DIAGNOSTIK AV HJÄRTAMYLOIDOS VILKEN ROLL HAR KLINISK FYSIOLOGI?

Per Lindqvist

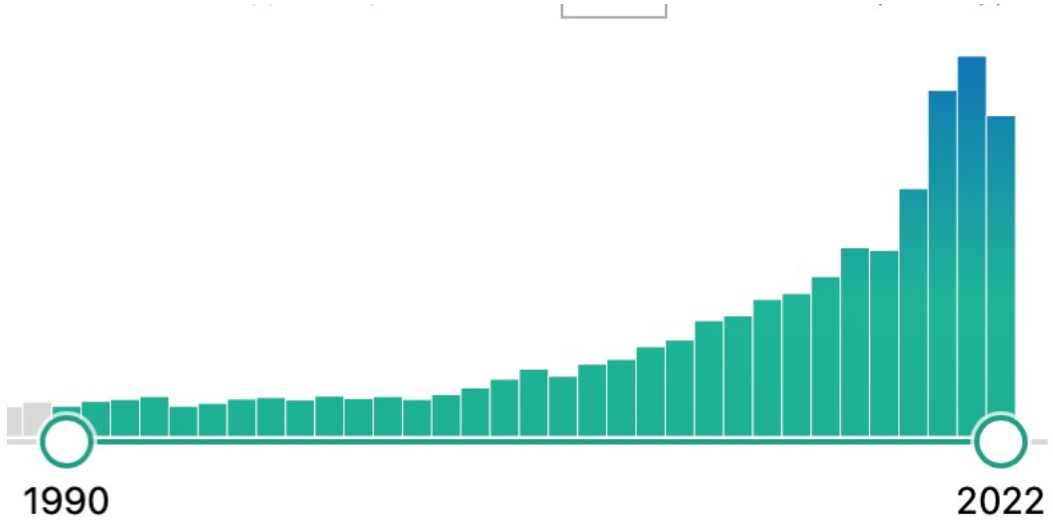
Professor

Klinisk Fysiologi

Umeå, Sweden

UMEÅ UNIVERSITY

CARDIAC AMYLOIDOS



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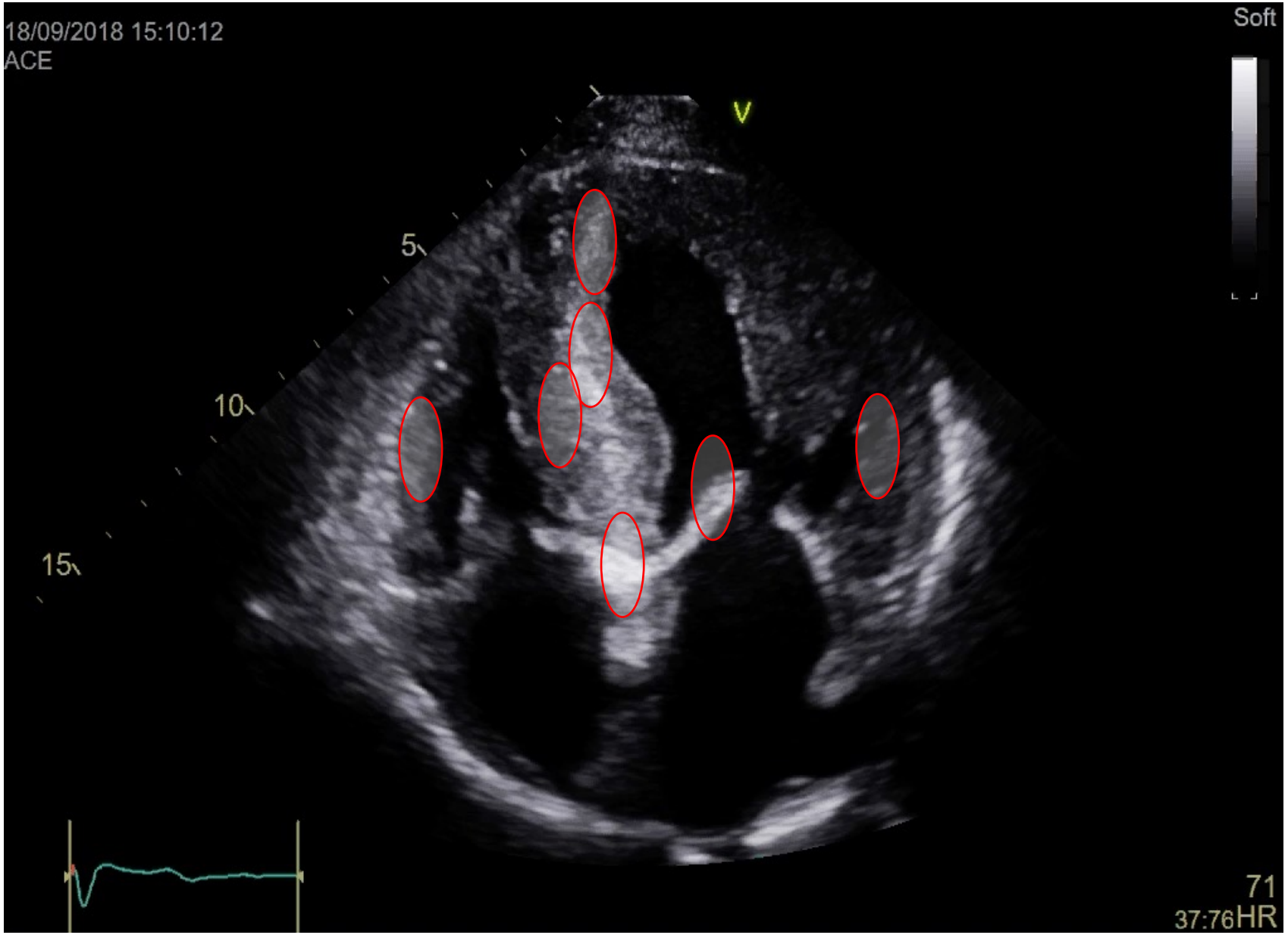
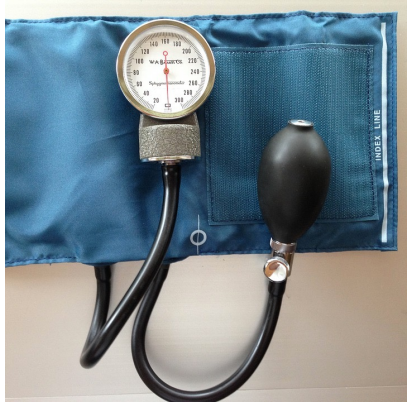
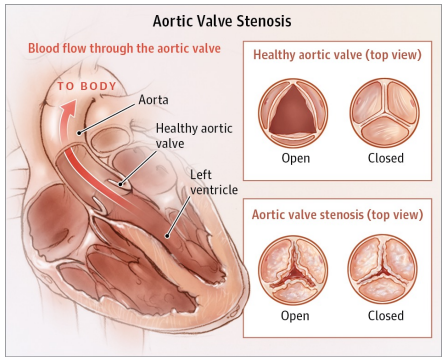
En rörlig bild som ger mycket information!

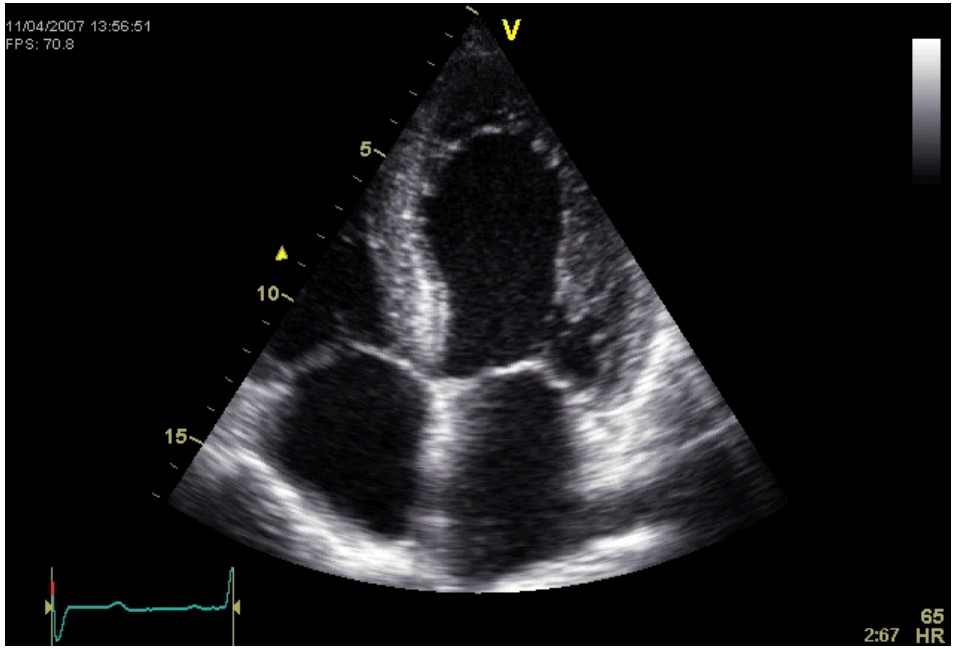


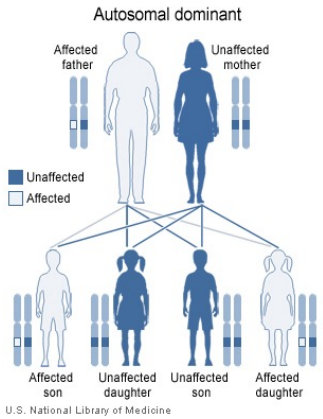


Hypertensiv Hypertrofi?

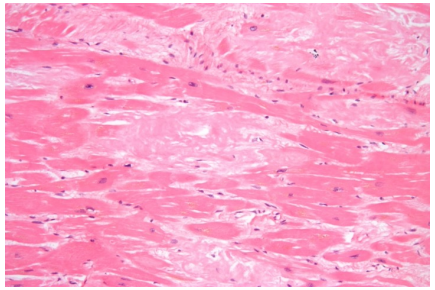


Aortastenosis hypertrofi?





Hypertrof kardiomyoapthy hypertrofi?



Hjärtamyloidos?

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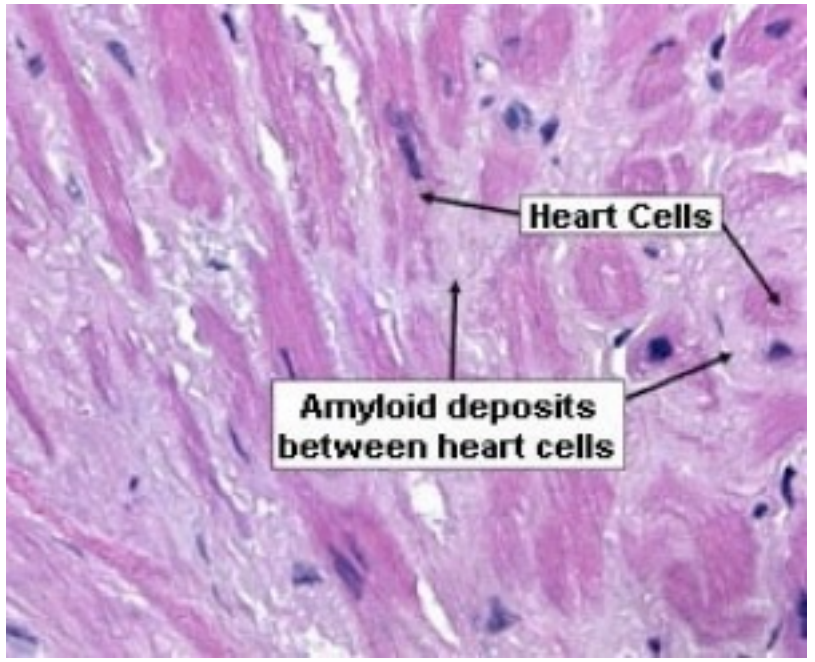
Hjärtamyloidos



Wikipedia

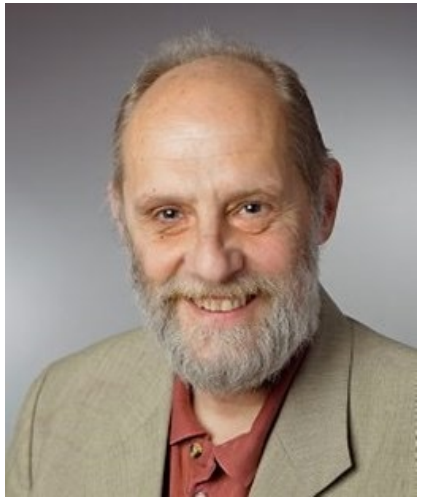
Amyloid light chains AL-amyloidos (CA)

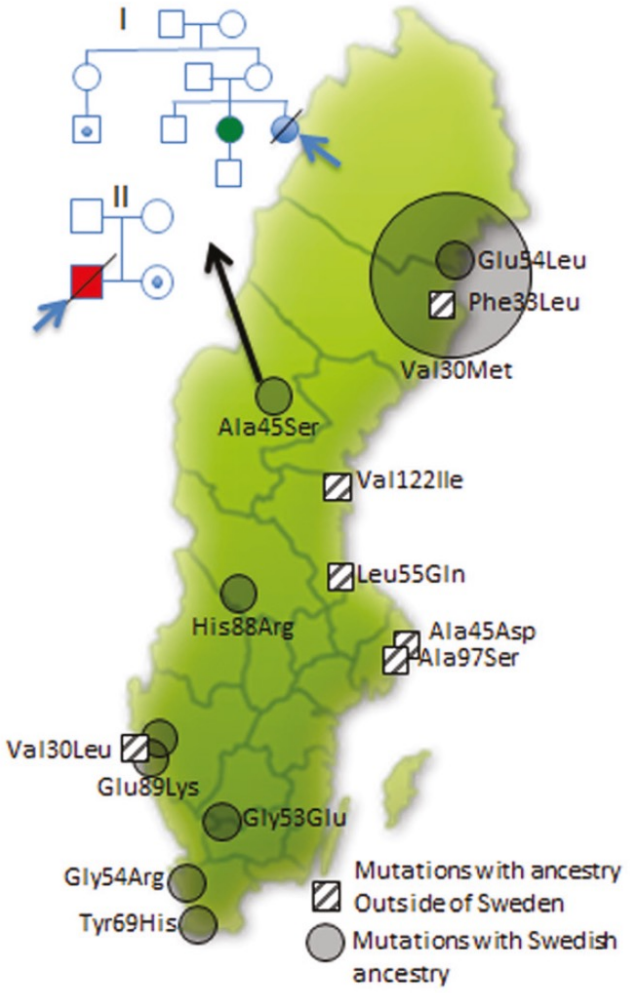
ATTR-cardiac amyloidos (ATTR-CA)

Heriditary ATTR-CA (ATTRv)

Wild type ATTR-CA (ATTRwt)

Heriditary ATTR-amyloidosis (ATTRv) 17 mutationer i Sverige, 140 i världen.



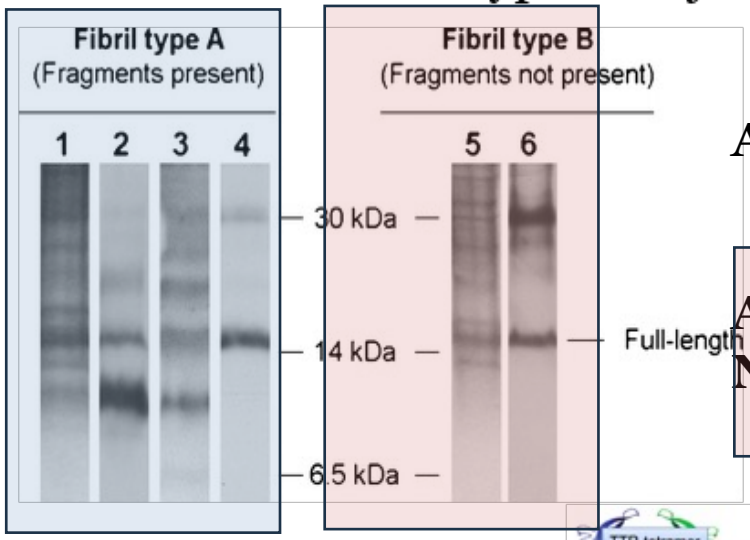


ATTR-CA och fibrilltyp A och B

Fibrilltyp och hjärtsvikt

Amyloidos-CA

ATTRwt
ATTRv (late onset)
hjärtsvikt

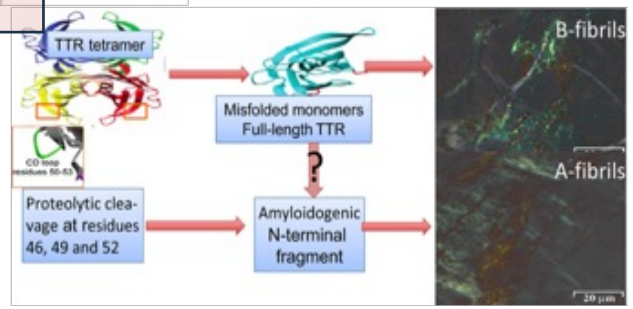


Variation in amount of wild-type transthyretin in different fibril and tissue types in ATTR amyloidosis

Inse et al, J of Mol Med 2011,89,171-180

Amyloidos

ATTRv (early onset)
Neurologiska symptom



ATTRwt

European Heart Journal (2015) **36**, 2585–2594
doi:10.1093/eurheartj/ehv338

CLINICAL RESEARCH
Heart failure/cardiomyopathy

Wild-type transthyretin amyloidosis as a cause of heart failure with preserved ejection fraction

Esther González-López[1], Maria Gallego-Delgado[1], Gonzalo Guzzo-Merello[1], F. Javier de Haro-del Moral[2], Marta Cobo-Marcos[1], Carolina Robles[1], Belén Bornstein[3,4,5], Clara Salas[6], Enrique Lara-Pezzi[7], Luis Alonso-Pulpon[1], and Pablo Garcia-Pavia[1,7]*

Conclusions

ATTRwt is an underdiagnosed disease that accounts for a significant number (13%) of HFpEF cases. A ^{99m}Tc-DPD scintigraphy-based protocol is safe to detect ATTRwt among elderly patients admitted due to HFpEF.

The high number of patients with HFpEF caused by ATTRwt revealed in this study suggests that this entity must be routinely considered in all HFpEF patients. Emerging drugs should be evaluated in these patients who currently do not have any specific treatment.

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How common is cardiac amyloidosis (ATTR-CA) in heart failure clinics?

State-of-the-art radionuclide imaging in cardiac transthyretin amyloidosis

Vasvi Singh, MD,[a] Rodney Falk, MD,[b] Marcelo F. Di Carli, MD,[a] Marie Kijewski, PhD,[a] Claudio Rapezzi, MD,[c] and Sharmila Dorbala, MD[a,b,d]

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doi:10.1007/s12350-018-01552-4

Table 2. Screening for cardiac ATTR amyloidosis using ^{99m}Tc-PYP or DPD

First Author	Radiotracer	N	Cohort	Prevalence of ATTR
Gonzalez-Lopez[38]	^{99m}Tc-DPD	120	Heart failure with preserved EF Hospitalized patients 42% women	13.3%
Castano[39]	^{99m}Tc-PYP	151	TAVR Age > 75 years Severe aortic stenosis Low flow low gradient AS Mean LVEF 46%	16%
Haq[36]	^{99m}Tc-PYP		Hereditary ATTR No heart failure Normal echocardiogram Normal cardiac biomarkers	83%
Bennani-Smires[37]	^{99m}Tc-DPD	49	Age > 65 years Heart failure with preserved EF	18%
Longhi S[56]	^{99m}Tc-DPD	43	Aortic stenosis 5 with echo red flags underwent ^{99m}Tc-DPD and all were strongly positive	11.6%
Longhi S[41]	^{99m}Tc-DPD	12400	All bone scans performed over a 5 + year period for clinical reasons	0.36%
Mohamed-Salem[42]	^{99m}Tc-DPD	1114	Age ≥ 75 years Bone scan for clinical reasons	2.78%
Sperry[40]	^{99m}Tc-PYP	98	Carpal tunnel surgery Men ≥ 50 years Women ≥ 60 years 10 patients with biopsy proven amyloid from carpal tunnel procedure were evaluated by ^{99m}Tc-PYP	10.2%

HFpEF
AS

HFpEF
AS

Journal of Nuclear Cardiology

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ATTRwt in Umeå region

ESC HEART FAILURE
ESC Heart Failure (2020)
Published online in Wiley Online Library (wileyonlinelibrary.com) **DOI:** 10.1002/ehf2.13110

SHORT COMMUNICATION

Prevalence of wild type transtyrethin cardiac amyloidosis in a heart failure clinic

Krister Lindmark[1], Björn Pilebro[1]*, Torbjörn Sundström[2] and Per Lindqvist[3]

[1]*Heart Centre, Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden;* [2]*Diagnostic Radiology, Department of Radiation Sciences, Umeå University, Umeå, Sweden;* [3]*Heart Centre, Department of Surgery and Perioperative Sciences, Umeå University, Umeå, Sweden*

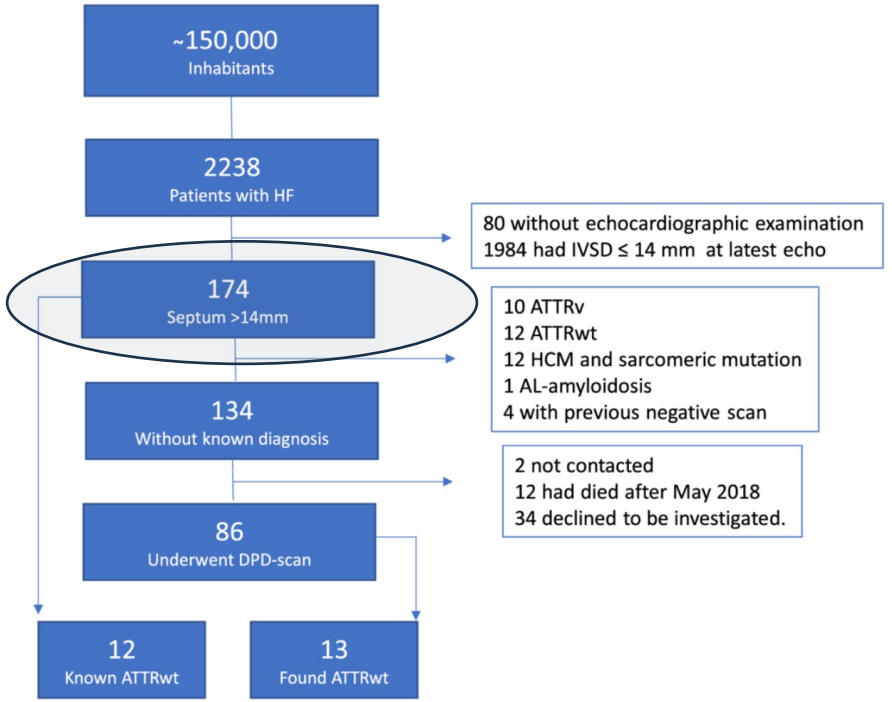


Fig 1. Flow chart for patient cohort describing patient selection, drop out, and results. AL, light chain amyloid; ATTRv, hereditary amyloid; ATTRwt, wild type amyloid; HCM, sarcomeric hypertrophic cardiomyopathy; HF, heart failure; IVSD, end-diastolic interventricular septum thickness.

Hög ålder

Män

Förmaskflimmer

Table 1 Characteristics of HF patients with ATTRwt amyloidosis in the Umeå area, *n* = 25

Age, years, median (min–max)	84 (58–91)
Male gender, *n* (%)	22/25 (88.0%)
Previous carpal tunnel operation, *n* (%)	7/25 (28%)
Spinal stenosis, *n* (%)	4/25 (16%)
Cardiac pacemaker, *n* (%)	5/25 (20%)
Diagnosis of atrial fibrillation, *n* (%)	20/25 (80.0%)
NTproBNP, ng/L, median (min–max)	2113 (592–29 459)
Hs-TroponinT, ng/L, median (min–max)	52 (18–168)
NYHA-class I, *n* (%)	3 (12%)
NYHA-class II, *n* (%)	9 (36%)
NYHA-class III, *n* (%)	13 (52%)
Known coronary disease, *n* (%)	8 (32%)
Significant valve disease[a], *n* (%)	2 (8%)
LVEF < 50%, *n* (%)	11/24 (46%)
Interventricular septal diameter[b] (IVSD), mm, median (min–max)	16.5 (12–25)[2]
Posterior wall thickness (PWT), mm, median (min–max)	13 (7–18)
IVSD/PWT median (min–max)	1.4 (1.0–2.1)
Global longitudinal strain, %, median (min–max)	10.6 (6.6–21.4)
Apical sparing, *n* (%)	24/25 (96%)

[a]One patient with severe tricuspid regurgitation. One patient with previous AVR.
[b]One patient had previous myocardial infarction with thinning of interventricular septum.

Symmetriskt ökad väggtjocklek

CTS

46% LVEF <50%

Apical sparing

Approximately 20% of investigated patients in a cohort with heart failure and increased myocardial wall thickness has ATTRwt. Calculated for the whole population of heart failure patients, the prevalence is just over 1.1%. Comparing this number to the total population would give an estimated prevalence of 1:6000.

AL amyloidosis and ATTR amyloidosis- differences?

Kristen et al, Circulation. 2016 ;68(1).

TABLE 1 Clinico-Pathological Characteristics

	Valid, n	Total	AL Amyloid (n = 107)	mt-ATTR Amyloid (n = 33)	wt-ATTR Amyloid (n = 76)	p Values Total	AL vs. mt-ATTR	AL vs. wt-ATTR	mt-ATTR vs. wt-ATTR
Age at baseline, yrs (median [range])	215	67.2 (30.5-86.5)	61.5 (37.0-85.9)	63.2 (30.5-75.9)	72.4 (55.0-86.5)	**<0.001***	0.887†	**<0.001†**	**<0.001†**
Male	216	163 (75.5)	70 (65.4)	22 (66.7)	71 (93.4)	**<0.001‡**	1.000‡	**<0.001‡**	**0.001‡**
Female		53 (24.5)	37 (34.6)	11 (33.3)	5 (6.6)				
Karnofsky index	192	80 (70-85)	80 (70-80)	80 (72.5-87.5)	80 (80-85)	**0.012***	0.326†	**0.003†**	0.293†
NYHA functional class	207	3.0 (2-3)	3 (2-3)	2.5 (2-3)	3 (2-3)	0.185*	0.085†	0.989†	0.094†
Diastolic blood pressure, mm Hg	202	70 (70-80)	70 (61.3-80.0)	70 (70-80)	75 (70-80)	**0.010***	0.112†	**0.003†**	0.536†
eGFR, ml/min/1.73 m^2	211	69.2 (55.0-88.9)	74.0 (56.0-91.4)	81.9 (61.6-107.7)	64.0 (51.4-78.4)	**0.012***	0.209†	*0.029†*	**0.005†**
NT-proBNP, ng/ml	203	5,510 (2,430-10,341)	7,684 (3,726-14,288)	3,330 (1,109-6,160)	3,710 (1,813-7,249)	**<0.001***	**<0.001†**	**<0.001†**	0.320†
Abnormal TnT	203	186 (91.6)	89 (89.0)	27 (90.0)	70 (95.9)	0.273‡	1.000‡	0.157‡	0.354‡
Beta-blocker	212	140 (66.0)	57 (54.3)	20 (62.5)	63 (84.0)	**<0.001‡**	0.542‡	**<0.001‡**	*0.022‡*
ACE inhibitor/AT1	212	116 (54.7)	45 (42.9)	14 (43.8)	57 (76.0)	**<0.001‡**	1.000‡	**<0.001‡**	**0.002‡**
MR antagonist	212	84 (39.6)	34 (32.4)	14 (43.8)	36 (48.0)	0.090‡	0.291‡	*0.044‡*	0.833‡
Electrocardiography findings									
Heart rate, beats/min	206	79 (68.8-91.3)	83 (75.0-96.5)	77 (68-87)	74 (60.0-81.3)	**<0.001***	0.091†	**<0.001†**	0.118†
PQ interval, ms	146	180 (156-207)	178 (149-197)	180 (154-198)	195 (173-224)	*0.037**	0.532†	**0.012†**	0.100†
QRS duration, ms	203	106 (94-128)	103 (93-118)	108 (92-128)	111 (98-149)	*0.022**	0.313†	**0.006†**	0.313†
QTc, ms	203	441 (418-468)	436 (416-464)	449 (424-476)	450 (420-471)	0.392*	0.252†	0.293†	0.699†
Low voltage	201	62 (30.8)	40 (39.6)	9 (29.0)	13 (18.8)	**0.015‡**	0.396‡	**0.004‡**	0.300‡
Atrial fibrillation	216	46 (21.3)	17 (15.9)	6 (18.2)	23 (30.3)	0.065‡	0.790‡	*0.029‡*	0.241‡
Echocardiography findings									
LA diameter, mm	208	44 (40-48)	43 (40-48)	43 (40.0-47.5)	45 (41-48)	0.505*	0.840†	0.318†	0.320†
Thickness of septal wall, mm	209	18 (16-21)	17 (15-20)	19 (15-22)	20 (17-22)	**<0.001***	0.115†	**<0.001†**	0.215†
LV end-diastolic volume, ml	207	79.4 (65.0-95.2)	72.0 (61.6-91.1)	79.4 (68.4-104.0)	83.2 (72.0-99.4)	**0.005***	0.068†	**0.002†**	0.670†
Myocardial contraction fraction, %	207	17.3 (12.4-25.4)	17.9 (12.9-25.9)	17.7 (9.9-25.7)	16.2 (12.2-24.3)	0.484*	0.672†	0.228†	0.675†
LV mass, g/m^2	207	203 (172-262)	185 (163-218)	237 (189-294)	232 (184-279)	**<0.001***	**<0.001†**	**<0.001†**	0.817†
LV ejection fraction, %	208	43.8 (34.7-55.6)	43.8 (35.0-54.4)	45.0 (35.1-55.6)	42.7 (34.3-60.6)	0.975*	0.793†	0.986†	0.897†
Mitral annular systolic velocity, m/s	169	5.0 (4-7)	6.0 (4-8)	5.0 (4-7)	5.0 (4-7)	0.387*	0.329†	0.224†	0.819†
RV hypertrophy	160	95 (59.4)	51 (58.0)	15 (68.2)	29 (58.0)	0.709‡	0.469‡	1.000‡	0.446‡
Impaired RV function	161	110 (68.3)	62 (70.5)	13 (56.5)	35 (70.0)	0.443‡	0.219‡	1.000‡	0.296‡
Pericardial effusion	206	68 (33.0)	46 (44.7)	10 (31.3)	12 (16.9)	**0.001‡**	0.220‡	**<0.001‡**	0.122‡
Voltage to mass ratio	193	0.96 (0.68-1.22)	1.06 (0.78-1.32)	1.01 (0.71-1.17)	0.77 (0.12-1.08)	**<0.001***	0.352†	**<0.001†**	*0.021†*
Histological findings and survival									
Amyloid load, %	215	30.5 (18.3-42.1)	28.3 (18.5-38.0)	35.0 (25.0-47.7)	34.0 (15.0-44.1)	0.067*	*0.022†*	0.156†	0.417†
Median overall survival since baseline, months‖ (median [95% CI])	213 total/112 events	30.7 (20.5-40.8)	15.7 (11.5-19.9)	38.9 (20.6-57.2)	64.0 (20.5-107.0)	**<0.001§**	**0.028§**	**<0.001§**	0.638§

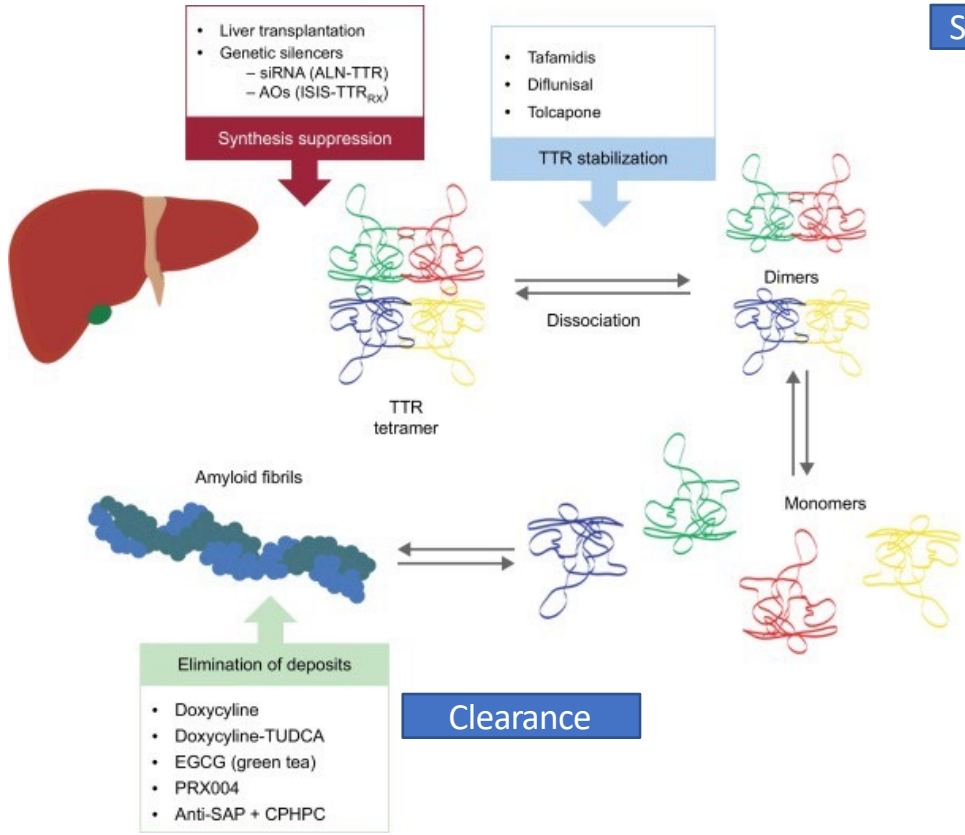
Values are n (%) or median (interquartile range) unless otherwise indicated. **Bold** indicates significant after multiple testing procedure; *italics* indicates not significant after multiple testing procedure. *Kruskal-Wallis test. †Mann-Whitney *U* test. ‡Fisher exact test. §Log-rank test. ‖Median (95% confidence interval).

ACE = angiotensin-converting enzyme; AL = light-chain amyloid; AT1 = angiotensin 1; CI = confidence interval; eGFR = estimated glomerular filtration rate; IQR = interquartile range; LA = left atrial; LV = left ventricular; MR = mineralocorticoid; mt-ATTR = mutant-type transthyretin (amyloid); NT-proBNP = N-terminal pro-B-type natriuretic peptide; NYHA = New York Heart Association; QTc = corrected QT interval; RV = right ventricular; TnT = troponin T; wt-ATTR = wild-type transthyretin (amyloid).

BEHANDLING TTR(ETIOLOGISK)

Syntes

Stabiliserare

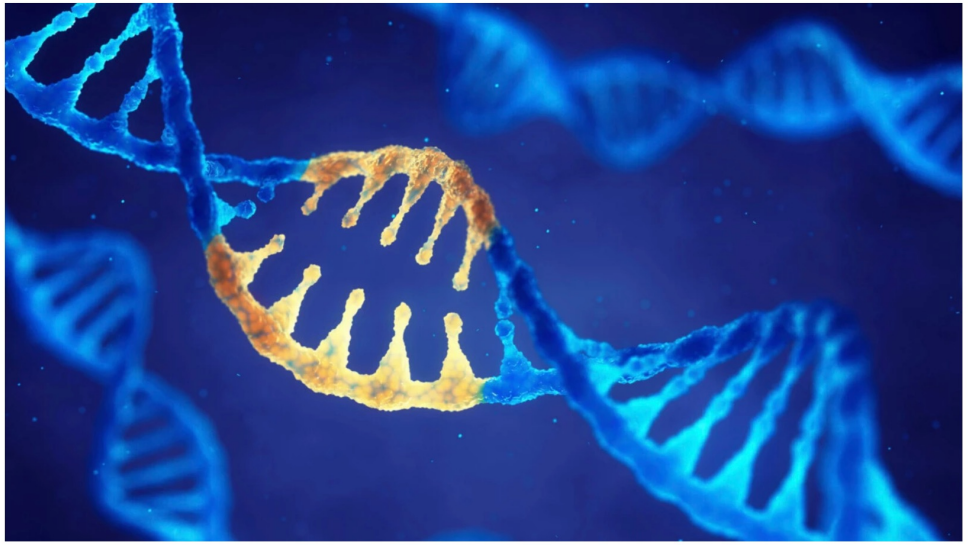


Clearance

Publicerad: 31 aug, 2022

Skelleftesjuka först ut att behandlas med gensaxen

NYHET Den så kallade gensaxen som upptäcktes vid Umeå universitet och har belönats med nobelpriset, har nu för första gången börjat användas för behandling på människor. Umeå är ett av tre center i världen i vad som än så länge är en forskningsstudie. Förhoppningen är att gensaxen ska innebära bot för svåra ärftliga sjukdomar som Skelleftesjukan.



Gensaxen CRISPR/Cas9 går in och **Bild:** Canva

Björn Pilebro, överläkare vid Norrlands universitetssjukhus. **Bild:** Mattias Pettersson

UMEÅ UNIVERSITY

Standard heart failure medication in cardiac transthyretin amyloidosis: useful or harmful?

Fabian aus dem Siepen, Selina Hein, Ralf Bauer, Hugo A. Katus & Arnt V. Kristen

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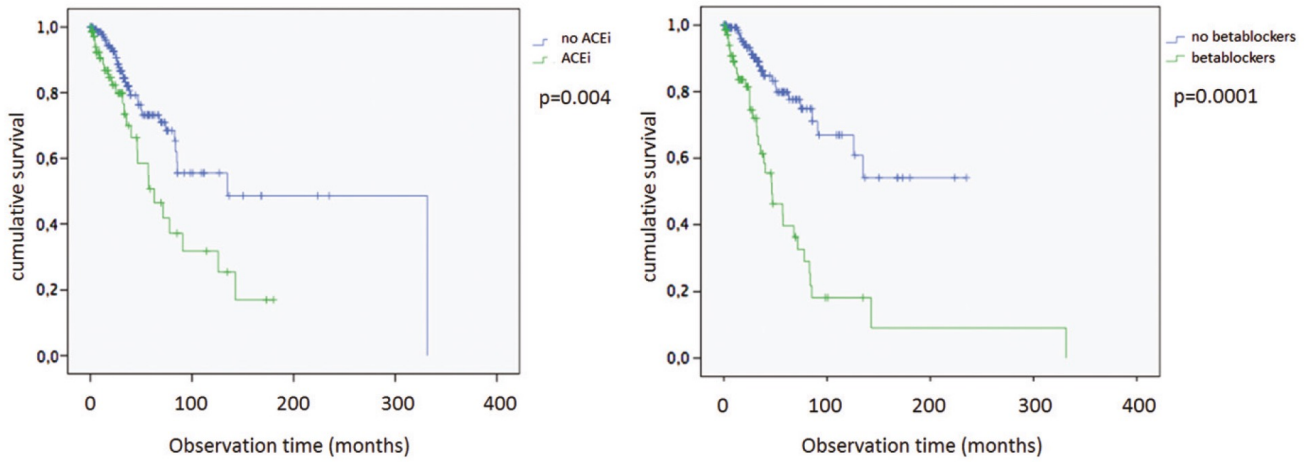
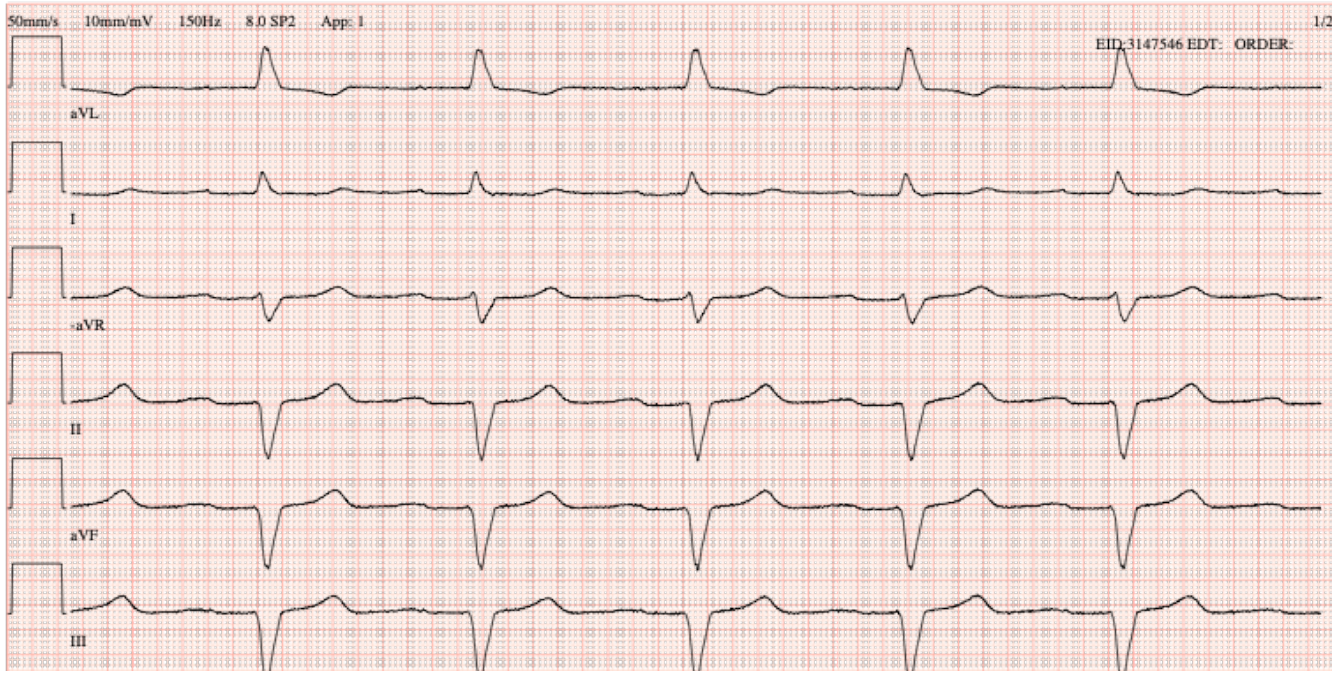


Figure 1. Kaplan–Meier analysis of patients with mATTR with and without heart failure medication.

IMAGING IN CARDIAC AMYLOIDOSIS

- ✓ **ECG**
- ✓ **Doppler Echocardiography**
- ✓ **DPD scintigraphy**
- ✓ **Cardiac MRI**
- ✓ **PET**

EKG



Förmaksflimmer (ffa.ATTRwt)

AV-block 1
Vänster ställd el axel
Ledningshinder
Q vågor anterioseptalt
Ingen LVH

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IMAGING IN CARDIAC AMYLOIDOSIS

- ✓ ECG
- ✓ Doppler Echocardiography
- ✓ DPD scintigraphy
- ✓ Cardiac MRI
- ✓ PET

JACC: CARDIOVASCULAR IMAGING
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ECHOCARDIOGRAPHY

REVIEW

MINI-FOCUS ISSUE: CARDIAC AMYLOIDOSIS

STATE-OF-THE-ART REVIEW

How to Image Cardiac Amyloidosis

A Practical Approach

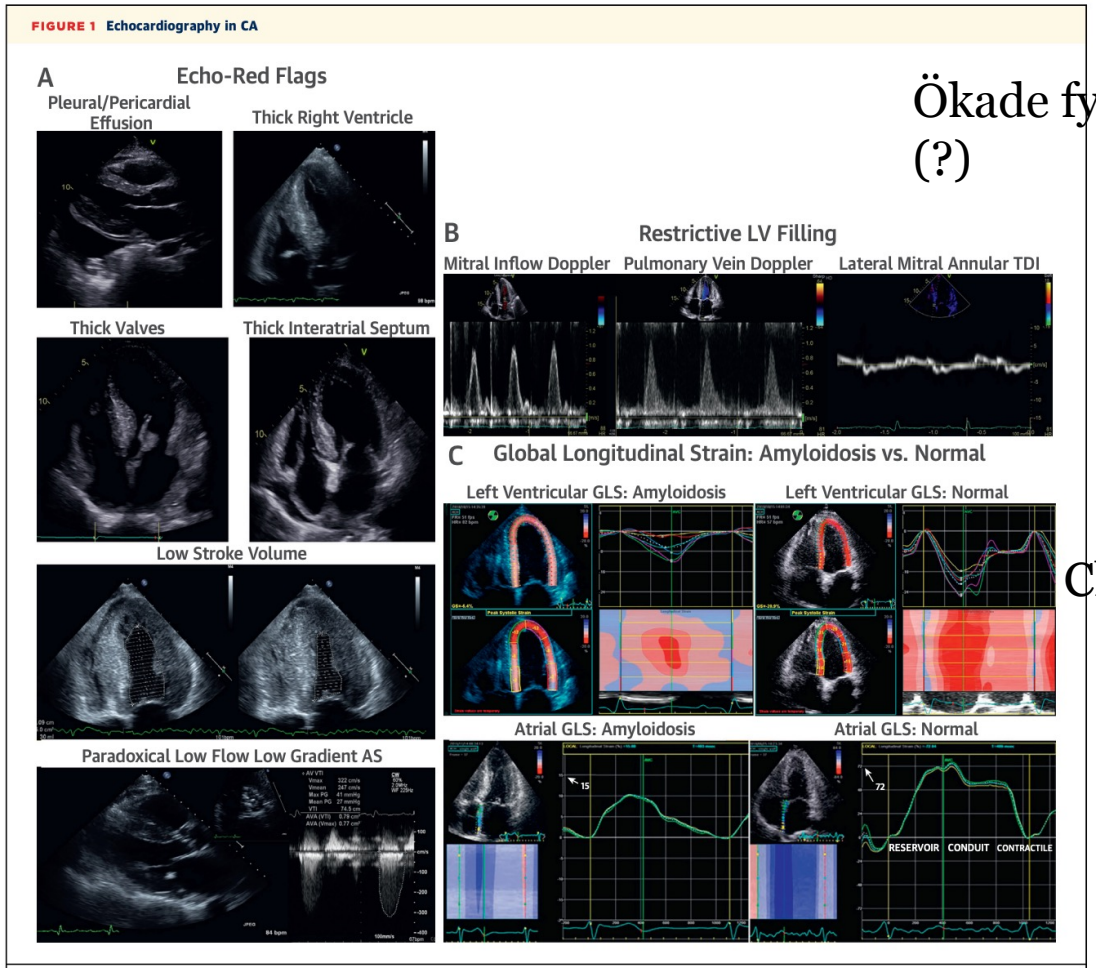
Sharmila Dorbala, MD, MPH,[a,b,c] Sarah Cuddy, MB BCh, BAO,[a,b,c] Rodney H. Falk, MD[c]

Perikardvätska (sent stadium)

Högerkammar engagemang

Klaff och förmaks engagemang

Low stroke volume



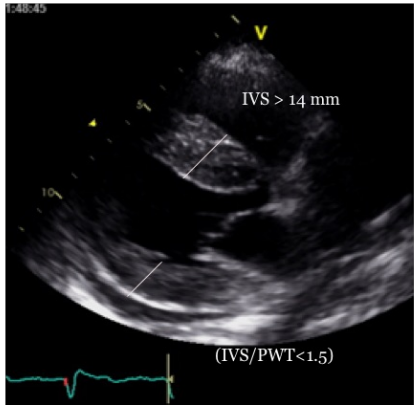
Ökade fyllnadstryck (?)

Cherry on the top

Nedsatt LV/LA strain

How to find patients with ATTR–CA in clinical practice?

Red flags = 1. increased wall thickness (concentric) with
2. low thickening fraction in the walls!



ATTR-CA > 12mm →

Många att screena!

Published in final edited form as:
Circ Heart Fail. 2019 September ; 12(9): e006075. doi:10.1161/CIRCHEARTFAILURE.119.006075.

Expert Consensus Recommendations for the Suspicion and Diagnosis of Cardiac ATTR Amyloidosis

Mathew S. Maurer, MD[1], Sabahat Bokhari, MD[1], Thibaud Damy, MD, PhD[2], Sharmila Dorbala, MD[3], Brian M. Drachman, MD[4], Marianna Fontana, PhD[5], Martha Grogan, MD[6], Arnt V. Kristen, MD[7], Isabelle Lousada[8], Jose Nativi-Nicolau, MD[9], Candida Cristina Quarta, MD, PhD[5,10], Claudio Rapezzi, MD[10], Frederick L. Ruberg, MD[11], Ronald Witteles, MD[12], Giampaolo Merlini, MD[13,14]

ATTR-CA; heart failure + >=14mm , male >65 år och female >70 år →

Missar vi några 12-14mm?

JACC: HEART FAILURE VOL. 7, NO. 8, 2019

STATE-OF-THE-ART REVIEW

Screening for Transthyretin Amyloid Cardiomyopathy in Everyday Practice

Ronald M. Witteles, MD,[a] Sabahat Bokhari, MD,[b] Thibaud Damy, MD, PhD,[c] Perry M. Elliott, MBBS, MD,[d] Rodney H. Falk, MD,[e] Nowell M. Fine, MD, SM,[f] Mariana Gospodinova, MD,[g] Laura Obici, MD,[h] Claudio Rapezzi, MD,[i] Pablo Garcia-Pavia, MD, PhD[j,k]

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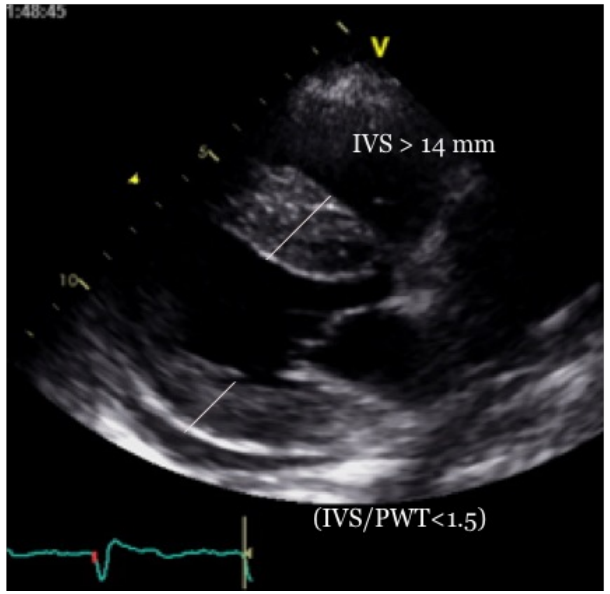
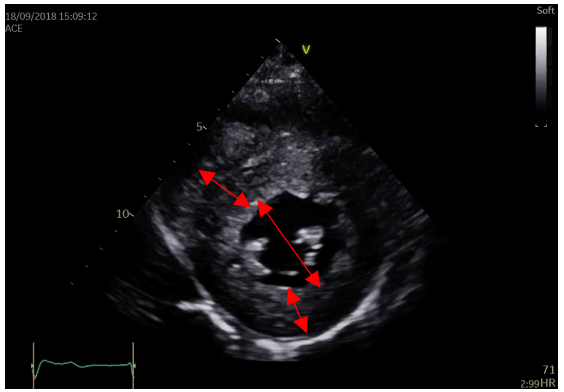
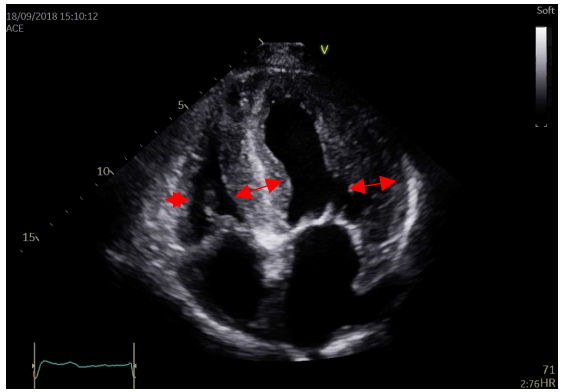
ECHOCARDIOGRAPHY

Findings related to cardiac amyloidosis

Red flags = 1. increased wall thickness (concentric) with
2. low thickening fraction in the walls!





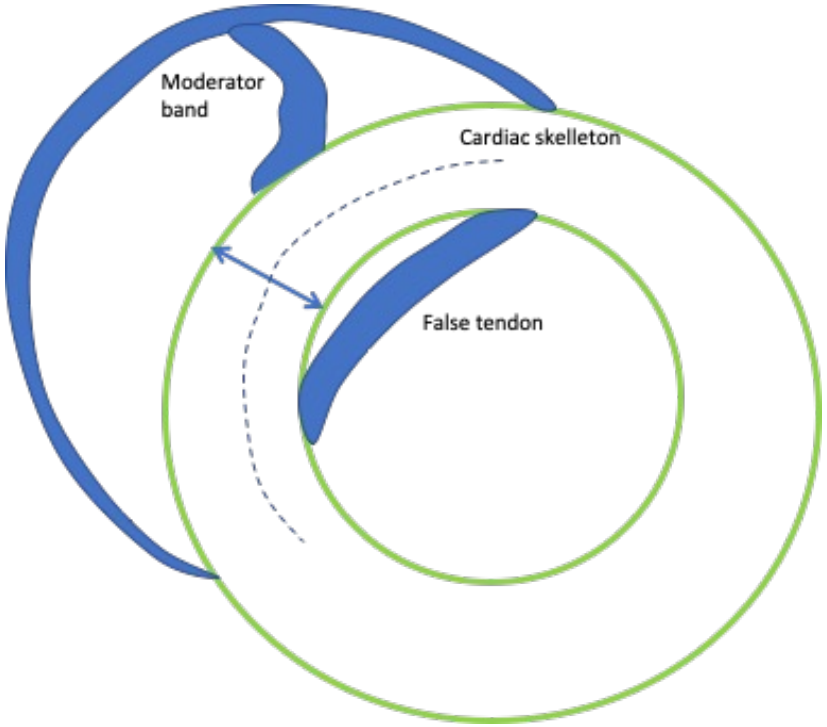


EKOKARDIOGRAFI
MYOKARDFÖRTJOCKNING

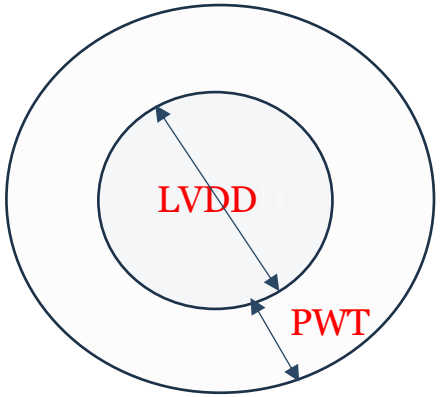
UMEÅ UNIVERSITY

ECHOCARDIOGRAPHY

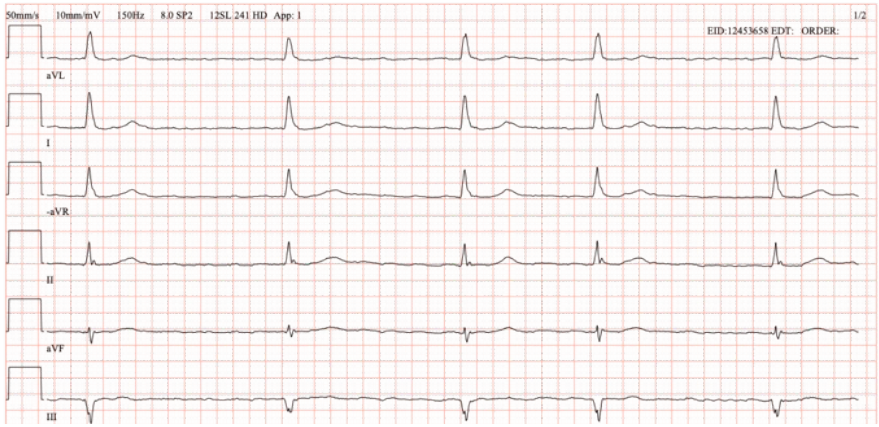
Findings related to cardiac amyloidosis



EKO och EKG



✓ **Red flag?** **ECG- voltage? No signs of LVH!**



Relative wall thickness,
RWT = PWTx2/LVDD

R vågen i -aVR

Journal of
Clinical Medicine

MDPI

Article

RWT/SaVR—A Simple and Highly Accurate Measure Screening for Transthyretin Cardiac Amyloidosis

Elsa Arnberg [1,*], Per Eldhagen [2], Viktor Löfbacka [1], Ashwin Venkateshvaran [2], Björn Pilebro [3] and Per Lindqvist [1]

wall thickness.

	AUC	Cut-Off Value	Sensitivity [%]	Specificity [%]	PPV	NPV	Accuracy	*p*-Value
RWT/SaVR	0.95	0.7	97	90	90	92	91	0.000
RWT	0.85	0.5	84	82	94	72	83	0.000
RELAPS	0.79	1.2	74	76	82	63	73	0.000
PWT, mm	0.84	11.5	82	78	88	75	82	0.000

102 ATTR-CA and 65 LVH

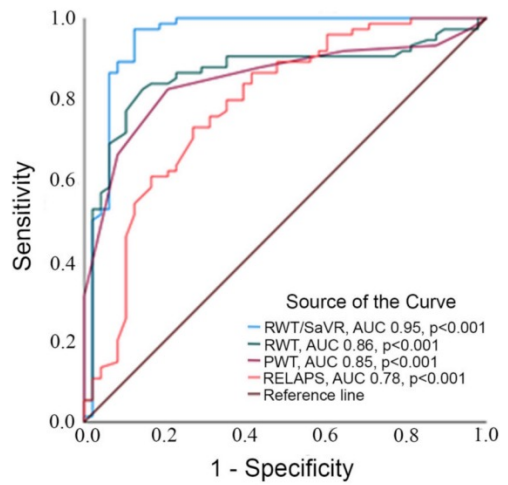


Figure 1. Legend to figure: ROC curve analyzing area under the curve testing RWT/SaVR, RWT, PWT and RELAPS.

IMAGING IN CARDIAC AMYLOIDOSIS

- ✓ ECG
- ✓ Doppler Echocardiography
- ✓ DPD scintigraphy
- ✓ Cardiac MRI
- ✓ PET

European Heart Journal – Cardiovascular Imaging (2014) **15**, 1289–1298
doi:10.1093/ehjci/jeu107

Utility and limitations of 3,3-diphosphono-1, 2-propanodicarboxylic acid scintigraphy in systemic amyloidosis

David F. Hutt[1], Anne-Marie Quigley[2], Joanne Page[2], Margaret L. Hall[2], Maria Burniston Dorothea Gopaul[1], Thirusha Lane[1], Carol J. Whelan[1], Helen J. Lachmann[1], Julian D. Gillmore[1], Philip N. Hawkins[1], and Ashutosh D. Wechalekar[1]*

[1]National Amyloidosis Centre, UCL Medical School (Royal Free Campus), Rowland Hill Street, London NW3 2PF, UK; and [2]Nuclear Medicine Department, Royal Free London NHS Foundation Trust, London, UK

Received 9 January 2014; accepted after revision 8 May 2014; online publish-ahead-of-print 16 June 2014

grade 0: no cardiac uptake and normal bone uptake
grade 1: cardiac uptake which is less than bone uptake
grade 2: cardiac uptake with intensity similar to or greater than bone uptake
grade 3: cardiac uptake with much reduced or absent bone signal

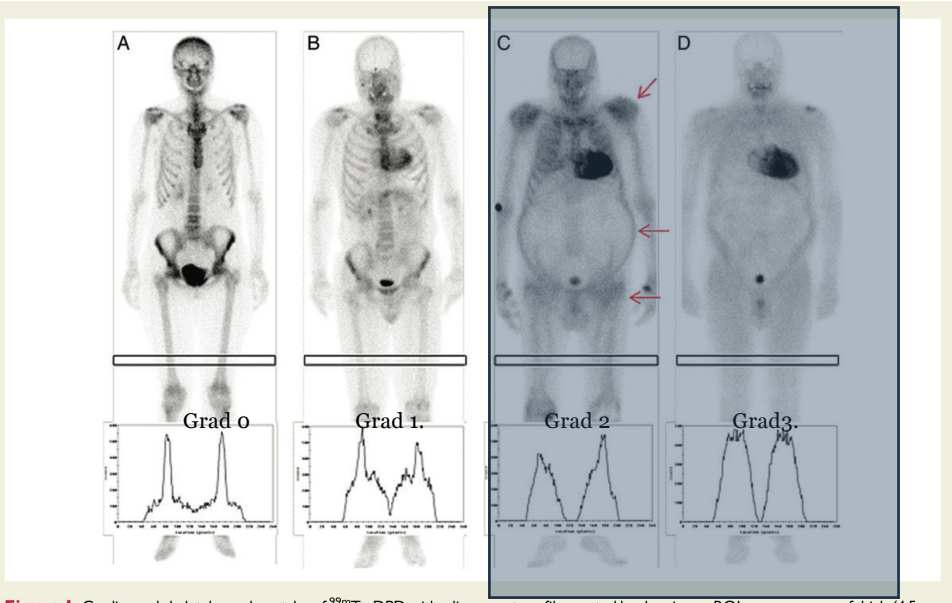
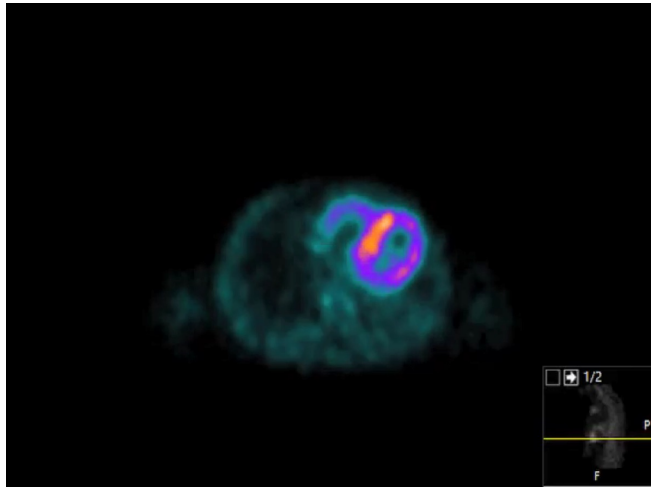


Figure 1 Cardiac and skeletal muscle uptake of ^{99m}Tc-DPD with a line count profile created by drawing an ROI across an area of thigh (4.5 cm wide) on the anterior whole body image. (*A*) A patient with no cardiac uptake with line profile showing sharply defined peaks over the femur and only background counts from adjacent soft tissue. (*B*) A patient with Grade 1 uptake with maintained femoral peak but more counts from the soft tissue on either side of the bone peak. (*C*) A patient with Grade 2 uptake with a maintained femoral peak but the soft-tissue counts have markedly increased. Deltoid, gluteal, and abdominal wall area (arrows)—a characteristic feature of ATTR amyloidosis. (*D*) A patient with Grade 3 uptake with no discernible femoral peak and just a generalized increase in counts. These figures (A–D) show that the peak bone uptake appears similar across the grades and the 'loss of bone signal' is likely due to progressive increase in soft-tissue uptake.

^{99m}Tc-DPD SPECT



DPD eller HDP?

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Wu and Yu *BMC Cardiovasc Disord* (2021) 21:482
https://doi.org/10.1186/s12872-021-02292-z

RESEARCH Open Access

Diagnostic performance of CMR, SPECT, and PET imaging for the detection of cardiac amyloidosis: a meta-analysis

Zhaoye Wu and Chunjing Yu*

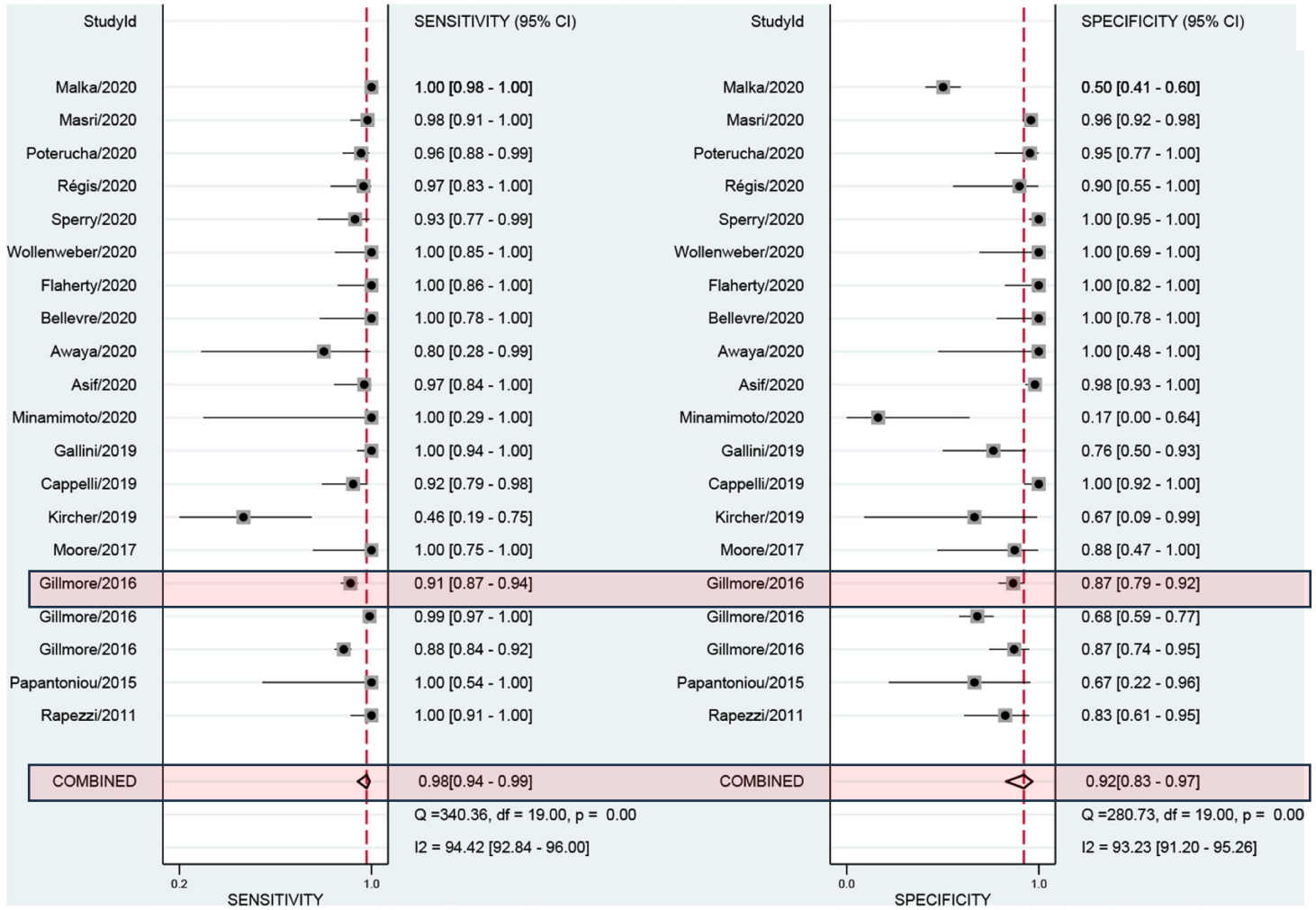


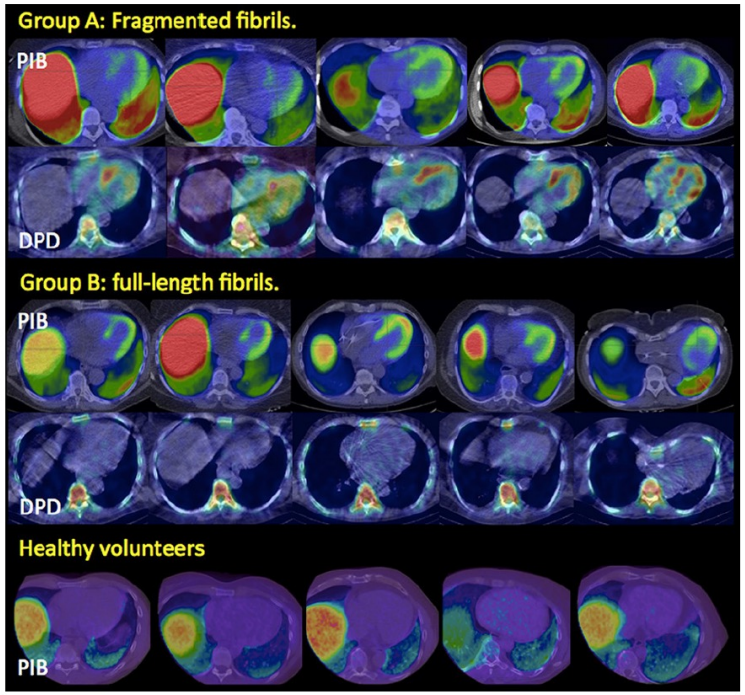
Fig. 4 Forest plot for diagnostic performance of SPECT

Journal of Nuclear Cardiolog

ORIGINAL ARTICLE

Positron emission tomography (PET) utilizing Pittsburgh compound B (PIB) for detection of amyloid heart deposits in hereditary transthyretin amyloidosis (ATTR)

Björn Pilebro,[a] Sandra Arvidsson,[a,b,c,d,e,f,g] Per Lindqvist,[b] Torbjörn Sundström,[c] Per Westermark,[d] Gunnar Antoni,[e] Ole Suhr,[f] and Jens Sörensen[g]



Cardiac ATTR

Non cardiac ATTR

Figure 1. Matched C-PIB-PET (*upper*) and DPD SPECT (*lower*) images of patients with type A fibrils (*group A*[11]) and type B fibrils (*group B*). At the bottom is ^{11}C-PIB-PET images from healthy volunteers.

JACC: CARDIOVASCULAR IMAGING
© 2014 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
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VOL. 7, NO. 2, 2014
ISSN 1936-878X/$36.00
http://dx.doi.org/10.1016/j.jcmg.2013.10.008

Native T1 Mapping in Transthyretin Amyloidosis

Marianna Fontana, MD,*†‡ Sanjay M. Banypersad, MB ChB,*†‡
Thomas A. Treibel, MBBS,*† Viviana Maestrini, MD,*§ Daniel M. Sado, BSc, BM,*†
Steven K. White, BSc, MB ChB,*† Silvia Pica, MD,* Silvia Castelletti, MD,*
Stefan K. Piechnik, PhD, MScEE,‖ Matthew D. Robson, PhD,‖ Janet A. Gilbertson, CSci,‡
Dorota Rowczenio, CSci,‡ David F. Hutt, BAppSc,‡ Helen J. Lachmann, MD,‡
Ashutosh D. Wechalekar, MD,‡ Carol J. Whelan, MD,‡ Julian D. Gillmore, MD, PhD,‡
Philip N. Hawkins, PhD,‡ James C. Moon, MD*†
London and Oxford, United Kingdom; and Rome, Italy

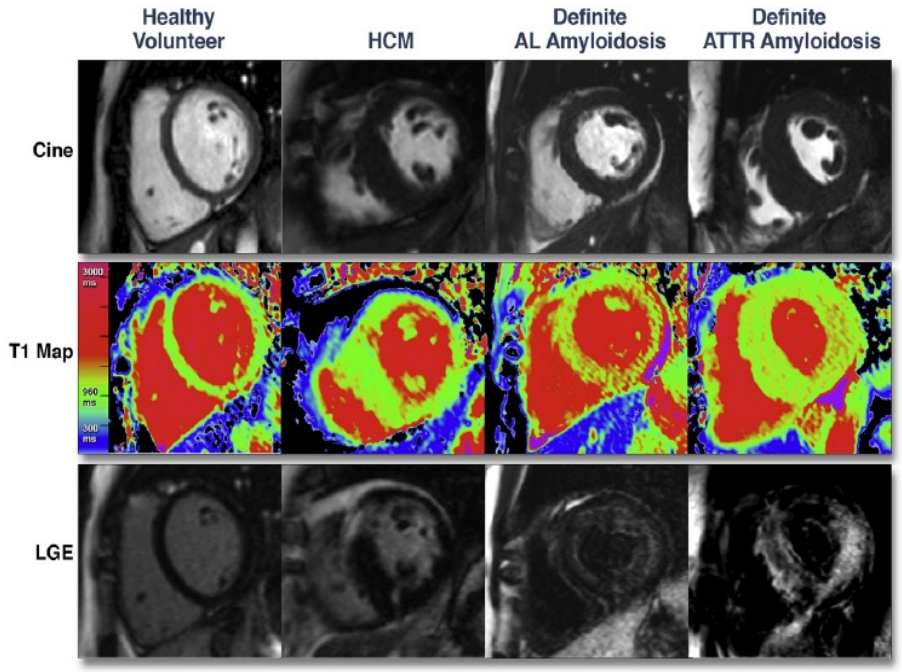

Figure 2. Characteristic Examples From CMR Scans

CMR end-diastolic cine still **(top)**, shortened modified look-locker inversion recovery native T1 map **(middle)**, and late gadolinium enhancement (LGE) images **(bottom)** in **(left to right)** healthy volunteer, hypertrophic cardiomyopathy (HCM), definite immunoglobulin light-chain amyloidosis (AL amyloidosis), and definite transthyretin amyloidosis (ATTR amyloidosis) patients.

Wu and Yu *BMC Cardiovasc Disord* (2021) 21:482
https://doi.org/10.1186/s12872-021-02292-z

BMC Cardiovascular Disorders

RESEARCH Open Access

Diagnostic performance of CMR, SPECT, and PET imaging for the detection of cardiac amyloidosis: a meta-analysis

Zhaoye Wu and Chunjing Yu*

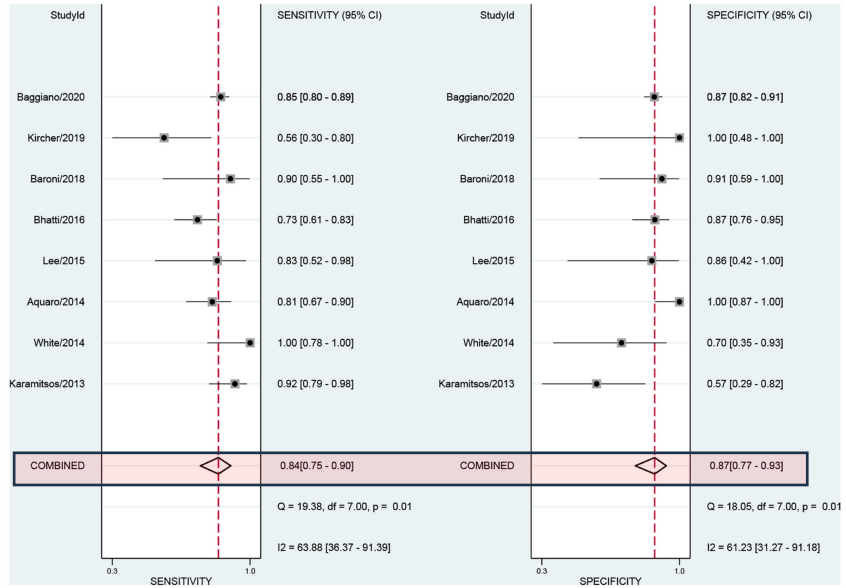

Fig. 3 Forest plot for diagnostic performance of CMR

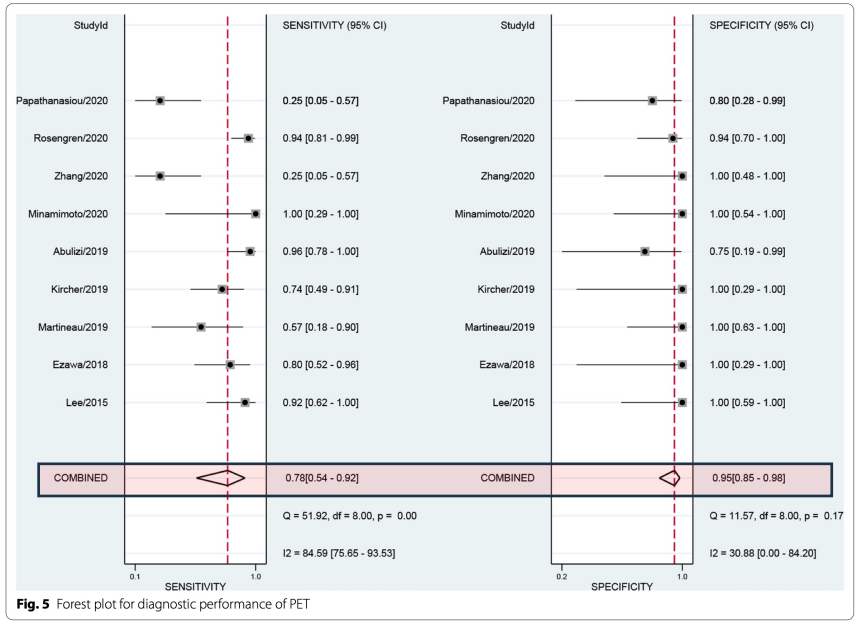

Fig. 5 Forest plot for diagnostic performance of PET

Valideringsstudie 112 ATTR-CA och 82 LVH > 14mm IVS

RWT/R-aVR > 0.7 = sens 95 spec 87 for positive DPD

RELAPS > 1 = sens 82 spec 66

UMEÅ UNIVERSITY

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EDITORIAL COMMENT

Broadening the Phenotypic Spectrum and the Diagnostic Needs of TTR-Related Cardiac Amyloidosis*

Claudio Rapezzi, MD,[a] Anna Laura Tinuper, MD,[a] Massimiliano Lorenzini, MD[a,b]

TABLE 1 Role Of Different Imaging Techniques and Biomarkers in the Various Phases of Evaluation and Management of TTR-related CA

Phase of Workup	Echo	CMR*	"Bone Tracers" Scintigraphy	NT-proBNP	Other
Diagnostic suspicion	+++	++	+	+	Serum retinol-binding protein 4 (13)
Definite diagnosis	++	++	+++	–	
Early diagnosis	+	+?	+++	–	
Functional evaluation	+++	+++	– (+ for MIBG)	++	
Prognostic stratification	+	++	++±	++ (14)	Troponin (14)
Amyloidotic burden	+	++	+	–	
Response to therapy	+	++?	?	++?	6MWT ?

*Late gadolinium enhancement extracellular volume and native T1 mapping.

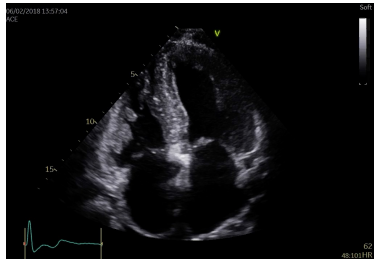
+++ = very useful, recommended; ++ and ++± = useful, to be considered; + = possibly useful; +/– = role uncertain; – = not useful; 6MWT = 6-min walk test; ATTR = transthyretin-related amyloidosis; CA = cardiac amyloidosis; CMR = cardiac magnetic resonance; Echo = echocardiography; MIBG = meta iodine-131-meta-iodobenzylguanidine; NT-proBNP = N-terminal pro–B-type natriuretic protein.

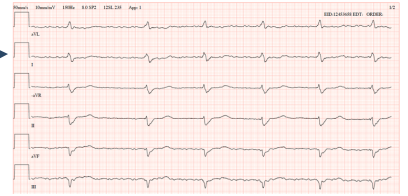
This is how we do in Umeå

Heart failure, Bradyarytmias, atrial fibrillation

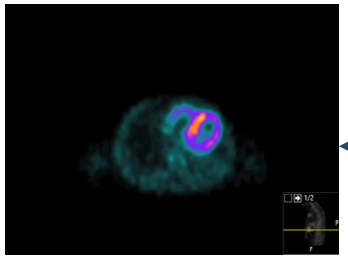
ECHO+ECG

Not CA





INCREASED WALL THICKNESS+ NO LVH ECG



DPD-scintigraphy + screening with kappa/lambda and M-component in serum and urine (AL CA)

DPD grade 0-1 och/eller MG

DPD 2-3, ingen MG

Biopsi

ATTR-amyloidos

AL-amyloidos

Gentestning

ATTRv

ATTRwt

KLINFYS ROLL ÄR ATT….

Screena med EKO och ECG : Septum >14mm, ökad RWT och normala/låga amplituder i EKG inger tillsammans stark misstanke på hjärtamyloidos

Rekommendera/utföra DPD skintigrafi efter positiv screening för att påvisa ATTR-CA.

Vid icke konklusiva fynd ; biopsi (AL amyloidos), cMRI (differentialdiagnosis). PET ?

GLÖM INTE ATT….

..leta även AL -amyloidos

..leta också bland HFmrEF och HFrEF

..vara generös med DPD skintigrafi

Varför upptag med ^{99m}Tc-DPD i hjärta?

International Journal of Cardiology 352 (2022) 84–91

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International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Cardiac microcalcifications in transthyretin (ATTR) amyloidosis

Ulrika Thelander [a], Gunilla T. Westermark [b], Gunnar Antoni [c,d], Sergio Estrada [c], Alice Zancanaro [a], Elisabet Ihse [a], Per Westermark [a,*]

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[b] Department of Medical Cell Biology, Uppsala University Hospital, Uppsala University, Uppsala, Sweden
[c] Department of Medicinal Chemistry, Uppsala University Hospital, Uppsala University, Uppsala, Sweden
[d] PET Centre, Uppsala University Hospital, Uppsala University, Uppsala, Sweden

Conclusions: Our study indicates that binding of skeletal probes to amyloid-containing hearts depends on an irregular presence of clouds of very tiny calcifications, which seem not to be directly associated with amyloid fibrils. Therefore, [^{99m}Tc]Tc-DPD bone scans can be considered surrogate markers of ATTR amyloid but have to be used carefully to estimate amyloid amount or disease progression.