
Svensk Förening för Klinisk Fysiologi presenterar
Höstmötet 2023
2-3 oktober, Steam Hotel, Västerås
https://www.sfkf-hostmotet.se/
Sista anmälningsdag 2023-07-31
Begränsat antal rum – vänta inte med din anmälan!

Vänster kammares geometri

Jonas Selmeryd

Överläkare Fysiologkliniken Västerås

Disposition

- I mikroskopet
- I makroskopet
- Ska vi mäta LVM och RWT och i så fall hur?
- Word of caution

Disposition

- I mikroskopet

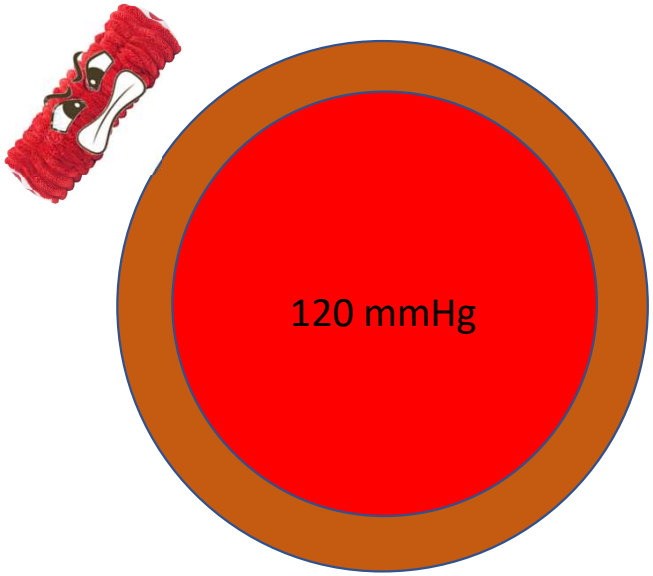
Wall stress

$$\text{Väggtension} = \text{Wall stress} = \frac{PR}{2w}$$ (Laplace lag)

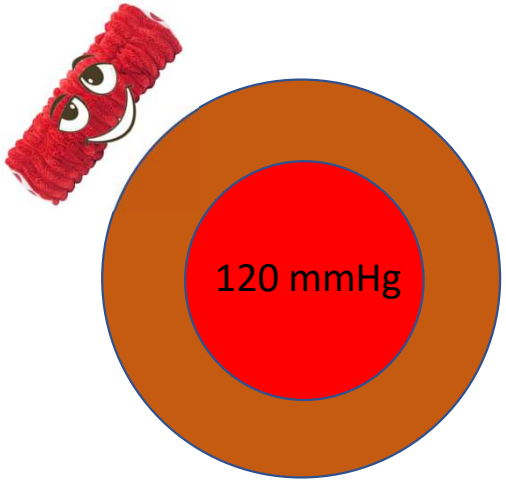
Laplace lag Väggstress = Kammartryck * Innerradie / 2*Väggtjocklek

Talar om vilken kraft (afterload) en enskild myocyt måste övervinna när den förkortas

Tidigt i systole



Väggstress = 175 mmHg



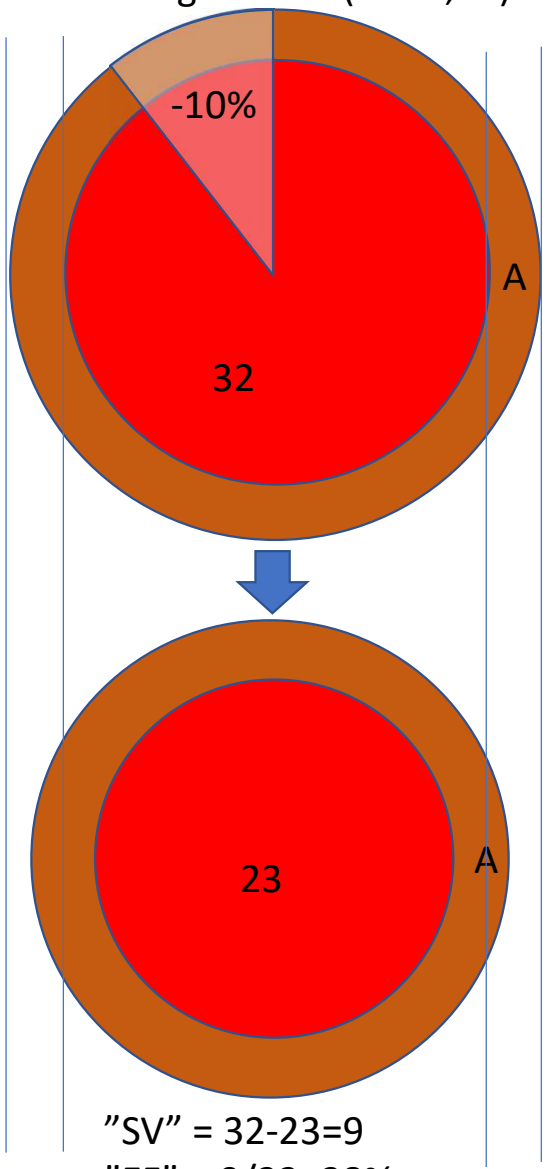
Väggstress = 50 mmHg

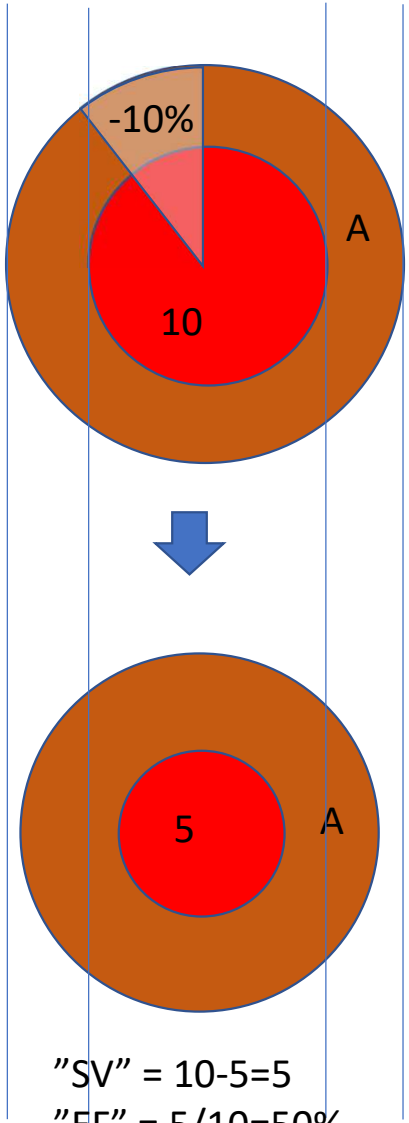
Excentrisk geometri (rwt 0,25)

Koncentrisk geometri (rwt 0,7)

Diastole

Systole





”SV” = 32-23=9
”EF” = 9/32=28%

”SV” = 10-5=5
”EF” = 5/10=50%

Trots identisk fiberförkortning (-10%) och myokardmängd (A) minskar innerarean mer vid excentrisk geometri än koncentrisk

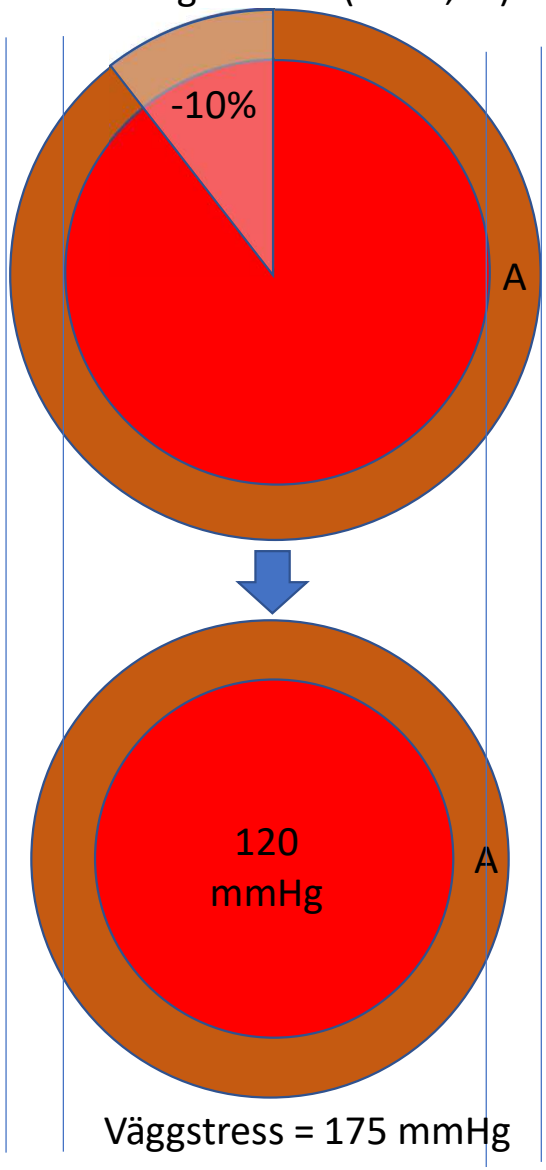
Excentrisk geometri = volymsarbete

Excentrisk geometri (rwt 0,25)

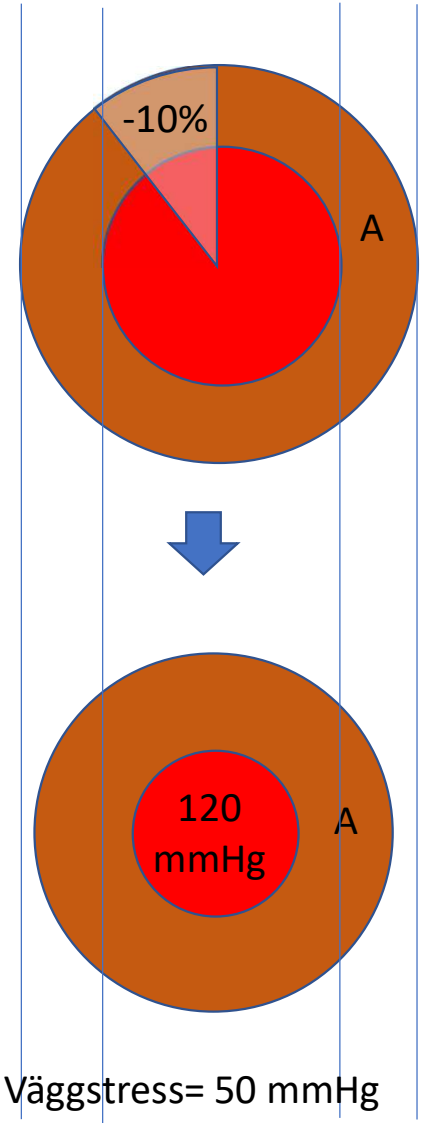
Koncentrisk geometri (rwt 0,7)

Diastole

Systole



Väggstress = 175 mmHg



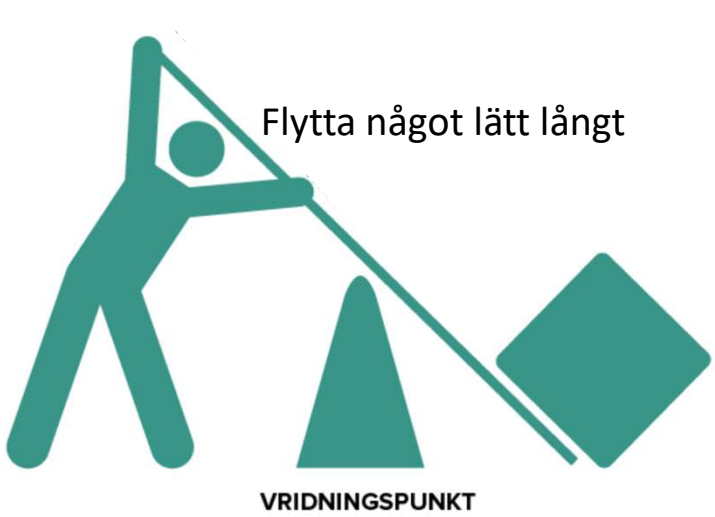
Väggstress= 50 mmHg

Vid identisk fiberförkortning (-10%) och myokardmängd (A) kommer väggstressen i den koncentriska kammaren vara lägre

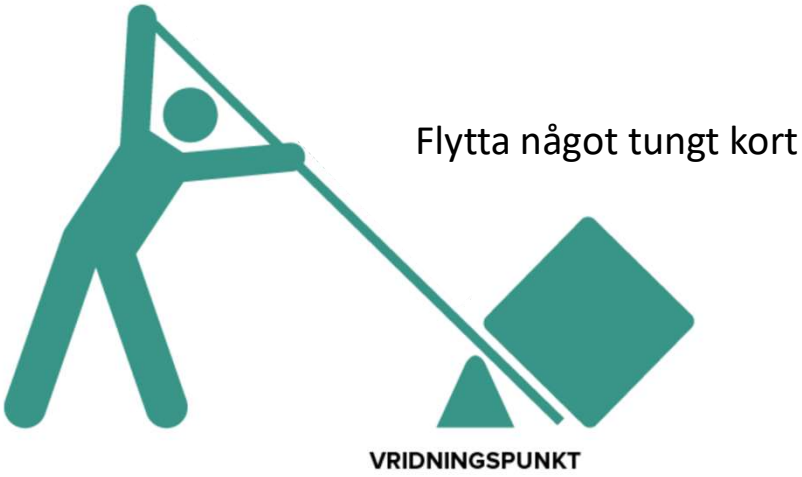
Eller om man vänder på det: för en given tension i myocyterna kommer ett högre tryck i kammaren genereras vid koncentrisk geometri

Koncentrisk geometri = tryckarbete

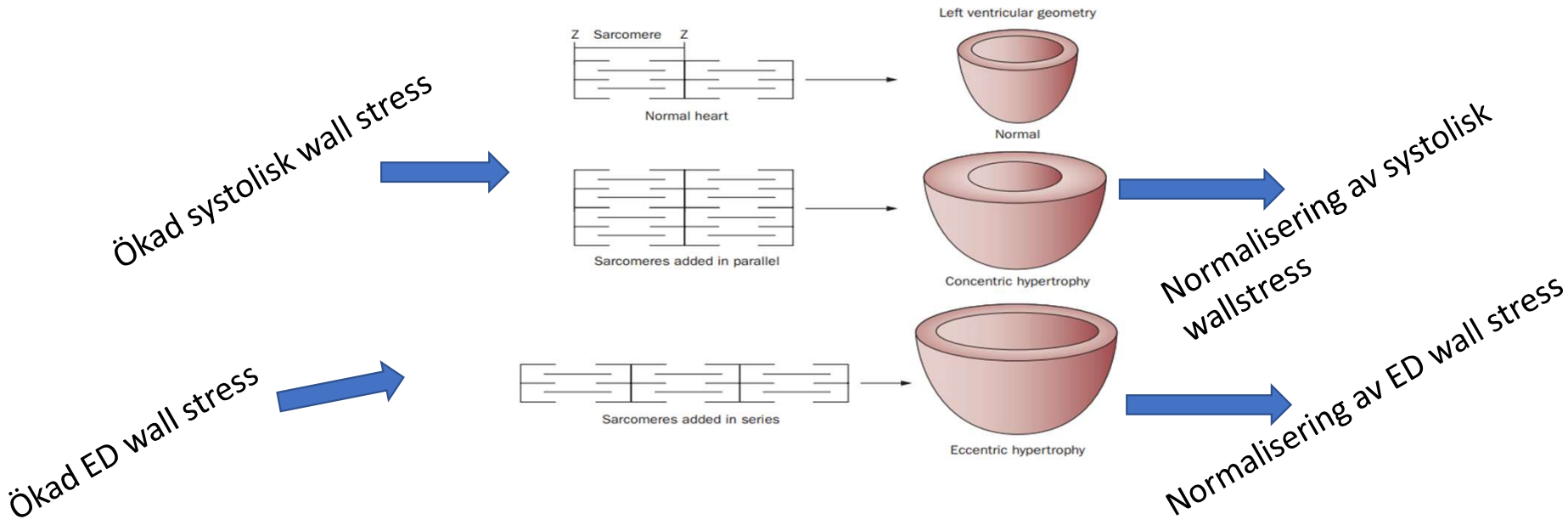
Excentrisk geometri



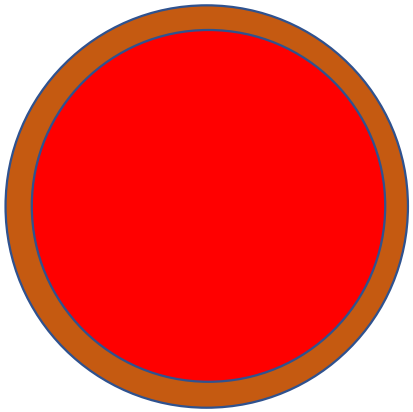
Koncentrisk geometri



Reglering av hypertrofi



Som alltid en grav förenkling dock…

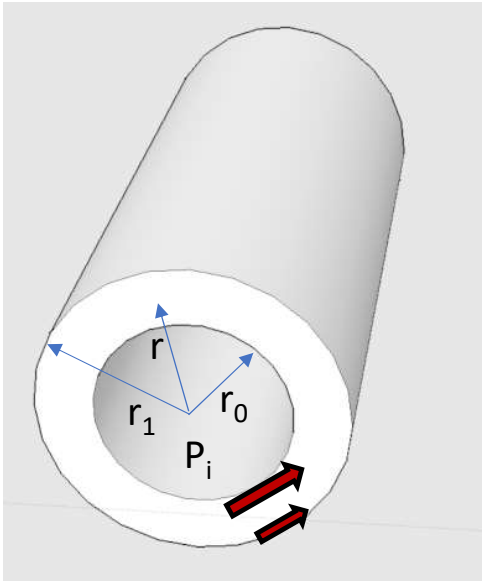


Laplace lag gäller för en tunn-väggig sfär

$$\text{Left ventricular wall stress} = \frac{\text{Cavity pressure} \times \text{Radius}}{\text{Wall thickness} \times 2}$$

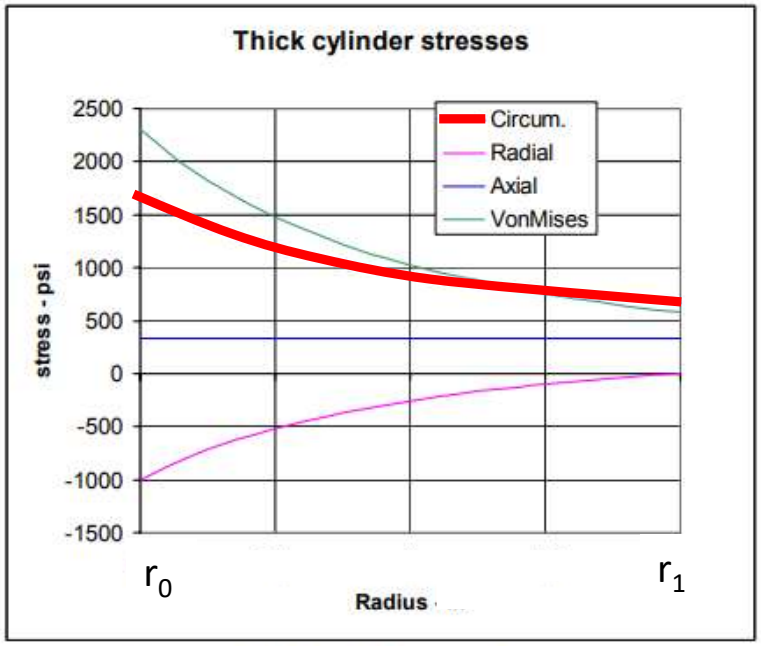
- Hjärtat snarare en tjockväggig cylinder eller tjockväggig ellipsoid
- Dessutom kommer väggstress variera mellan endokard och epikard, med fiberriktning och över tid

Stress varierar mellan epi- och endokard



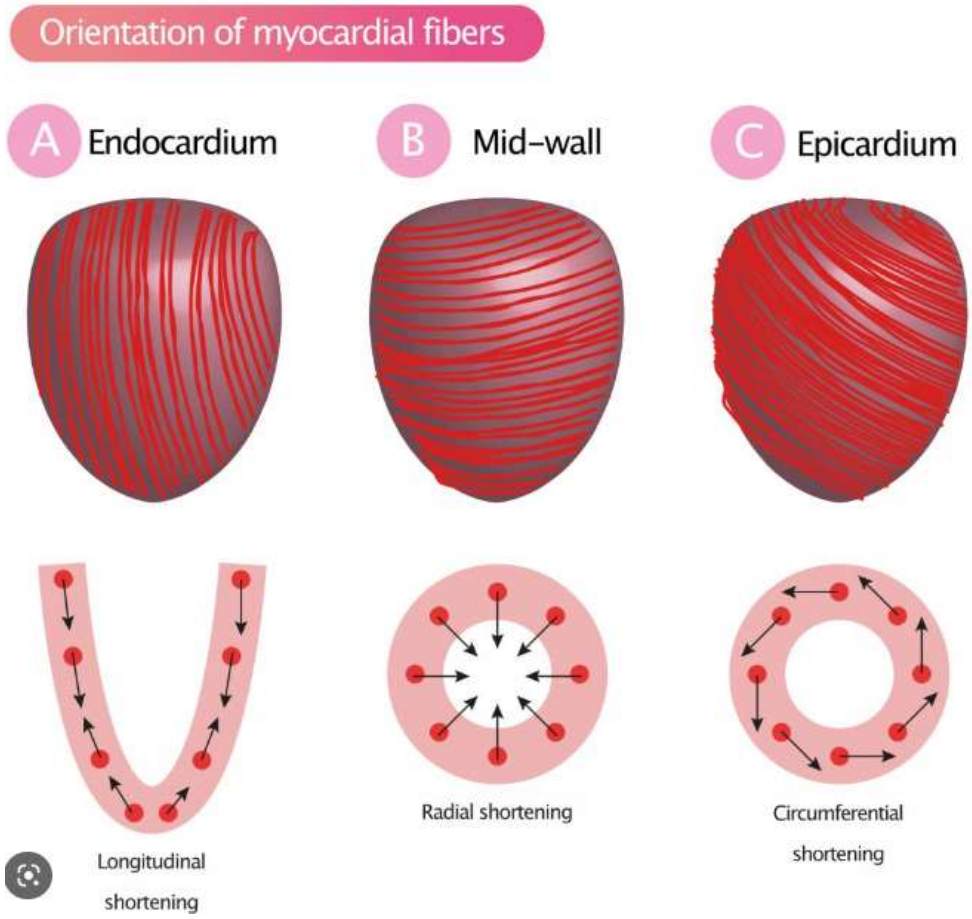
$$\sigma_\theta = \frac{P_i r_i^2}{r_o^2 - r_i^2}\left[1 - \frac{r_o^2}{r^2}\right]$$ =

Afterload



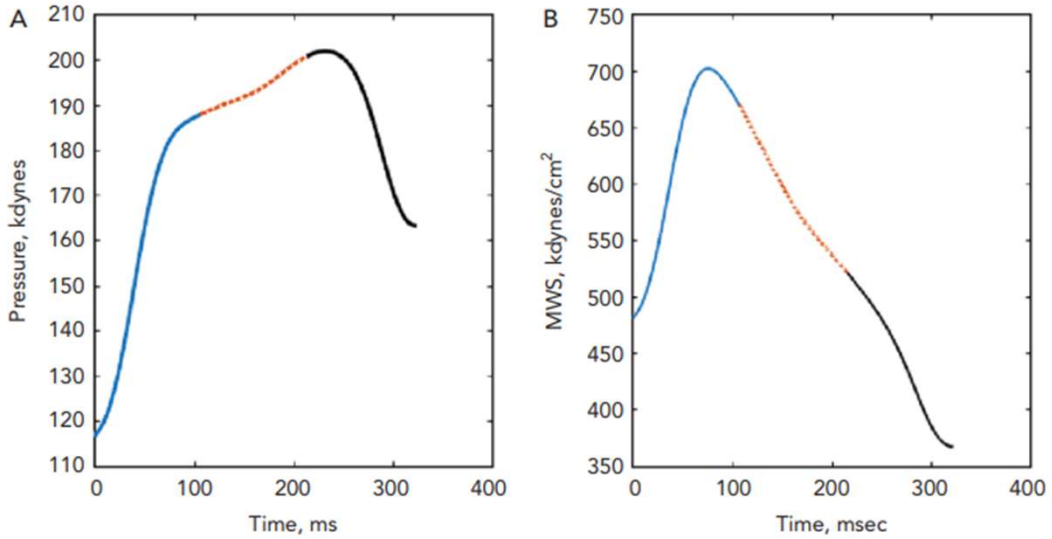
Afterload högre för endokardiella fibrer än epikardiella

Fiberorientering…



Stress och tid…

Figure 4: Time-Resolved Myocardial Wall Stress of a Normal Aged Left Ventricle



(A) The ejection-phase aortic pressure profile. (B) The time-resolved ejection-phase myocardial wall stress (MWS). (C) The pressure–MWS relation. In all plots, the 1st, 2nd and 3rd thirds of ejection are plotted in solid blue, dotted orange, and solid black, respectively. It can be seen that MWS peaks in early systole and subsequently decreases, even in the context of increasing pressure. This is due to a mid-systolic shift in the pressure-stress relation (black arrow) that favours lower MWS for any given pressure. This shift is due to the geometric reconfiguration of the left ventricle (decreased cavity volume relative to left ventricular wall volume), and is impaired in the presence of reductions in left ventricular ejection fraction, concentric geometric remodelling and reduced early systolic ejection (reduced early-phase ejection fraction).

Pathophysiology

Ventricular–Arterial Coupling in Chronic Heart Failure

Julio A Chirinos[1] and Nancy Sweitzer[2]

1. University of Pennsylvania Perelman School of Medicine and Hospital of the University of Pennsylvania, Philadelphia, PA, USA;
2. Tucson and Arizona Sarver Heart Center, University of Arizona College of Medicine, Tucson, AZ, USA

Strain och tid…

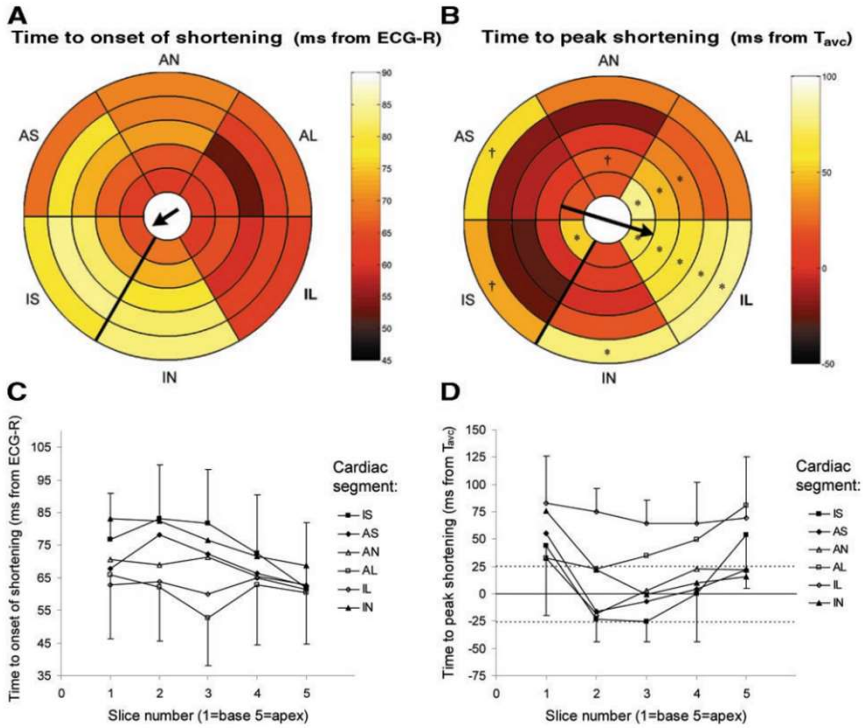


Fig. 4. Maps of the cardiac contraction timing in the healthy human heart. *A*: segmental bull's-eye map of T_{onset} relative to the ECG R wave, averaged over all subjects. The thick line between IN and IS denotes the inferior insertion of the right ventricle. *B*: segmental bull's-eye map of T_{peak} relative to T_{ave}, averaged over all subjects. A negative time indicates that peak shortening occurs before aortic valve closure, and a positive time indicates peak shortening occurs after aortic valve closure. T_{peak} is significantly later than T_{ave} in the marked segments: $^{*}P < 0.01$, $^{\dagger}P < 0.05$. *C*: T_{onset} averaged over all subjects, shown as a function of slice position and cardiac segment. The error bars indicate SD and are shown for the earliest and the latest segment only. *D*: T_{peak} averaged over all subjects and shown for all slices and myocardial segments. The solid and dashed lines indicate $T_{ave} \pm$ SD.

Am J Physiol Heart Circ Physiol 286: H1872–H1880, 2004.
First published January 15, 2004; 10.1152/ajpheart.01047.2003.

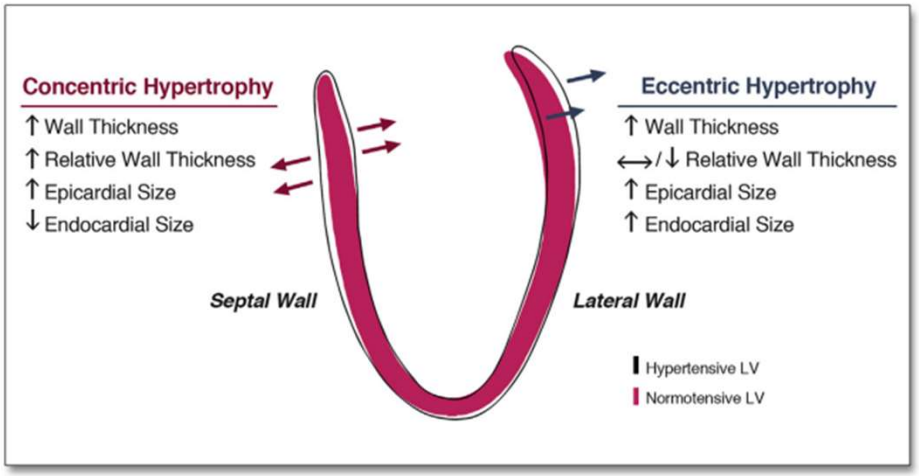
Timing of cardiac contraction in humans mapped by high-temporal-resolution MRI tagging: early onset and late peak of shortening in lateral wall

J. J. M. Zwanenburg,[1] M. J. W. Götte,[2] J. P. A. Kuijer,[1] R. M. Heethaar,[1] A. C. van Rossum,[2] and J. T. Marcus[1]
[1]*Department of Physics and Medical Technology and* [2]*Department of Cardiology, University Medical Center, VU 1007 MB Amsterdam, The Netherlands*

Submitted 5 November 2003; accepted in final form 9 January 2004

Remodellering regional process

FIGURE 3 3D Model of the Regional Changes in LV Geometry Associated With SBP



A long-axis section of the 3D cardiac magnetic resonance-derived fitted regression model taken at SBP of 100 mm Hg **(red filled contour)** and 180 mm Hg **(black outline)** shows how LV geometry varies between these 2 BP. **Arrows** indicate the relationship between each coefficient and SBP. Abbreviations as in Figure 1.

JACC: CARDIOVASCULAR IMAGING VOL. 8, NO. 11, 2015
ISSN 1936-878X/$36.00
http://dx.doi.org/10.1016/j.jcmg.2015.08.007

Precursors of Hypertensive Heart Phenotype Develop in Healthy Adults

A High-Resolution 3D MRI Study

Antonio de Marvao, PhD,* Timothy J.W. Dawes, PhD,* Wenzhe Shi, PhD,*† Giuliana Durighel, MSc,* Daniel Rueckert, PhD,† Stuart A. Cook, PhD,*‡§ Declan P. O'Regan, PhD*

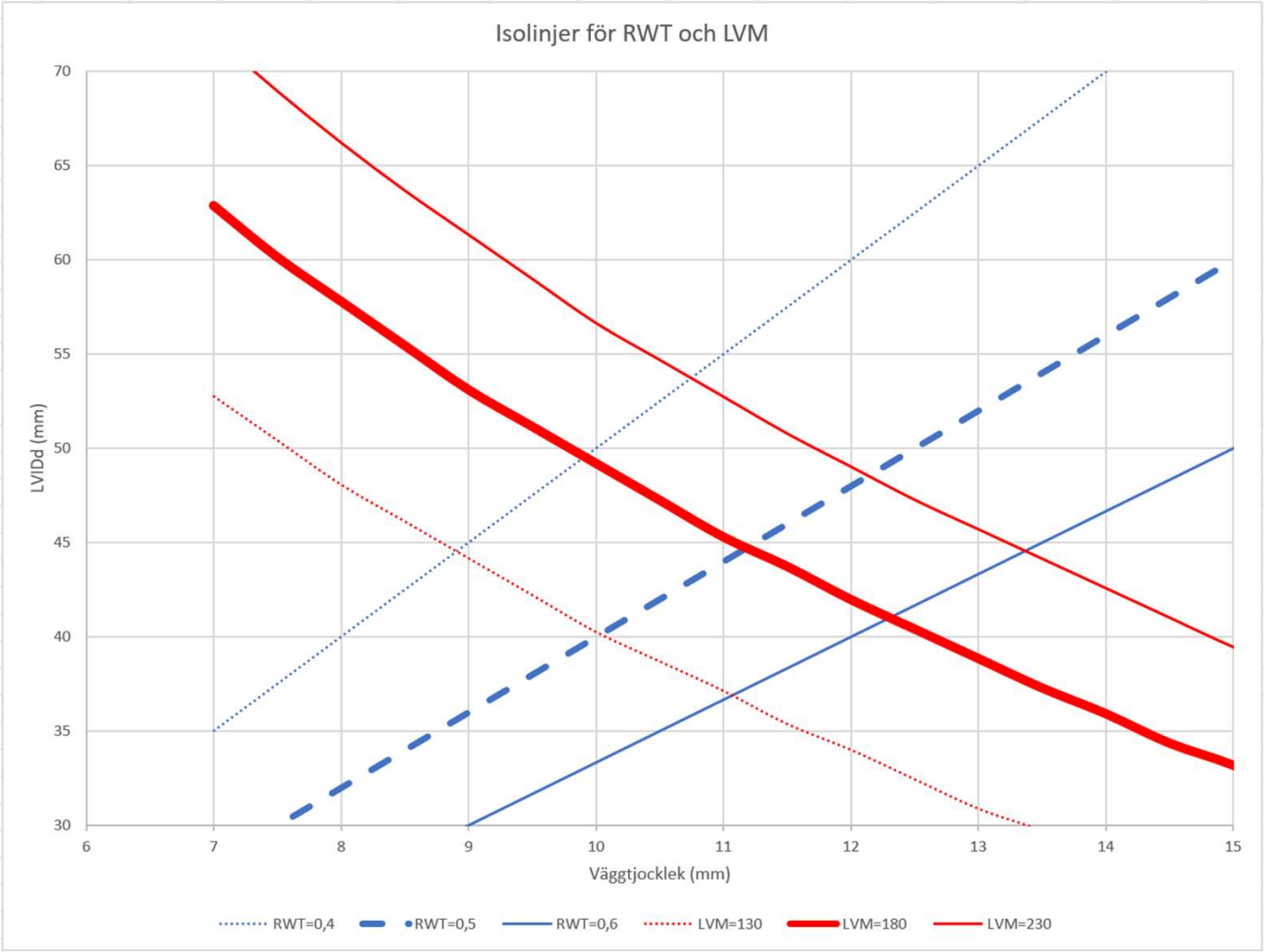
Disposition

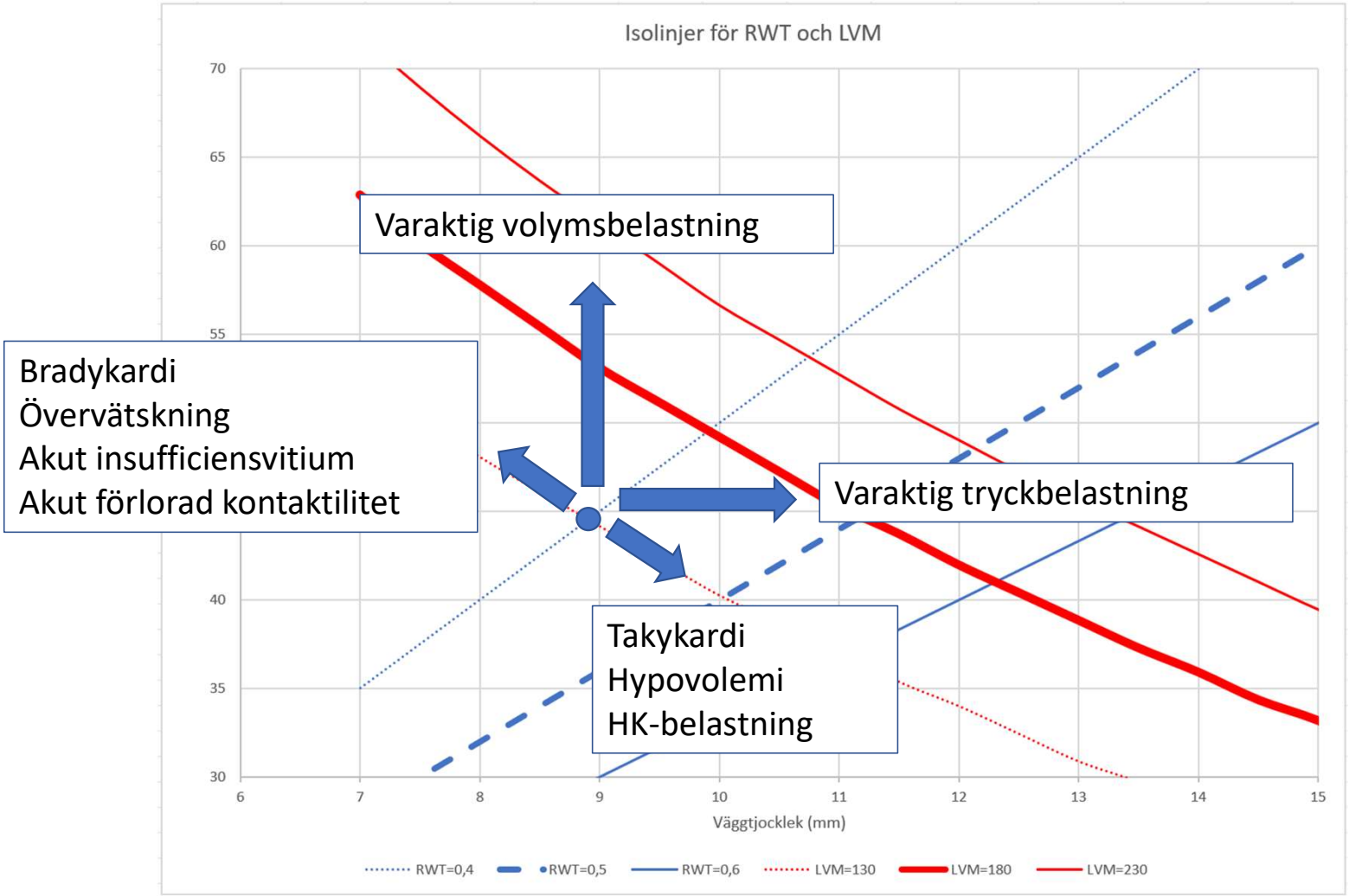
- I mikroskopet
- I makroskopet

Vänsterkammargeometri och ekomått

- Vänsterkammardiameter och volym
- Väggtjocklek
- Vänsterkammarmassa (LVM)
- Relativ väggtjocklek (RWT)
  - (ivs+pw)/lvidd eller 2*pw/lvidd
  - Två tolkningar:
    - Intimt förknippat med väggstress (Jämför med Laplace: Väggstress = Vänsterkammartryck/RWT)
    - Väggtjocklek ”indexerad” för vänsterkammardiameter

$$\text{Left ventricular wall stress} = \frac{\text{Cavity pressure} \times \text{Radius}}{\text{Wall thickness} \times 2}$$


Isolinjer för RWT och LVM
LVIDd (mm)
70
65
60
55
50
45
40
35
30
6
7
8
9
10
11
12
13
14
15
Väggtjocklek (mm)
RWT=0,4
RWT=0,5
RWT=0,6
LVM=130
LVM=180
LVM=230


Isolinjer för RWT och LVM
70
65
60
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40
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30
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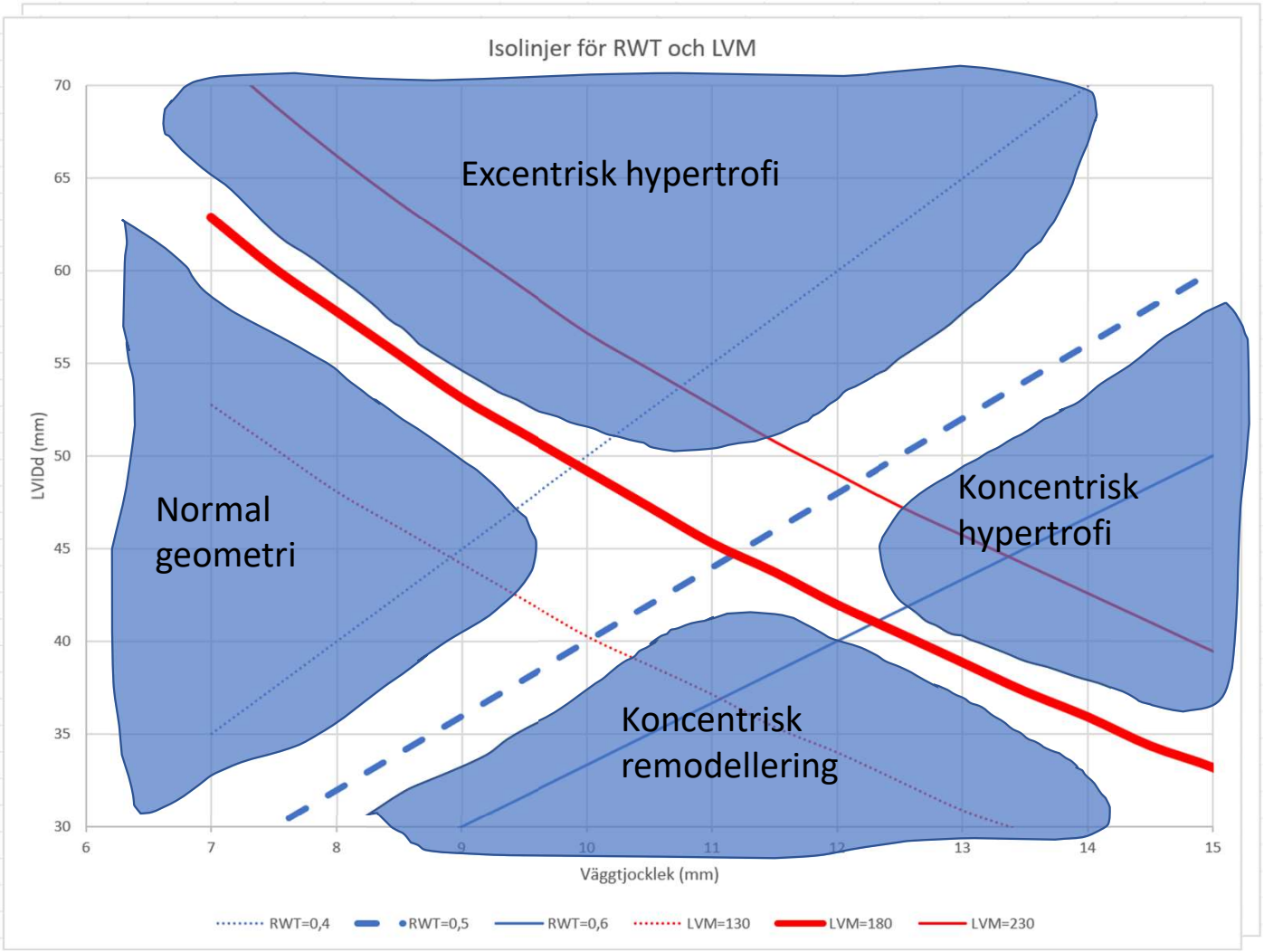
11
12
13
14
15
Väggtjocklek (mm)
RWT=0,4
RWT=0,5
RWT=0,6
LVM=130
LVM=180
LVM=230
Varaktig volymsbelastning
Bradykardi
Övervätskning
Akut insufficiensvitium
Akut förlorad kontaktilitet
Varaktig tryckbelastning
Takykardi
Hypovolemi
HK-belastning


Isolinjer för RWT och LVM
Excentrisk hypertrofi
Normal geometri
Koncentrisk hypertrofi
Koncentrisk remodellering
LVIDd (mm)
Väggtjocklek (mm)
70
65
60
55
50
45
40
35
30
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11
12
13
14
15
RWT=0,4
RWT=0,5
RWT=0,6
LVM=130
LVM=180
LVM=230

Koncentrisk remodellering?

- Liten kammare med tjocka väggar och normal massa
- Beskrivs ofta som ett förstadium till koncentrisk hypertrofi
- Reversibel normalisering av väggstress vid ökat afterload?
- Ospecifikt fynd: Kammarstelhet samt underfyllnad av vänsterkammaren pga takykardi, högerkammarbelastning, hypovolemi, inotropi m.m. ger liknande bild
- Det prognostiska värdet beror helt på vilken population man studerar
- Bra om man kan skilja detta från sann vänsterkammarhypertrofi
  - Olika patofysiologiska mekanismer
  - Olika prognostiskt värde

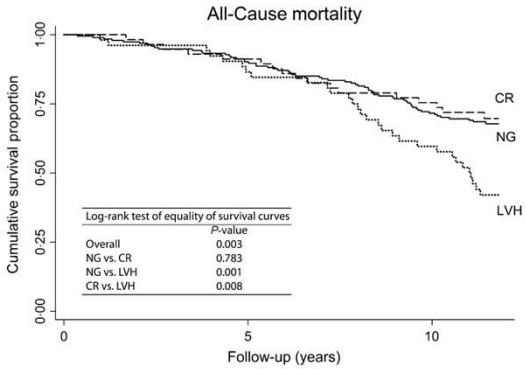


Figure 1 Kaplan–Meier survival curves for all-cause mortality. NG: normal geometry. CR, concentric remodelling. LVH, left ventricular hypertrophy.

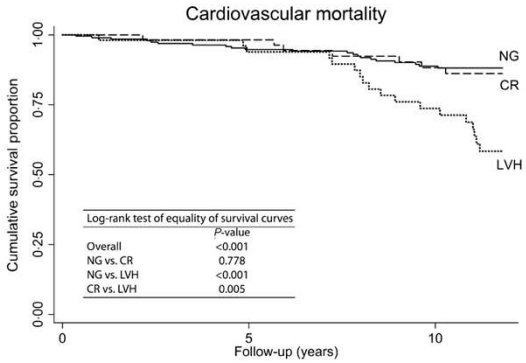


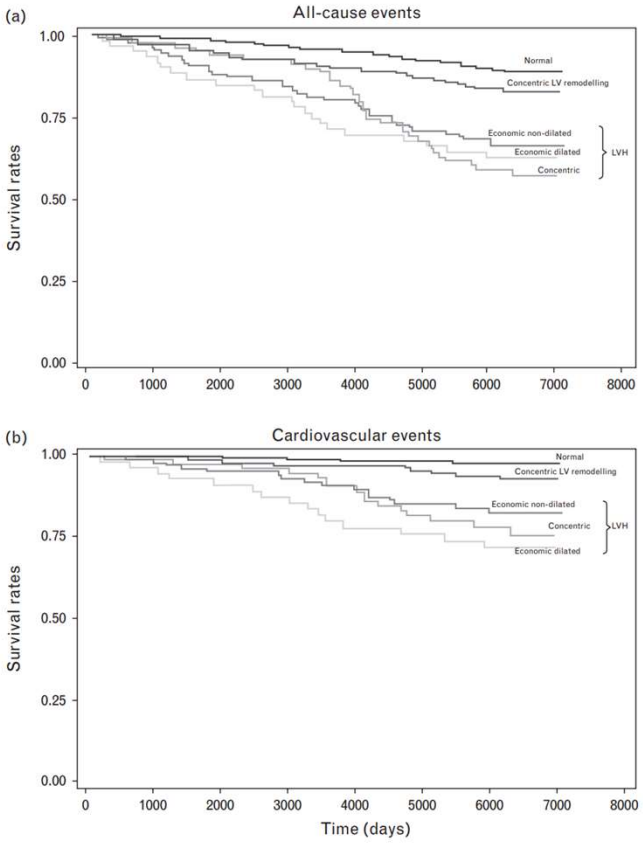
Figure 2 Kaplan–Meier survival curves for cardiovascular mortality. NG, normal geometry. CR, concentric remodelling. LVH, left ventricular hypertrophy.

Clin Physiol Funct Imaging (2014) **34**, pp442–448 doi: 10.1111/cpf.12114

Impact of left ventricular geometry on long-term survival in elderly men and women

Jonas Selmeryd[1], Milena Sundstedt[1], Göran Nilsson[2], Egil Henriksen[1] and Pär Hedberg[1,2]

[1]Department of Clinical Physiology, Västmanland County Hospital, and [2]Center of Clinical Research, Uppsala University, Västmanland County Hospital, Västerås, Sweden



Risk of mortality in relation to an updated classification of left ventricular geometric abnormalities in a general population: the Pamela study

Cesare Cuspidi[a,b], Rita Facchetti[a], Michele Bombelli[a], Carla Sala[c], Marijana Tadic[d], Guido Grassi[a,e], and Giuseppe Mancia[a,b]

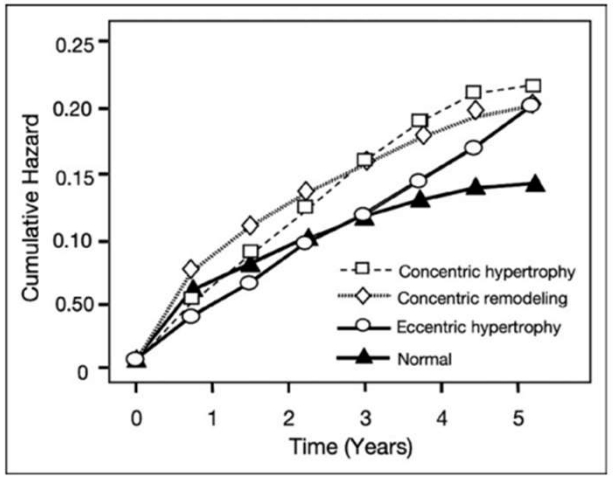


Figure 3. Cumulative hazard of mortality over time in 9,771 patients aged >70 years with normal ejection fractions. All groups had higher mortality over time ($p < 0.0001$) compared with normal geometry, and those with concentric hypertrophy and CR had higher mortality compared with those with eccentric hypertrophy ($p < 0.01$).

Left Ventricular Geometry and Mortality in Patients >70 Years of Age With Normal Ejection Fraction

Carl J. Lavie, MD[a,*], Richard V. Milani, MD[a], Hector O. Ventura, MD[a], and Franz H. Messerli, MD[b]

(Am J Cardiol 2006;98:1396–1399)

LVM och inte WT riskmarkör

Differential Value of Left Ventricular Mass Index and Wall Thickness in Predicting Cardiovascular Prognosis: Data From the PAMELA Population

Cesare Cuspidi,[1,2] Rita Facchetti,[1] Michele Bombelli,[1] Carla Sala,[3] Guido Grassi,[1,4] and Giuseppe Mancia[1,2]

American Journal of Hypertension 27(8) August 2014

Table 5. Unadjusted and adjusted relative hazard ratios and 95% confidence intervals of fatal and nonfatal cardiovascular events associated with the highest quintile of left ventricular mass, left ventricular mass/BSA, left ventricular mass/height$^{2.7}$, interventricular septum, posterior wall thickness, interventricular septum plus posterior wall thickness, and relative wall thickness, as compared with the corresponding lowest quintile

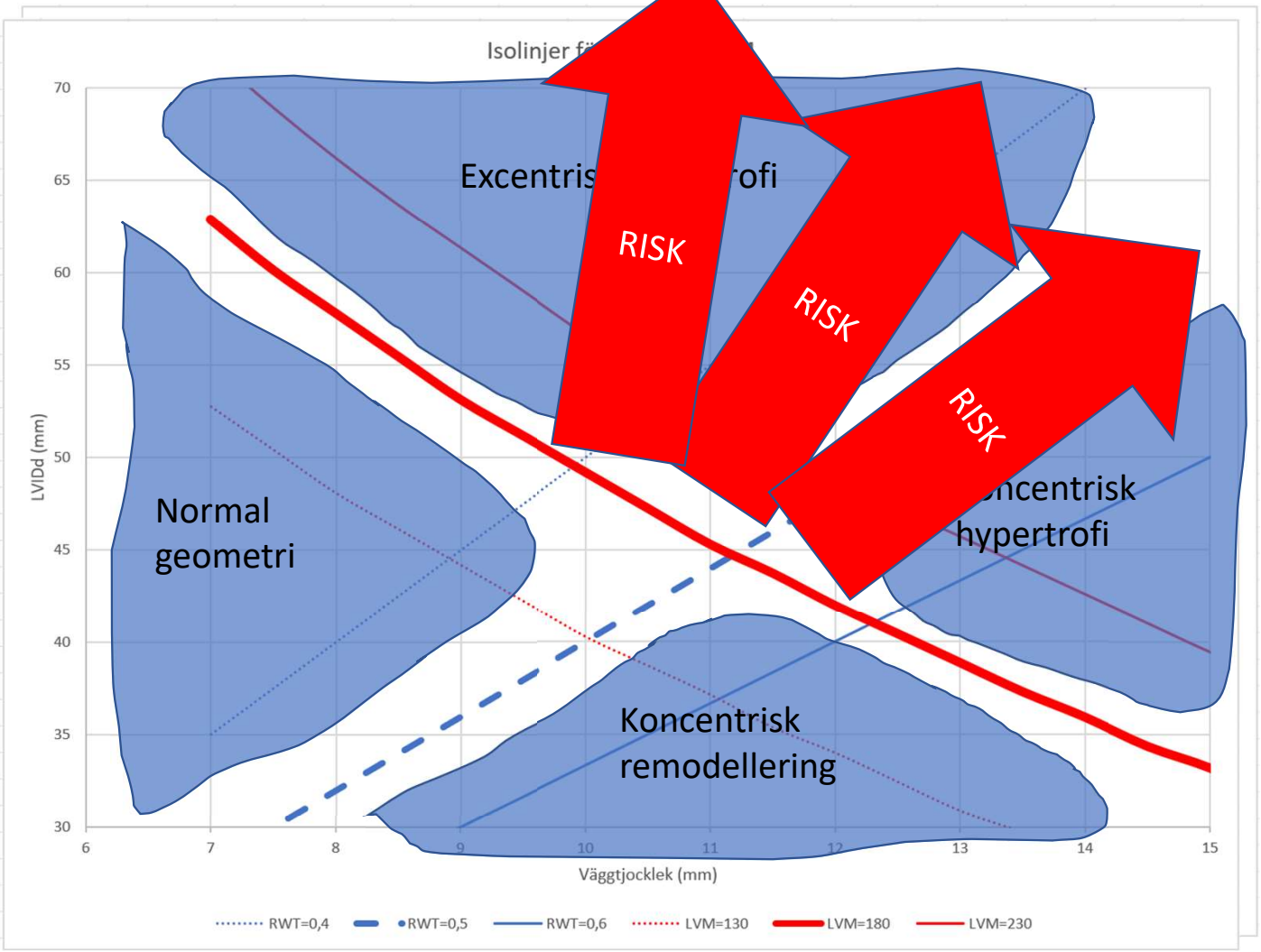
		Unadjusted			Adjusted[a]		
Variable	Quintile	HR	(95% CI)	*P* value	HR	(95% CI)	*P* value
LV mass	1st	1.00	(referent)		1.00	(referent)	
	5th	8.97	(4.29–18.73)	<0.0001	1.51	(0.65–3.49)	0.33
LV mass/BSA	1st	1.00	(referent)		1.00	(referent)	
	5th	13.74	(5.52–34.23)	<0.0001	2.72	(1.05–7.00)	0.03
LV mass/height$^{2.7}$	1st	1.00	(referent)		1.00	(referent)	
	5th	23.67	(7.43–75.40)	<0.0001	4.83	(1.45–16.13)	0.01
IVS thickness	1st	1.00	(referent)		1.00	(referent)	
	5th	7.59	(3.98–14.50)	<0.0001	1.28	(0.61–2.66)	0.51
PW thickness	1st	1.00	(referent)		1.00	(referent)	
	5th	7.07	(3.97–12.57)	<0.0001	1.60	(0.84–3.05)	0.15
IVS+PW	1st	1.00	(referent)		1.00	(referent)	
	5th	8.84	(4.22–18.51)	<0.0001	1.429	(0.61–3.35)	0.41
RWT	1st	1.00	(referent)		1.00	(referent)	
	5th	4.01	(2.17–7.41)	<0.0001	0.89	(0.46–1.71)	0.72

Abbreviations: BSA, body surface area; CI, confidence interval; HR, hazard ratio; IVS, interventricular septrum; LV, left ventricular; PW, posterior wall; RWT, relative wall thickness.

[a]Adjusted for age, sex, office systolic blood pressure, fasting blood glucose, total cholesterol, body mass index, and use of antihypertensive drugs.

CONCLUSIONS

This study indicates that LV wall thickness, different from LV mass index, does not provide a reliable estimate of cardiovascular risk associated with LVH in a general population. From these data it is recommended that echocardiographic laboratories should provide a systematic estimate of LV mass index, which is a strong, independent predictor of incident cardiovascular disease.


Isolinjer f
Excentris rofi
RISK
RISK
RISK
Normal geometri
ncentrisk hypertrofi
Koncentrisk remodellering
LVIDd (mm)
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Väggtjocklek (mm)
RWT=0,4
RWT=0,5
RWT=0,6
LVM=130
LVM=180
LVM=230

Patofysiologiska scenarion – ”Se mönstret”

- Ser vi en excentrisk kammare – tänk volymsbelastning
  - Träning
  - Klaffvitier (Aortainsufficiens, Mitralisinsufficiens)
  - Shuntvitier (Duktus, VSD)
  - Låg systemvaskulär resistens (AV-fistlar, anemi, tyreotoxikos)
  - Bradykardi
  - Kontraktilitetsförlust (DCM, IHD)
- Ser vi en koncentrisk kammare – tänk tryckbelastning
  - Blodtryck i aorta ascendens
    - Systemtrycket
    - Distensibilitet/kärlstelhet i ascendens
    - Arteriella pulsvågsreflektioner
  - Resistens i utflödesområdet (t.ex. aortastenos)
  - Slagvolymen

Eller inlagring (amyloidos)

Disposition

- I mikroskopet
- I makroskopet
- Ska vi mäta LVM och RWT och i så fall hur?

Borde vi mäta LVM och RWT?

echo research and practice | A Harkness, L Ring *et al.* | Reference limits for echocardiography | 7:1 | G1–G18

GUIDELINES AND RECOMMENDATIONS

2020

Normal reference intervals for cardiac dimensions and function for use in echocardiographic practice: a guideline from the British Society of Echocardiography

Allan Harkness MSc[1,*], Liam Ring MBBS[2,*], Daniel X Augustine MD[3,†], David Oxborough PhD[4], Shaun Robinson MSc[5] and Vishal Sharma MD[6,†] on behalf of the Education Committee of the British Society of Echocardiography

Table 2 Linear left ventricular dimensions and mass.

	Normal	Mild	Moderate	Severe
Males				
LV dimensions				
LVIDd (mm)	37–56	57–61	61–65	>65
LVIDs (mm)	22–41	41–45	46–50	>50
IVSd (mm)	6–12	–	–	–
LVPWd (mm)	6–12	–	–	–
LV mass				
LVMi (g/m²)	40–110	111–127	128–145	>145
LV mass (g)	72–219	–	–	–
Females				
LV dimension				
LVIDd (mm)	35–51	52–55	56–59	>59
LVIDs (mm)	20–37	38–42	43–46	>46
IVSd (mm)	5–11	–	–	–
LVPWd (mm)	6–12	–	–	–
LV mass				
LVMi (g/m²)	33–99	98–115	116–131	>131
LV mass (g)	51–173	–	–	–

IVSd, inter-ventricular septal thickness in diastole; LV, mass calculated using the linear method; LVIDd, left ventricular internal diameter in diastole; LVIDs, left ventricular internal diameter in systole; LVMi, left ventricular mass index; LVPWd, left ventricular posterior wall thickness in diastole.

meaningless.

LV wall thickness by itself does *not* define an individual as having left ventricular hypertrophy (LVH). Rather, the presence or absence of LVH is determined from LV mass after indexing to BSA. Wall thickness measurements, combined with the LV internal diameter in diastole, can

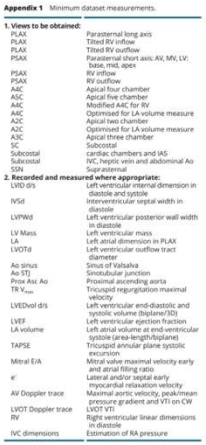
echo research and practice | S Robinson *et al.* | Minimum dataset for transthoracic echo | 7:4 | G59–G93

GUIDELINES AND RECOMMENDATIONS

2021

A practical guideline for performing a comprehensive transthoracic echocardiogram in adults: the British Society of Echocardiography minimum dataset

Shaun Robinson MSc[1], Bushra Rana MBBS[2], David Oxborough PhD[3], Rick Steeds MBBS[4], Mark Monaghan PhD[5], Martin Stout PhD[6], Keith Pearce[6], Allan Harkness MSc[7], Liam Ring MBBS[8], Maria Paton MSc[9], Waheed Akhtar MSc[10], Radwa Bedair MD[11], Sanjeev Bhattacharyya MD[12], Katherine Collins MSc[13], Cheryl Oxley BSc[14], Julie Sandoval MA[15], Rebecca Schofield MBChB[1], Anjana Siva PhD[16], Karen Parker[17], James Willis PhD[18] and Daniel X Augustine MD[18]



Appendix 1 Minimum dataset measurements.

1. Views to be obtained:	
PLAX	Parasternal long axis
PLAX	Tilted RV inflow
PLAX	Tilted RV outflow
PSAX	Parasternal short axis: AV, MV, LV: base, mid, apex
PSAX	RV inflow
PSAX	RV outflow
A4C	Apical four chamber
A5C	Apical five chamber
A4C	Modified A4C for RV
A4C	Optimised for LA volume measure
A2C	Apical two chamber
A2C	Optimised for LA volume measure
A3C	Apical three chamber
SC	Subcostal
Subcostal	cardiac chambers and IAS
Subcostal	IVC, hepatic vein and abdominal Ao
SSN	Suprasternal
2. Recorded and measured where appropriate:	
LVID d/s	Left ventricular internal dimension in diastole and systole
IVSd	Interventricular septal width in diastole
LVPWd	Left ventricular posterior wall width in diastole
LV Mass	Left ventricular mass
LA	Left atrial dimension in PLAX
LVOTd	Left ventricular outflow tract diameter
Ao sinus	Sinus of Valsalva
Ao ST	Sinotubular junction
Prox Asc Ao	Proximal ascending aorta
TR V_{max}	Tricuspid regurgitation maximal velocity
LVEDvol d/s	Left ventricular end-diastolic and systolic volume (biplane/3D)
LVEF	Left ventricular ejection fraction
LA volume	Left atrial volume at end-ventricular systole (area-length/biplane)
TAPSE	Tricuspid annular plane systolic excursion
Mitral E/A	Mitral valve maximal velocity early and atrial filling ratio
e'	Lateral and/or septal early myocardial relaxation velocity
AV Doppler trace	Maximal aortic velocity, peak/mean pressure gradient and VTI on CW
LVOT Doppler trace	LVOT VTI
RV	Right ventricular linear dimensions in diastole
IVC dimensions	Estimation of RA pressure

Borde vi mäta LVM och RWT?

GUIDELINES AND STANDARDS

2015

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE, Jonathan Afilalo, MD, MSc, Anderson Armstrong, MD, MSc, Laura Ernande, MD, PhD, Frank A. Flachskampf, MD, FESC, Elyse Foster, MD, FASE, Steven A. Goldstein, MD, Tatiana Kuznetsova, MD, PhD, Patrizio Lancellotti, MD, PhD, FESC, Denisa Muraru, MD, PhD, Michael H. Picard, MD, FASE, Ernst R. Rietzschel, MD, PhD, Lawrence Rudski, MD, FASE, Kirk T. Spencer, MD, FASE, Wendy Tsang, MD, and Jens-Uwe Voigt, MD, PhD, FESC, *Chicago, Illinois; Padua, Italy; Montreal, Quebec and Toronto, Ontario, Canada; Baltimore, Maryland; Créteil, France; Uppsala, Sweden; San Francisco, California; Washington, District of Columbia; Leuven, Liège, and Ghent, Belgium; Boston, Massachusetts*

4. LV Mass

LV mass is an important risk factor for, and a strong predictor of, cardiovascular events.[52-55] There are several methods that effectively calculate LV mass from M-mode echocardiography, 2DE, and 3DE

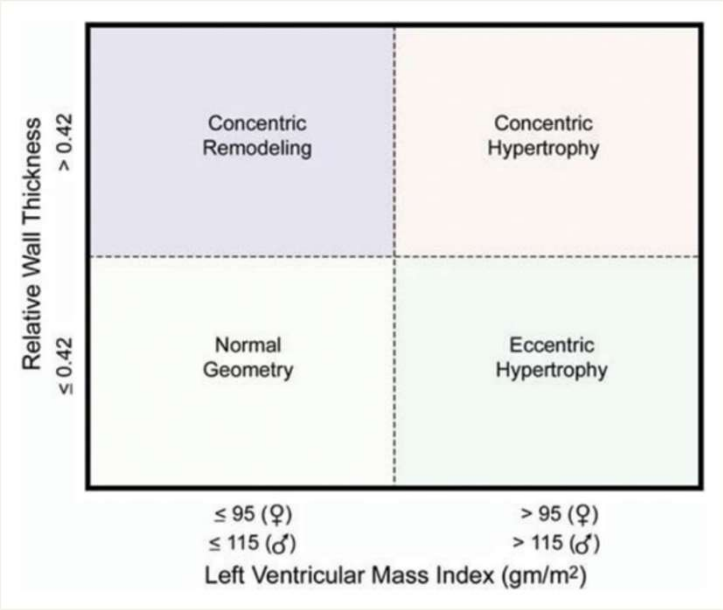
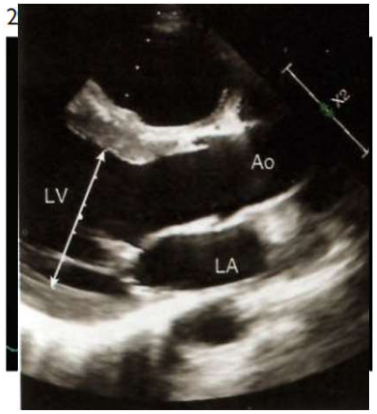
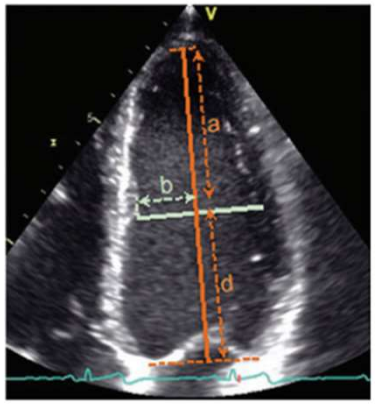


Figure 6 Comparison of RWT. Patients with normal LV mass can have either concentric remodeling (normal LV mass with increased RWT $\geq$ 0.42) or normal geometry (RWT $\leq$ 0.42) and normal LV mass. Patients with increased LV mass can have either concentric (RWT $\geq$ 0.42) or eccentric (RWT $\leq$ 0.42) hypertrophy. These LV mass measurements are based on linear measurements.

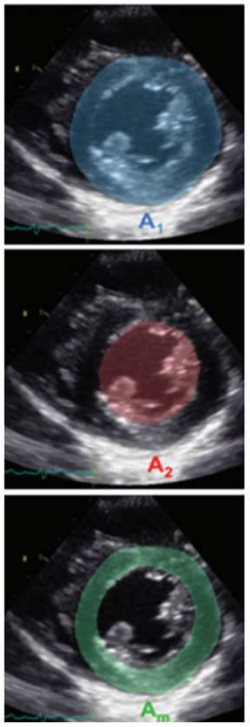
Hur ska vi mäta LVM?



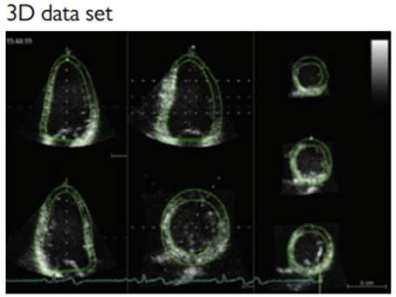
Linjära mått i PLAX



Truncated ellipsoid



Area-length method



3D

- Enkelt men grov. Funkar på ”snälla”
- Gott om normativa och prognostiska data

- Teoretiskt tilltalande. Färre geometriska antaganden.
- Bökiga. Begränsat med normativa och prognostiska data. Kräver god bildkvalitet.

Hur ska vi mäta LVM?

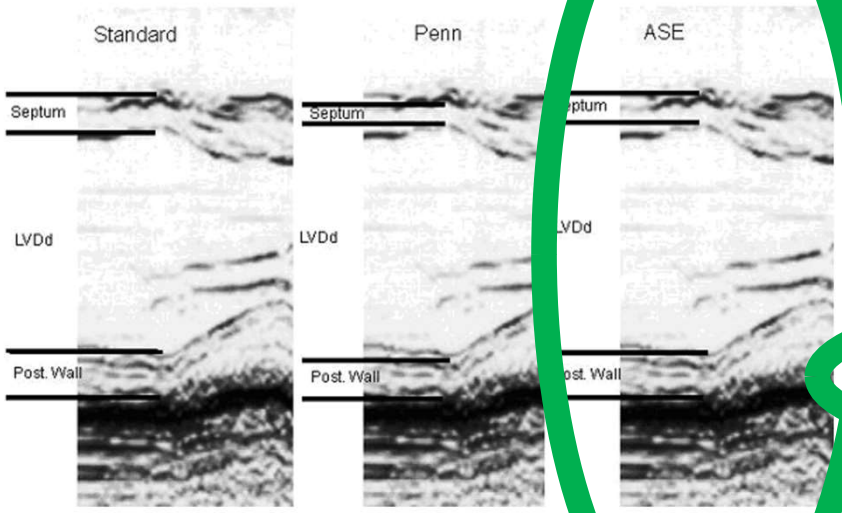


Figure 1
Comparison between M-mode border measurement conventions. The Standard conven measures from leading to tra edge in the septum and from leading to leading edge of the posterior wall. Penn criteria e des echoes from parietal w while ASE criteria measure leading to leading edge. (LVDd: Left Ventricular Diameter in Di le).

Leading-trailing
Leading-leading

Trailing-leading

Leading-leading

1.05*((LVIDD+PW+IVS)^3-LVIDD^3) (Troy)

1.04*((LVIDD+PW+IVS)^3-LVIDD^3)-13.6 (Devereux)

0.8*(1.04*((LVIDD+PW+IVS)^3-LVIDD^3))+0.6 (Kalibrerad Devereux)

Varför? Mest spritt. Används bl.a. av Norre.

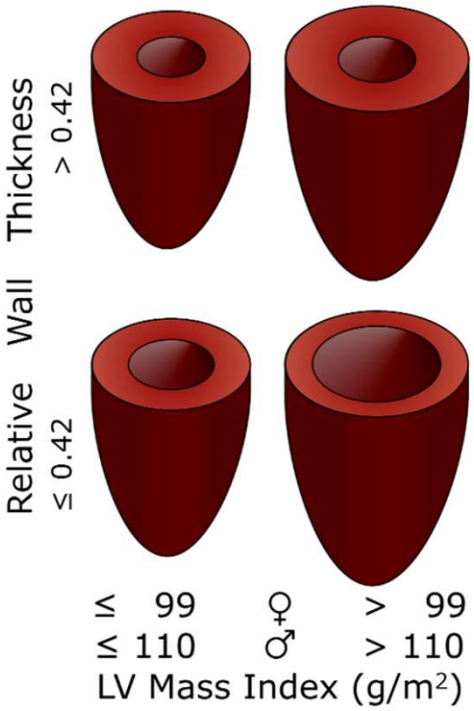
Hur ska vi beräkna RWT?

- Lang: (2*PW)/LVIDD
- British Soc of Echo: (PW+IVS)/LVIDD
- PAMELA: (PW+IVS)/LVIDD
- Stoylen (HUNT): (PW+IVS)/LVIDD

Bägge förekommer. Ger olika resultat. ”Känns fel” slänga information om IVS.

En svag rekommendation blir att använda (PW+IVS)/LVIDD

Var är normal LVM och RWT?



echo research and practice | A Harkness, L Ring et al. | Reference limits for echocardiography | 7:1 | G1-G18

GUIDELINES AND RECOMMENDATIONS

Normal reference intervals for cardiac dimensions and function for use in echocardiographic practice: a guideline from the British Society of Echocardiography

Allan Harkness MSc[1,*], Liam Ring MBBS[2,*], Daniel X Augustine MD[3,†], David Oxborough PhD[4], Shaun Robinson MSc[5] and Vishal Sharma MD[6,†] on behalf of the Education Committee of the British Society of Echocardiography

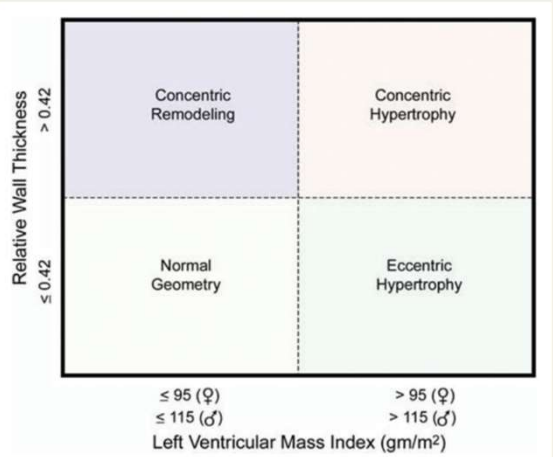


Figure 6 Comparison of RWT. Patients with normal LV mass can have either concentric remodeling (normal LV mass with increased RWT $\geq$ 0.42) or normal geometry (RWT $\leq$ 0.42) and normal LV mass. Patients with increased LV mass can have either concentric (RWT $\geq$ 0.42) or eccentric (RWT $\leq$ 0.42) hypertrophy. These LV mass measurements are based on linear measurements.

GUIDELINES AND STANDARDS

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE, Jonathan Afilalo, MD, MSc, Anderson Armstrong, MD, MSc, Laura Ernande, MD, PhD, Frank A. Flachskampf, MD, FESC, Elyse Foster, MD, FASE, Steven A. Goldstein, MD, Tatiana Kuznetsova, MD, PhD, Patrizio Lancellotti, MD, PhD, FESC, Denisa Muraru, MD, PhD, Michael H. Picard, MD, FASE, Ernst R. Rietzschel, MD, PhD, Lawrence Rudski, MD, FASE, Kirk T. Spencer, MD, FASE, Wendy Tsang, MD, and Jens-Uwe Voigt, MD, PhD, FESC, *Chicago, Illinois; Padua, Italy; Montreal, Quebec and Toronto, Ontario, Canada; Baltimore, Maryland; Créteil, France; Uppsala, Sweden; San Francisco, California; Washington, District of Columbia; Leuven, Liège, and Ghent, Belgium; Boston, Massachusetts*

TABLE 1. Demographic and clinical baseline characteristics of 1694 participants belonging to PAMELA population, according to type of left ventricular geometric abnormality

	LV geometric patterns					
	Normal LV geometry	Concentric LV remodelling	Eccentric-nondilated LVH	Concentric LVH	Eccentric-dilated LVH	P*
N	1291	160	106	78	59	
Male, *n* (%)	649 (50.3%)	84 (52.5%)	63 (59.4%)	35 (44.9%)	28 (47.5%)	0.9987
Age (years)	47.4 ± 13.3	58.7 ± 10.9	60.3 ± 10.7	60.5 ± 11.1	59.7 ± 12.1	<0.0001
Office SBP (mmHg)	127.2 ± 17.9	143.8 ± 21.7	148 ± 19.9	154 ± 23.5	147.3 ± 22.1	<0.0001
Office DBP (mmHg)	81.7 ± 9.8	88.7 ± 10.1	89.2 ± 9.4	93.3 ± 12.1	86.6 ± 10.1	<0.0001
Office HR (beats/min)	70.5 ± 9.4	75.5 ± 12.6	69.9 ± 12.1	72.9 ± 12.4	69.1 ± 9.4	0.3299
24-h SBP (mmHg)	117.5 ± 10.1	124.3 ± 12	127.1 ± 12.6	129.6 ± 13.7	125 ± 14.1	<0.0001
24-h DBP (mmHg)	73.2 ± 6.8	76.7 ± 7.6	77.4 ± 8	79.2 ± 9.5	74 ± 8.1	<0.0001
BMI (kg/m^2)	24.7 ± 3.8	27.6 ± 4.6	26.7 ± 3.9	28.4 ± 5	28.9 ± 8.5	<0.0001
Total cholesterol (mg/dl)	220 ± 42.7	235 ± 40.9	220.5 ± 42.1	231.4 ± 40.3	226.2 ± 48.2	<0.0001
HDL cholesterol (mg/dl)	56.3 ± 15.7	52.5 ± 14.2	52.9 ± 14.7	54 ± 15.5	50.7 ± 14.7	0.0002
Serum glucose (mg/dl)	88 ± 16.1	101.2 ± 36.5	94.2 ± 21.6	97.9 ± 23.4	95.3 ± 35.1	<0.0001
GFR (ml/min)	89.3 ± 14.9	79.9 ± 17	82 ± 17	80.1 ± 15.7	82.2 ± 18.6	<0.0001
LVMI (g/m^2)	79.6 ± 14.2	88.6 ± 13.3	118.3 ± 13.8	122.1 ± 18.4	132 ± 22.3	<0.0001
LVMI (g/m$^{2.7}$)	36 ± 7.4	42.7 ± 7.9	55.9 ± 7.5	59.7 ± 9.2	63.5 ± 12.7	<0.0001
Antihypertensive drugs, *n* (%)	135 (10.5%)	61 (38.1%)	39 (36.8%)	46 (59%)	31 (52.5%)	<0.0001
History of CVD, *n* (%)	29 (2.2%)	5 (3.1%)	11 (10.4%)	3 (3.8%)	13 (22%)	<0.0001
Smoking, *n* (%)	385 (29.8%)	37 (23.1%)	21 (19.8%)	19 (24.4%)	10 (17.0%)	0.0021

Cut-offs used for defining LV geometric patterns: LVMI (114 g/m^2 men, 99 g/m^2 women); RWT (0.45 men, 0.44 women), LVIDd (5.8 cm men, 5.3 cm women). CVD, cardiovascular disease; GFR, glomerular filtration rate; HDL, high-density lipoprotein; HR, heart rate; LVMI, left ventricular mass index.
*P value for trend.

Partition values for defining LVH and left ventricular geometric patterns were derived from the distribution of LVM normalized to BSA, RWT and LVIDd diameter (Table 1), using 1.96 standard deviation (SD) above the mean from 675 healthy persons from the PAMELA population after excluding a total of 376 individuals with isolated home or ambulatory hypertension, obesity, diabetes mellitus and cardiovascular diseases.

Risk of mortality in relation to an updated classification of left ventricular geometric abnormalities in a general population: the Pamela study

Cesare Cuspidi[a,b], Rita Facchetti[a], Michele Bombelli[a], Carla Sala[c], Marijana Tadic[d], Guido Grassi[a,e], and Giuseppe Mancia[a,b]

Journal of Hypertension 2015, 33:2133–2140

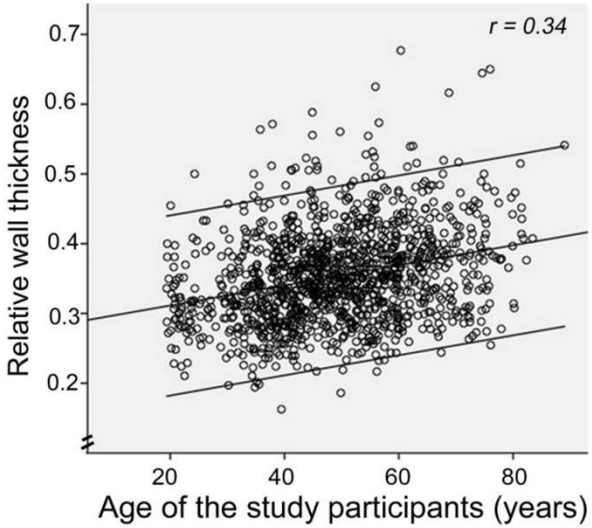
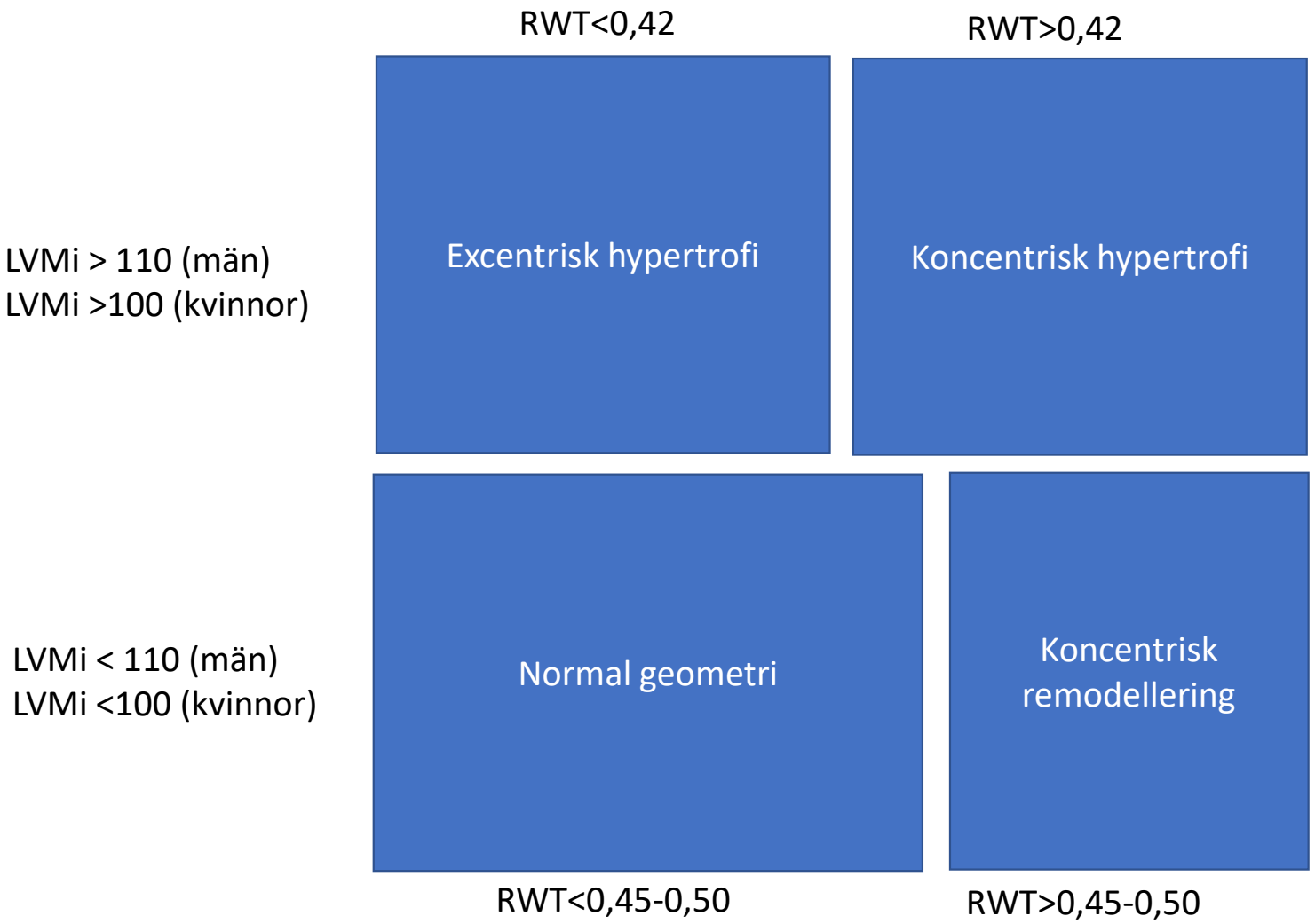


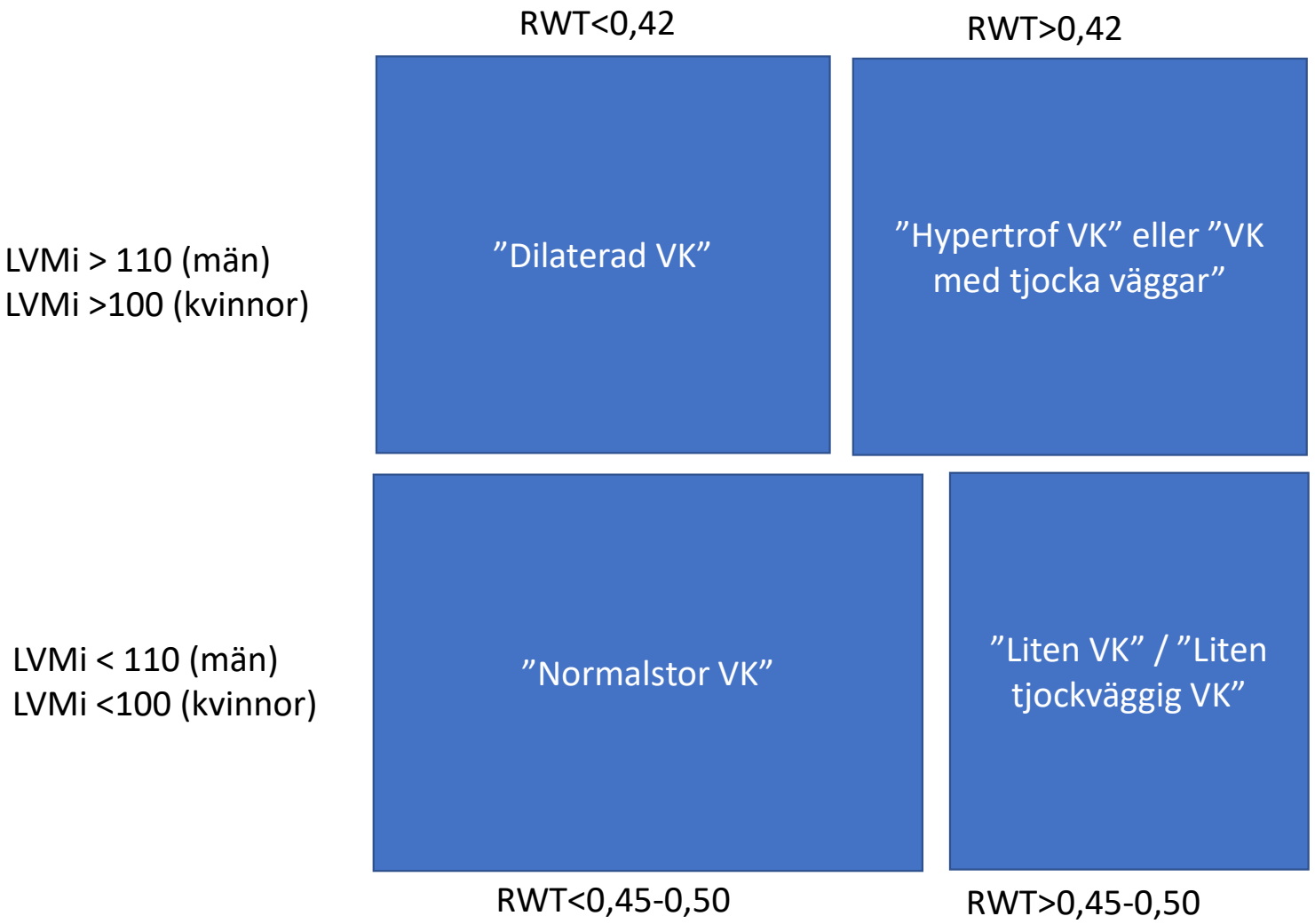
Figure 4 The association of RWT with age. RWT, relative wall thickness.

Importance of length and external diameter in left ventricular geometry. Normal values from the HUNT Study

Asbjørn Støylen,[1,2] Harald E Mølmen,[3,4] Håvard Dalen[1,2,5]

. *Open Heart* 2016;**3**:e000465. doi:10.1136/openhrt-2016-000465

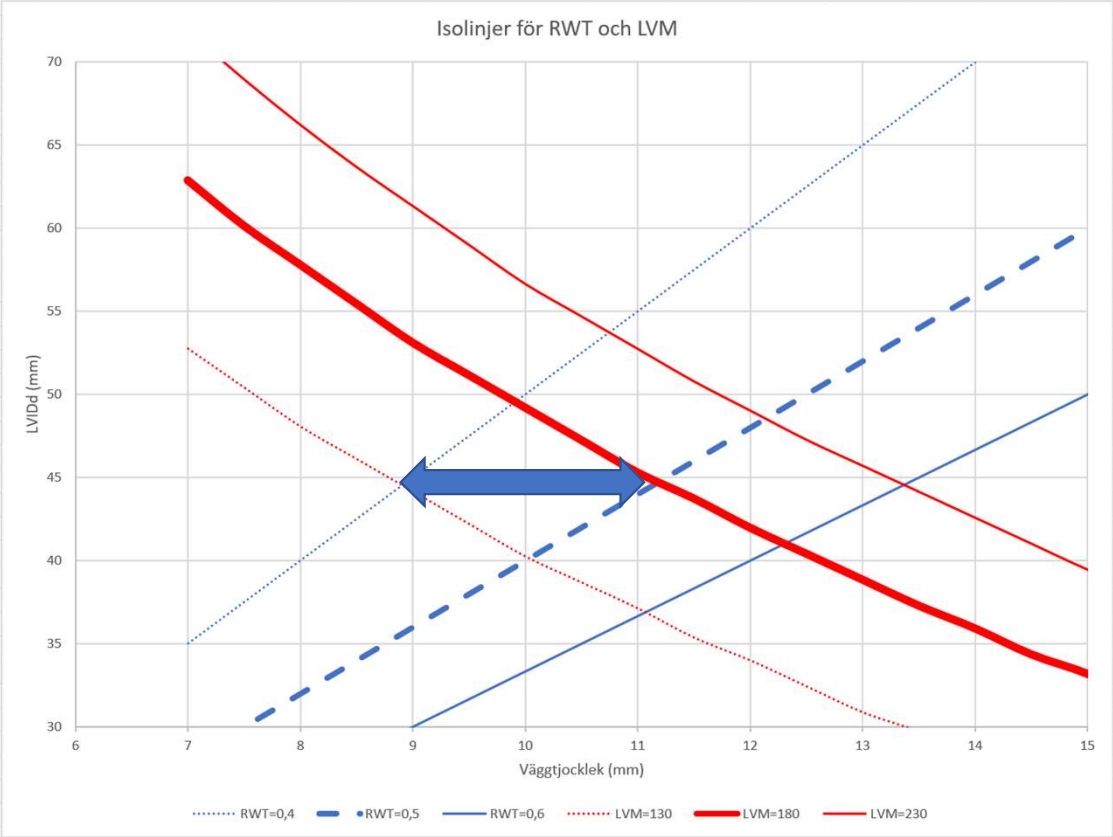

RWT<0,42
RWT>0,42
LVMi > 110 (män)
LVMi >100 (kvinnor)
Excentrisk hypertrofi
Koncentrisk hypertrofi
LVMi < 110 (män)
LVMi <100 (kvinnor)
Normal geometri
Koncentrisk remodellering
RWT<0,45-0,50
RWT>0,45-0,50


RWT<0,42
RWT>0,42
LVMi > 110 (män)
LVMi >100 (kvinnor)
”Dilaterad VK”
”Hypertrof VK” eller ”VK med tjocka väggar”
LVMi < 110 (män)
LVMi <100 (kvinnor)
”Normalstor VK”
”Liten VK” / ”Liten tjockväggig VK”
RWT<0,45-0,50
RWT>0,45-0,50

Disposition

- I mikroskopet
- I makroskopet
- Ska vi mäta LVM och RWT och i så fall hur?
- Word of caution

Word of caution



Kuberade mått…

2mm kan ge 50g skillnad

Reproducerbarhet RV:

- LVM: CV 12% och MDC ~80g (vid **blind** jämförelse)

- RWT: CV 12% och MDC 0,15 (vid **blind** jämförelse)

Sammanfattning

- Mät LVM och RWT och fundera över klassifikationen
- Rapportera förståndigt.
- Var medveten om mätosäkerheten och jämför inte ”blint”
- Jämför inte mellan modaliteter
- Ökad väggtjocklek
  - Hypertrofi
  - Inlagring
  - Koncentrisk remodellering
- Mät representativa mått
  - Flytta mätpunkter, kolla i flera projektioner, undvik ”septumbullen”

”Hypertrofi eller ökad väggtjocklek av annan orsak?”

Tack


Svensk Förening för Klinisk Fysiologi presenterar
Höstmötet 2023
2-3 oktober, Steam Hotel, Västerås
https://www.sfkf-hostmotet.se/
Sista anmälningsdag 2023-07-31
Begränsat antal rum – vänta inte med din anmälan!