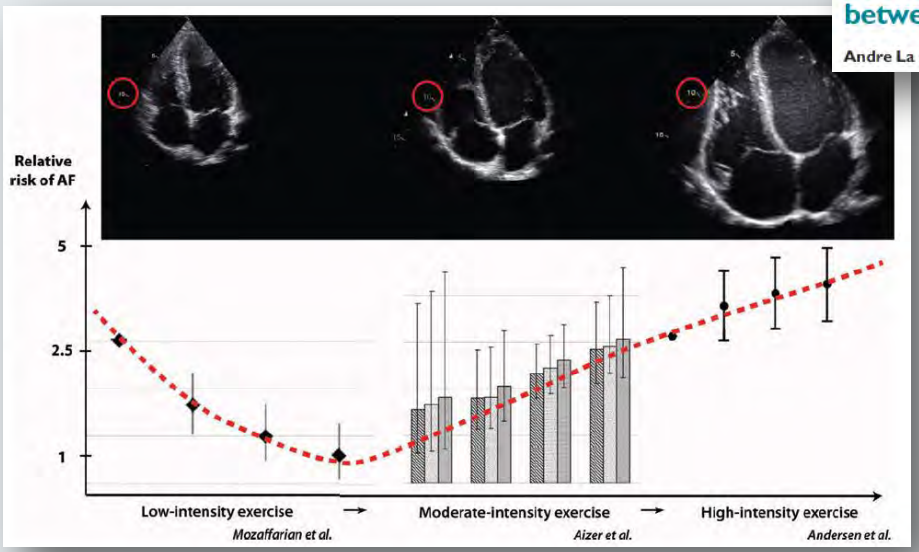
European Heart Journal (2013) 34, 3599–3602
doi:10.1093/eurheartj/eht265

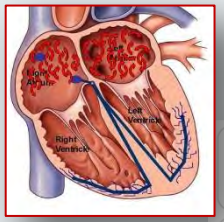
EDITORIAL

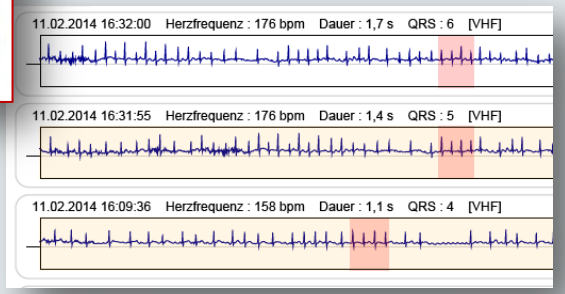
Atrial fibrillation in athletes and the interplay between exercise and health

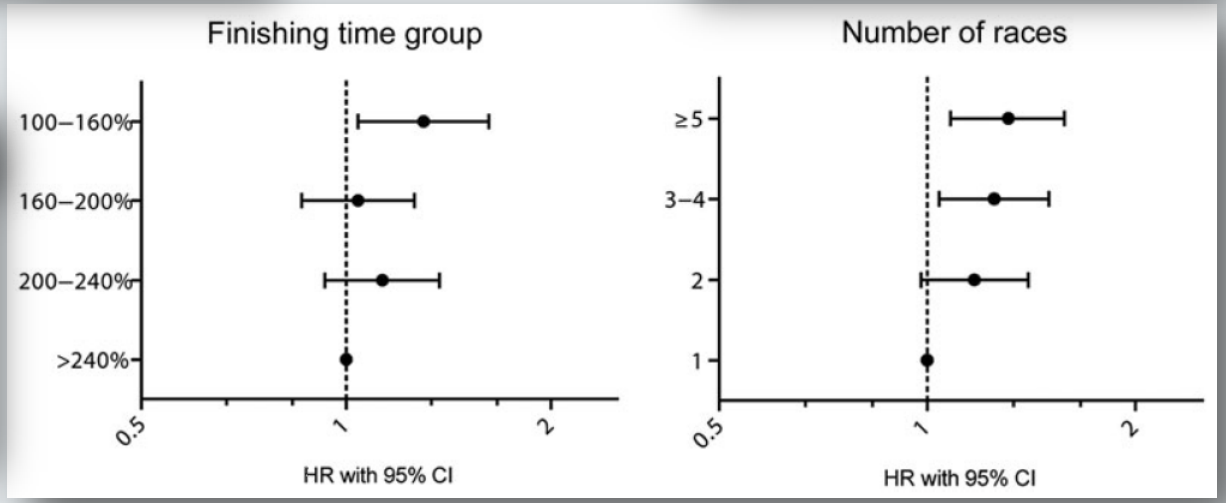
Andre La Gerche[1,2] and Christian Marc Schmied[3]*











Andersen K, et al. Risk of arrhythmias in 52'755 long-distance cross-country skiers: a cohort study. Eur Heart J 2013;34:3624-31

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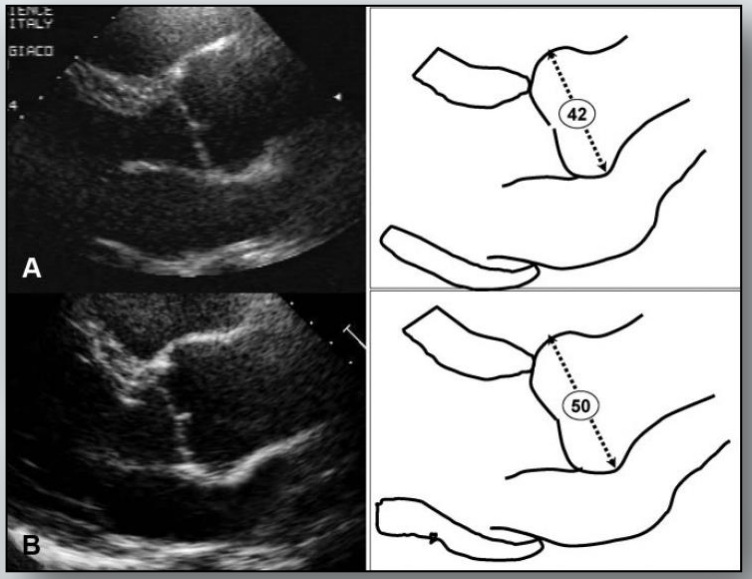
Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

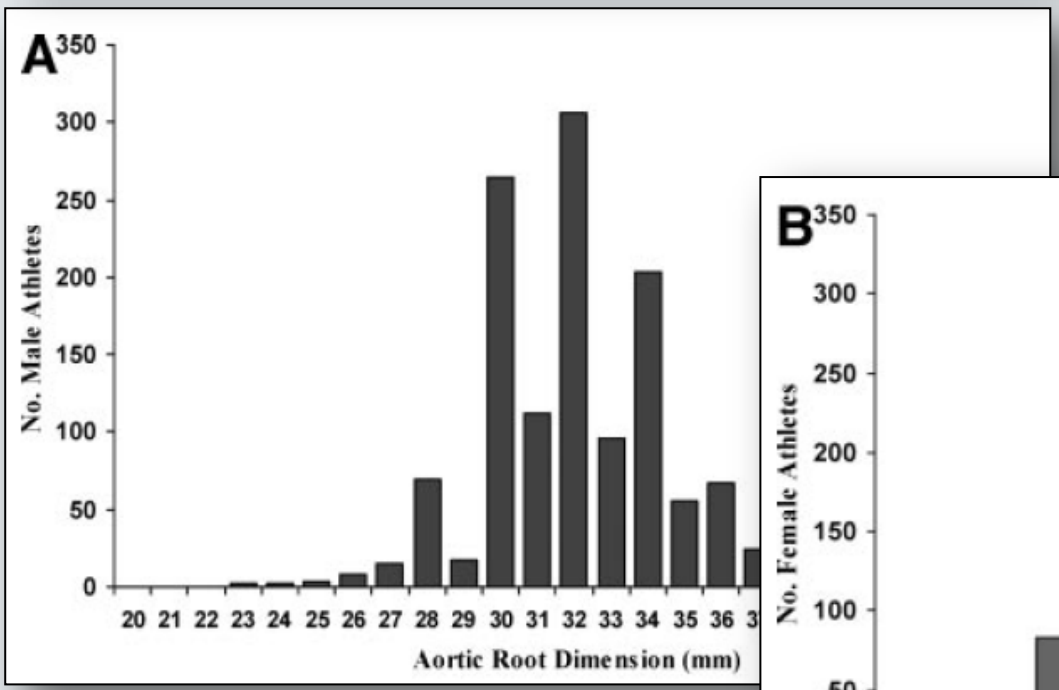
American Heart Association

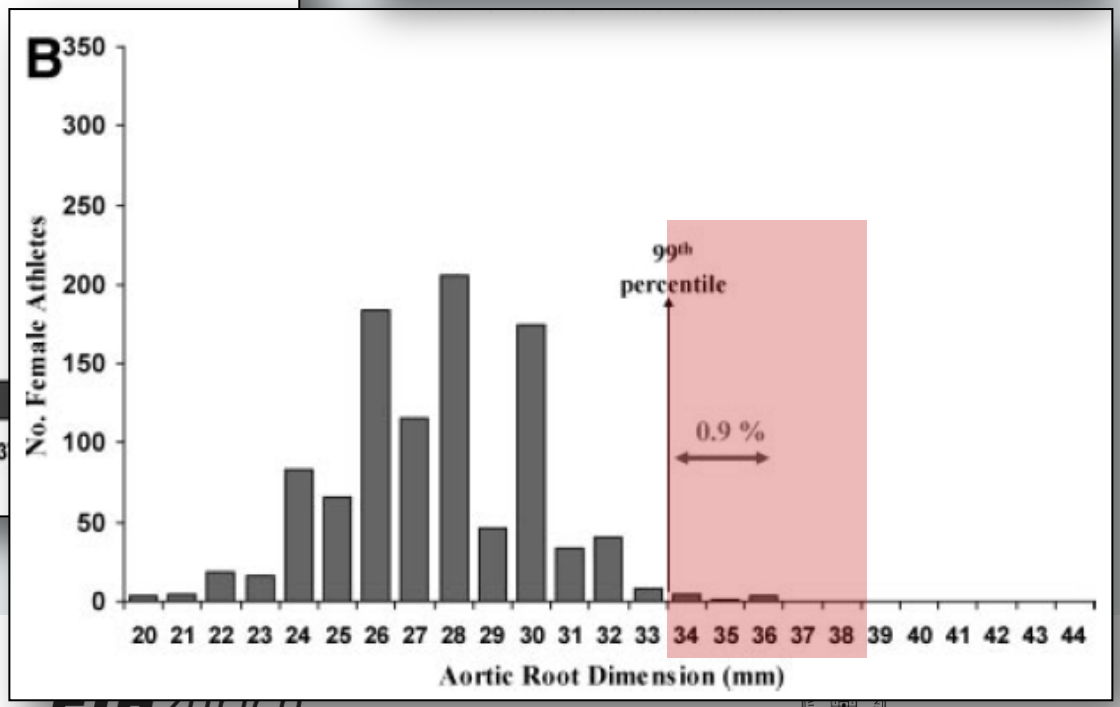
Prevalence and Clinical Significance of Aortic Root Dilation in Highly Trained Competitive Athletes

Antonio Pelliccia, Fernando M. Di Paolo, Elvira De Blasiis, Filippo M. Quattrini, Cataldo Pisicchio, Emanuele Guerra, Franco Culasso and Barry J. Maron

Circulation. 2010;122:698-706; originally published online August 2, 2010;

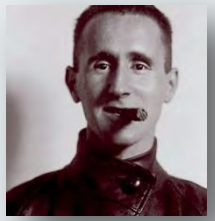






«Der grosse Sport fängt da an, wo er längst aufgehört hat, gesund zu sein»

Bertold Brecht



Aktuelle Screening-Konzepte zur Prävention des plötzlichen Herztods im Sport

Kardiales Screening bei jungen Sportlern

…zur Detektion von angeborenen Kardiopathien

ANAMNESE

«Lausanne Recommendations» (IOC)

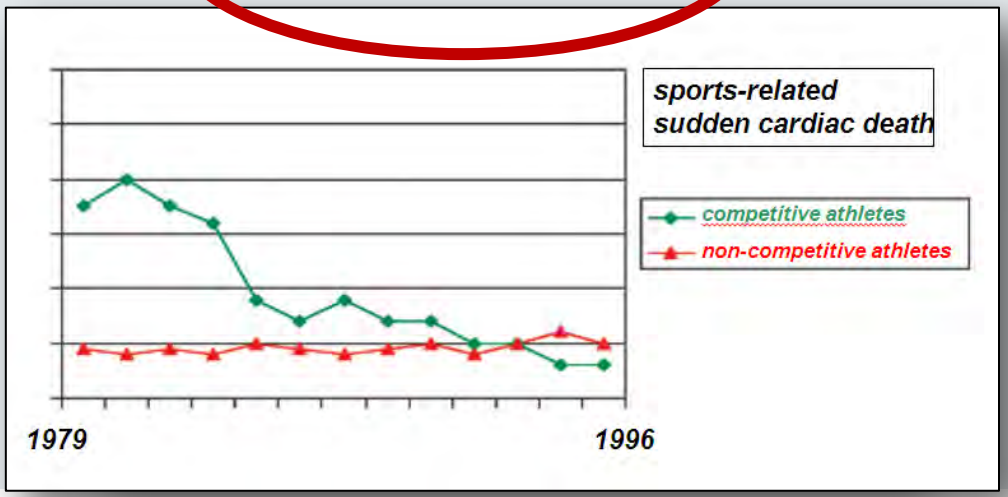
- Persönliche Anamnese, Familienanamnese
- cave AthletInnen

STATUS

fokussiert:

- Auskultation
- Blutdruckmessung
- Marfan-Stigmata (Ghent Criteria)

RUHE EKG



Corrado D, et al. JAMA 2006 Oct 4;296(13):1593-601.

TABLE. The 12-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes

American Heart Association. Learn and Live

Medical history*

Personal history

1. Exertional chest pain/discomfort
2. Unexplained syncope/near-syncope†
3. Excessive exertional and unexplained dyspnea/fatigue, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure

Family history

6. Premature death (sudden and unexpected, or otherwise) before age 50 years due to heart disease, in ≥1 relative
7. Disability from heart disease in a close relative <50 years of age
8. Specific knowledge of certain cardiac conditions in family members: hypertrophic or dilated cardiomyopathy, long-QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias

Physical examination

9. Heart murmur‡
10. Femoral pulses to exclude aortic coarctation
11. Physical stigmata of Marfan syndrome
12. Brachial artery blood pressure (sitting position)§

Maron B, et al. Circulation, 2007;115(12):1643-455

Sensitivität,: 45.5% [95% CI, 16.8% to 76.2%]
Spezifität, 94.4% [CI, 92.0% to 96.2%]

Aktuelles Europäisches Konzept:
Sensitivität 90.9% (CI, 58.7% to 99.8%)
Spezifität 82.7% (CI, 79.1% to 86.0%)
falsch-positiv: 16.9%

Baggish AL, et al. Ann Intern Med. 2010;152(5):269-75

«No - you can't!»

Seattle Conference 2012, Seattle/WA

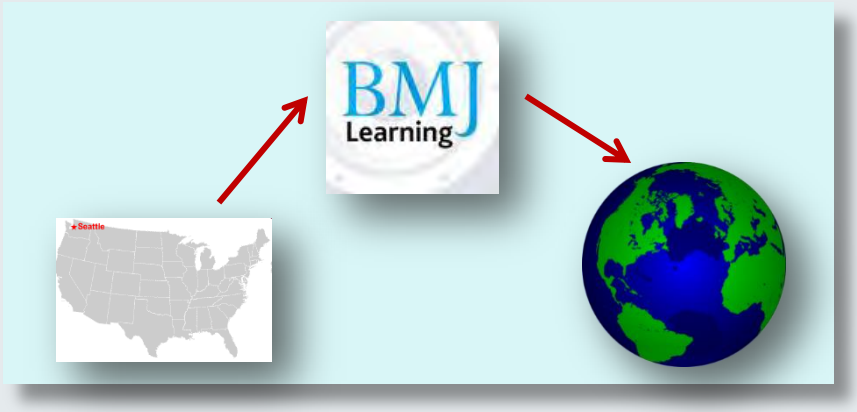
«Yes – we can!»

Normale Sportler-EKG Befunde
Häufige, durch den Sport/ein "Sportherz" bedingte, physiologische EKG-Veränderungen.
Keine weiteren Abklärungen notwendig.

Abnormale EKG Befunde
Seltene, nicht durch ein regelmässiges Training bedingte, pathologische EKG-Veränderungen.
Weitere Abklärungen zwingend notwendig.

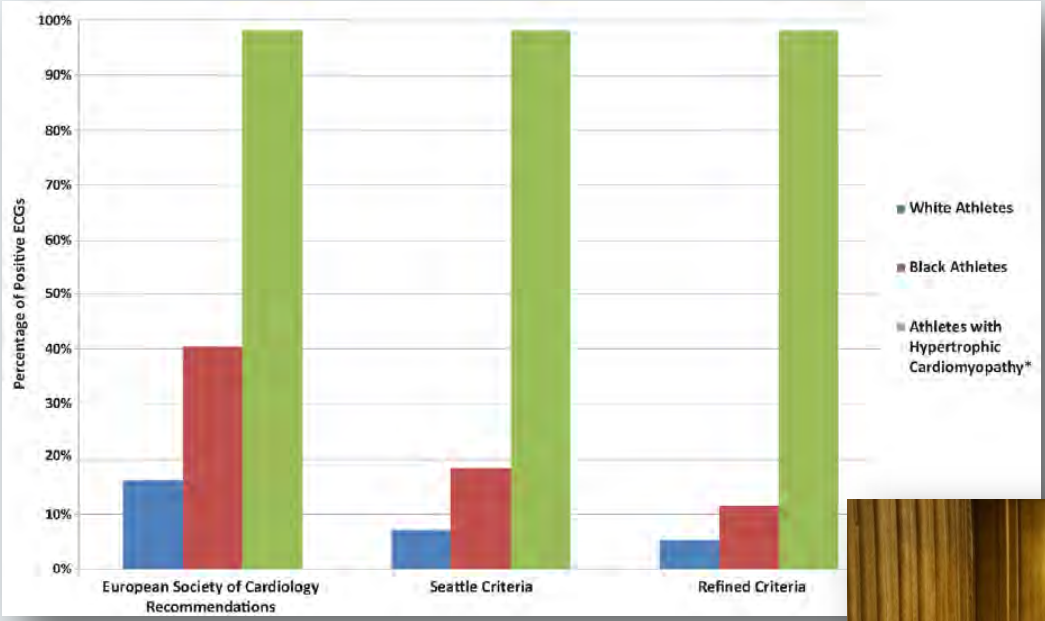
The “Seattle Recommendations”

Sinusbradykardie (> 30/min), -arrhythmie
Junctionaler, ektoper Ersatzrhythmus
“wandernder Schrittmacher”
AV block 1° oder 2° (Mobitz Typ I)
Inkompletter Rechtsschenkelblock
“early repolarization”
Isoliert erhöhte QRS voltage



Negative T-Wellen
(>1mm in ≥ 2 Ableitungen, *exkl. III, aVR, V1)*
Ausnahme: V2-V4 mit ST-Segment-Erhöhung bei schwarzen Athleten
ST-Segment Senkung (≥ 0.5mm in ≥ 2 Ableitungen)
Q-Zacken (> 3 mm tief, 40 ms lang, ≥ 2 Ableitungen, *exkl. III/aVR)*
Kompletter LSB/unspezifischer SB (≥ 140ms)
Links-Achsendeviation (-30° bis -90°)
Linksatriale Dilatation
Rechtsventrikuläre Dilatation plus
Achsendeviation (>120°)

AV block 2° (Typ Mobitz II), AV block III°
Verkürztes PQ Intervall (< 120ms) mit Delta Welle
und QRS-Verbreiterung (>120ms)
QTc-Verlängerung (♂≥ 470ms, ♀≥ 480ms, immer ≥ 500ms)
QTc-Verkürzung (< 320ms)
Sinusbradykardie (<30/min), Pausen ≥ 3 sek.
“Brugada-like” EKG (Typ I)
Ventrikuläre Rhythmusstörungen
(≥ 2 VES pro Ruhe-EKG “tracing”, Couplets/Tachykardien
Supraventrikul. Rhythmusstörungen (Afib/-flut)



Comparison of Electrocardiographic Criteria for the Detection of Cardiac Abnormalities in Elite Black and White Athletes

Nabeel Sheikh, Michael Papadakis, Saqib Ghani, Abbas Zaidi, Sabiha Gati, Paolo Emilio Adami, François Carré, Frédéric Schnell, Mathew Wilson, Paloma Avila, William McKenna and Sanjay Sharma

Circulation. 2014;129:1637-1649; originally published online March 11, 2014;
doi: 10.1161/CIRCULATIONAHA.113.006179

Circulation

Seattle Conference 2015

UniversitätsSpital Zürich

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Universität Zürich[UZH]

Kardiales Screening bei älteren Sportlern

…zur Detektion der Koronaren Herzkrankheit

ANAMNESE

STATUS

RUHE EKG

Kardiovaskulärer
RISK SCORE
(inkl. Blutentnahme)

BILDGEBENDE VERFAHREN

BELASTUNGSTEST

Das Kollektiv der «älteren» Sportler steht im Fokus

Pheidippides (530 bis 490 v. Christus)

Precompetition medical assessment of referees and assistant referees selected for the 2010 FIFA World Cup

Mario Bizzini,[1] Christian Schmied,[2] Astrid Junge,[1] Jiri Dvorak[1,3]

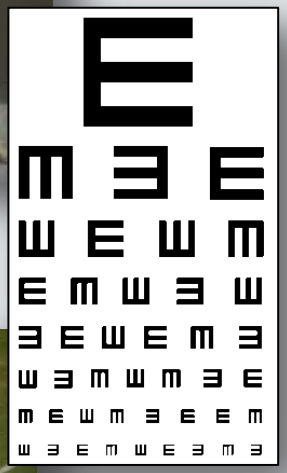


Table 1 Number and percentage of referees with suspicious findings in 12-lead resting ECG, transthoracic echocardiography and exercise ECG

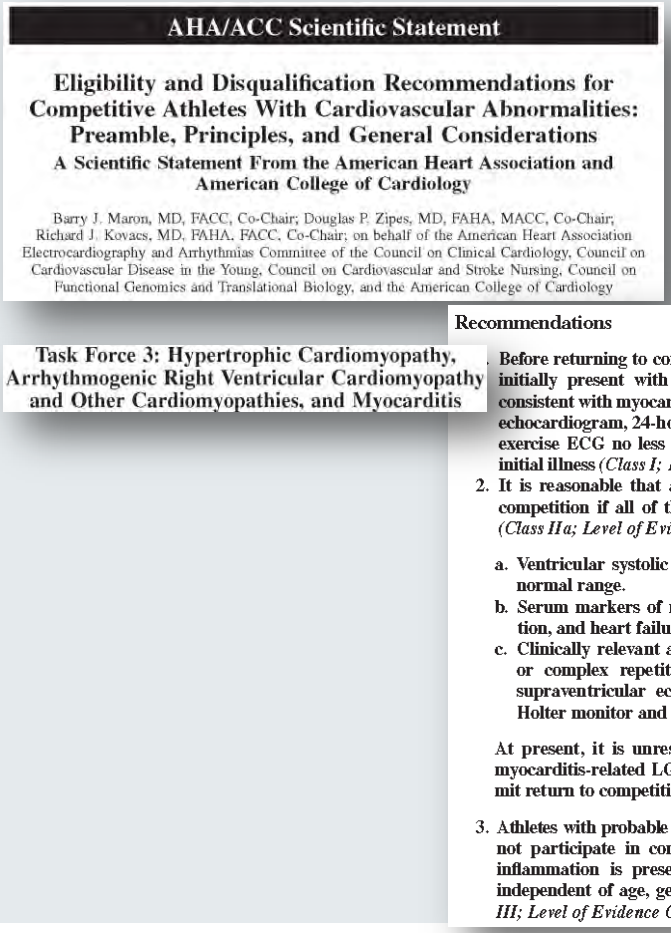
Examination	Suspicious findings
12-lead resting ECG	Brugada-like pattern (n=4, 4.4%)
	P dextro-atriale, incomplete RBBB (n=1, 1.1%)
	Ectopic supra-ventricular pacemaker (n=1, 1.1%)
	Left anterior hemi-block+incomplete RBBB (n=2, 2.2%)
	T wave inversions V4–V6+inferior leads (n=1, 1.1%)
	T wave inversions inferior leads (n=3, 3.3%)
Transthoracic echocardiography	Hypertrophic left ventricle with impairment of diastolic function (including dilatation of left atrium) (n=5, 5.6%)
	Hypertrophic left ventricle without impairment of diastolic function (n=2, 2.2%)
	Dilatation of aortic root/ascending aorta (n=2, 2.2%)
	Hyper-trabeculated right ventricle (n=2, 2.2%)
	Mitral valve prolapse, mild regurgitation (n=1, 1.1%)
	Mild mitral regurgitation due to fibrotic changes (n=2, 2.2%)
	Left ventricular 'hypertrabeculation', borderline non-compaction pattern (n=2, 2.2%)
Exercise ECG	ST segment depression ≥2 mm in leads V4–V6 (n=4, 4.4%)
	Exercise hypertension (n=5, 5.6%)

Trainingsempfehlungen bei bekannter kardiovaskulärer Krankheit

AHA/ACC:

Eligibility and Disqualification Recommendations for Competitive Athletes with Cardiovascular Abnormalities

Circulation 2015 Dec 1;132(22):e256



AHA/ACC Scientific Statement

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Preamble, Principles, and General Considerations

A Scientific Statement From the American Heart Association and American College of Cardiology

Barry J. Maron, MD, FACC, Co-Chair; Douglas P. Zipes, MD, FAHA, MACC, Co-Chair; Richard J. Kovacs, MD, FAHA, FACC, Co-Chair; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology

Task Force 3: Hypertrophic Cardiomyopathy, Arrhythmogenic Right Ventricular Cardiomyopathy and Other Cardiomyopathies, and Myocarditis

Recommendations

1. Before returning to competitive sports, athletes who initially present with an acute clinical syndrome consistent with myocarditis should undergo a resting echocardiogram, 24-hour Holter monitoring, and an exercise ECG no less than 3 to 6 months after the initial illness *(Class I; Level of Evidence C)*.
2. It is reasonable that athletes resume training and competition if all of the following criteria are met *(Class IIa; Level of Evidence C)*:
   a. Ventricular systolic function has returned to the normal range.
   b. Serum markers of myocardial injury, inflammation, and heart failure have normalized.
   c. Clinically relevant arrhythmias such as frequent or complex repetitive forms of ventricular or supraventricular ectopic activity are absent on Holter monitor and graded exercise ECGs.

   At present, it is unresolved whether resolution of myocarditis-related LGE should be required to permit return to competitive sports.
3. Athletes with probable or definite myocarditis should not participate in competitive sports while active inflammation is present. This recommendation is independent of age, gender, and LV function *(Class III; Level of Evidence C)*.

ESC:

Recommendations for competitive sports participation in athletes with cardiovascular disease

Eur Heart J (2005) 226, 1422-1445

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

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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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

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Konklusionen und Ausblick

Konklusionen und Ausblick

- *Der plötzliche sport-assoziierte Herztod ist, je nach Kollektiv, epidemiologisch aber natürlich immer auch emotional ein relevantes Ereignis.*

- *Das Herz/Herz-Kreislaufsystem unterliegt (physiologischen), durch regelmässiges Training verursachten Adaptationen, die das kardiale Screening erschweren («Sportherz»).*

- *Durch ein gezieltes und richtliniengetreues Screening kann die überwiegende Zahl dieser tragischen Ereignisse verhindert werden. Doch das Bewusstsein, dass (evidenzbasiertes) kardiales Screening zur Standardbetreuung jedes Sportlers gehören sollte, ist noch zu wenig verbreitet.*

- *Sogenannte «Hobby-Sportler» werden diesbezüglich aktuell massiv unterbetreut (und werden zudem selten in den Statistiken erfasst).*

- *Die akkurate Beurteilung des 12-Ableitungs Ruhe-EKG ist der entscheidende Schritt in der Vorsorgeuntersuchung.*

- *Die Sensitivität/Spezifität der Interpretation des Sportler-EKGs wurde (und wird) aktuell stetig verbessert («Seattle Criteria»).*

- *Rund 10% der Fälle von Herzstillstand im Sport sind nicht durch Screening zu verhindern, in diesen Situationen (wie auch bei der commotio cordis) sind akkurate Akutmassnahmen vor Ort entscheidend («rescue on the field», «AED»).*

- *Die Beurteilung der Veränderungen des rechten Ventrikels bei jungen, und die Detektion und Risikoeinschätzung von «Koronar-Plaques» bei älteren Sportlern stellen die aktuell anspruchsvollsten Herausforderungen dar.*