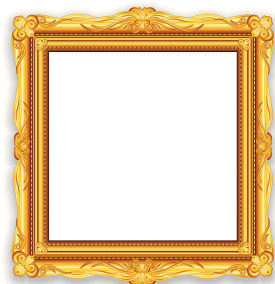
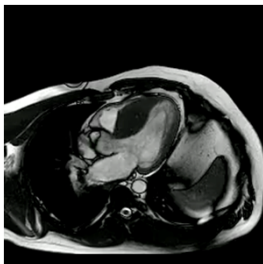


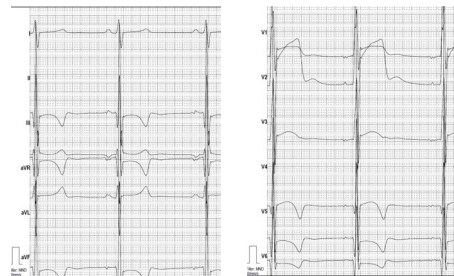
### Hypertrophe Kardiomyopathien inkl. Differentialdiagnostik



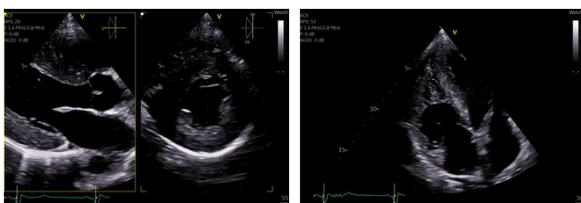
Fabian Knebel, FESC  
Sana Klinikum Berlin-Lichtenberg  
meet-Echokardiographiekurs  
26.6.2024



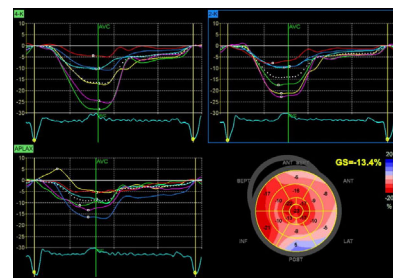
### Fall von gestern...



### TTE



### Speckle Tracking



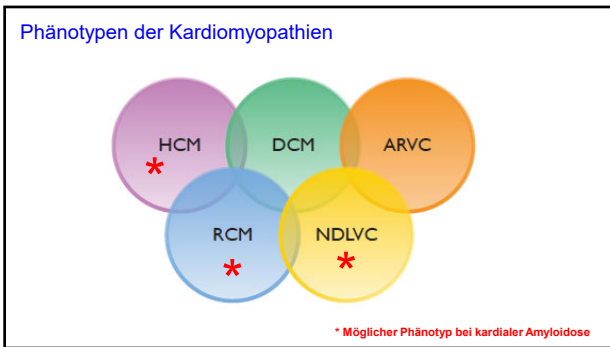
Mitochondriale Myopathie, Mutation in SCL25-A3 Gen, Kleinwuchs



Echo first

COR	LOE	RECOMMENDATIONS
I	B-IbR	1. In patients with suspected HCM, a transthoracic <b>echocardiogram</b> (TTE) is recommended in the initial evaluation. <sup>1,2</sup>

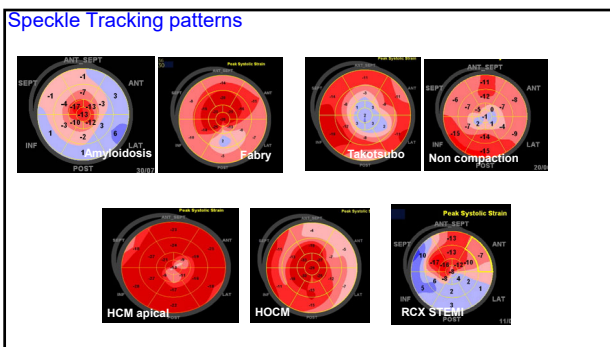
Ommen JACC 2024



How do we define LV hypertrophy?

- Heart failure in <math>145</math> years
- Aortic disease in <math>145</math> years
- Hypertension or normotensive
- Secondary involvement: aortic stenosis
- Peripheral polyangiopathy
- Prolonged QT
- Skin blemishes
- Repetitive hiccup tics
- Bilateral carpal tunnel syndrome
- Subendocardial infarction of LGE or increased ECV
- Reduced OES velocity to mass ratio
- Pseudo Q waves on ECG
- AV conduction disease
- Possible family history of Atrial Fibrillation (AF)
- Chromosomal structural fragments
- Known recipient transplanted in HCM

Arbela E. EHJ 2023



Was ist neu?

2023 ESC Guidelines for the management of cardiomyopathies

Developed by the task force on the management of cardiomyopathies of the European Society of Cardiology (ESC)

Author: Paul M. McKelvie, David S. Lim, J. Janssens, et al.

2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

Author: Peter D. Parise, Thomas A. Whellan, et al.

**Blick in die neue ESC Kardiomyopathie Guideline (2023)**

**Die Kardiologie**  
vom 28. Februar 2024

**Leitlinien**  
Kardiologie  
https://doi.org/10.1007/s12181-024-0985-w  
Angenommen: 28. Februar 2024

© Deutsche Gesellschaft für Kardiologie – Herz- und Kreislaufrehabilitation e.V. / Public Health / Springer Medizin Verlag GmbH, ein Teil von Springer Nature  
all rights reserved 2024

**Kommentar zu den Leitlinien 2023 der ESC zum Management von Kardiomyopathien**

Benjamin Meder<sup>1</sup>, Lars Eckardt<sup>2</sup>, Volker Falk<sup>3</sup>, Sabine Klassen<sup>4</sup>, Thomas Klöpperheiser<sup>5</sup>, Fabian Krüger<sup>6</sup>, Eric Schöler-Bahr<sup>7</sup>, Janette Schütz-Mengler<sup>8</sup>

<sup>1</sup>Herz für immer Institut für Kardiologie, Angiologie und Pneumologie, Universitätsklinikum Heidelberg, Heidelberg, Deutschland; <sup>2</sup>Abteilung für Kardiologie I, Rhythmologie, Universitätsklinikum Münster, Münster, Deutschland; <sup>3</sup>Abteilung für Kardiologische Chirurgie, Charité – Universitätsmedizin Berlin, Berlin, Deutschland; <sup>4</sup>Experimental & Clinical Research Center (ECRC), Charité – Universitätsmedizin Berlin, Campus Berlin-Book, Berlin, Deutschland; <sup>5</sup>Praxis für Kardiologie, Berlin, Deutschland; <sup>6</sup>Abteilung für Innere Medizin I, Charité – Universitätsmedizin Berlin, Campus Lichtenberg, Berlin, Deutschland; <sup>7</sup>Abteilung für Geriatrie und Herz-Kreislauferkrankungen (GHC), Universitätsklinikum Münster, Münster, Deutschland; <sup>8</sup>Kardiologie für Erwachsene, Universitätsklinikum Erlangen, Erlangen, Deutschland

**Cardiomyopathies and HFrEF in the 2023 ESC guidelines**

**6.7.2. Echocardiography**  
The non-invasive nature and widespread availability of echocardiography make it the main imaging tool, from initial diagnosis to follow-up. Transthoracic echocardiography (TTE) provides relevant information on global and regional RV and LV anatomy and function as well as valve function and the presence of dynamic obstruction, pulmonary hypertension, or pericardial effusion.<sup>10,11</sup> Regional deformation imaging (speckle tracking or tissue Doppler) with global longitudinal strain is a more sensitive marker than EF to detect subtle ventricular dysfunction (eg, in genotype-positive HCM, DCM, and AHC family members<sup>12,13</sup>), and may help discriminate between different aetiologies of hypertrophy<sup>14</sup> (eg, amyloidosis, HCM, and athlete's heart).<sup>15</sup> Mechanical

**Diagnosis**

**Treatment**

Management of patients with HFrEF

- Diuretics for fluid retention (Class II)
- Digoxin/Emagifloxin (Class I)
- Treatment for aetiology CV and non-CV comorbidities (Class I)

Arbore E. EHJ 2023  
McDonagh T. EHJ 2023

**Was ist selten?**



**Wirklich so selten?**

Amyloidose: (> 80 J.)	1:10
HCM	1:200-1:400
Fabry	1:40.000

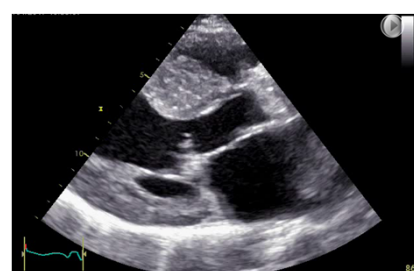
**HFpEF Therapien**

- SGLT-2-I
- Diuretika?
- MRA?
- Sacubitril-Valsartan?
- Statine?

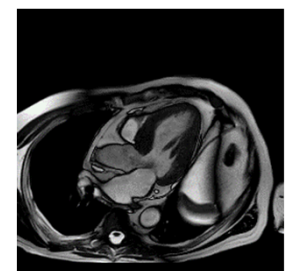
**Gezielte Therapien?**

**Hypertrophie Kardiomyopathie (HCM)**

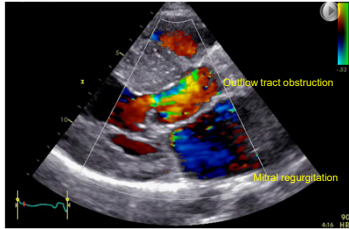
**Hypertrophic cardiomyopathy?**



**Septale HCM mit SAM**



Pathomechanisms in HOCM

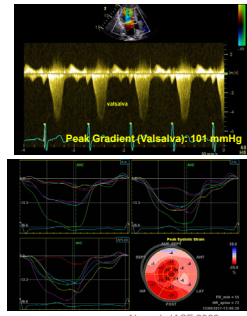
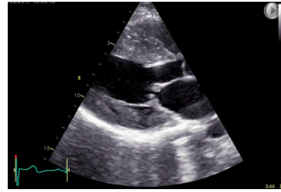


HOCM

SECTION 1: MULTIMODALITY IMAGING FOR THE EVALUATION OF SUSPECTED OR CONFIRMED HCM

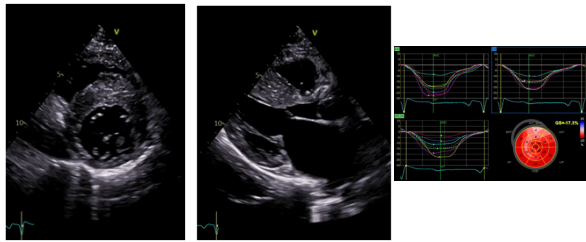
A. Assessment of Left Ventricular Hypertrophy

Accurate quantification of the magnitude, location, and pattern of LVH is essential for the diagnosis and management of patients. Wall thickness  $\geq 15$  mm in the absence of other causes of hypertrophy in a non-dilated left ventricle (LV) defines HCM.<sup>7</sup> End diastolic wall



Nagueh JASE 2022

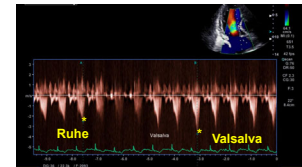
Septal HCM



How to: Valsalva Manöver im Echo



Antonio Maria Valsalva (1666-1723)



Checkliste Valsalva Manöver:

1. Patienten erklären, was zu tun ist (Pressen, > 10 sek)
2. CW Doppler sicher positionieren
3. Skala des CW Dopplers richtig einstellen (> 5 m/s)
4. Messung der v max
5. Morphologie des Jets („säbelscheidenartig“)

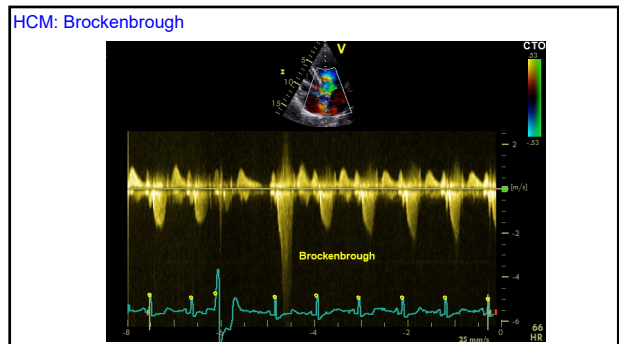
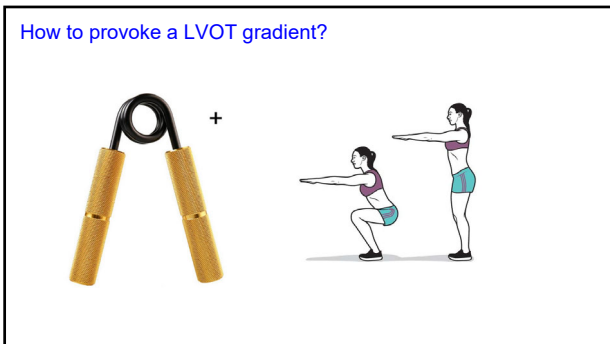
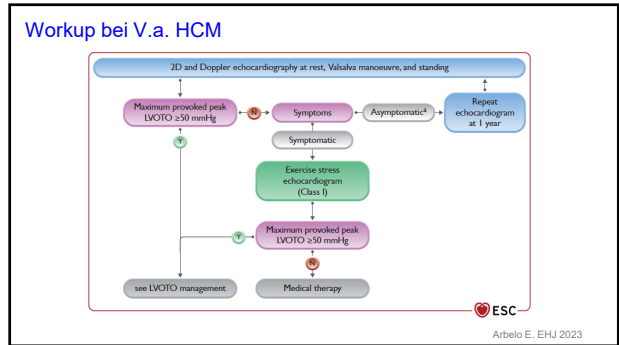
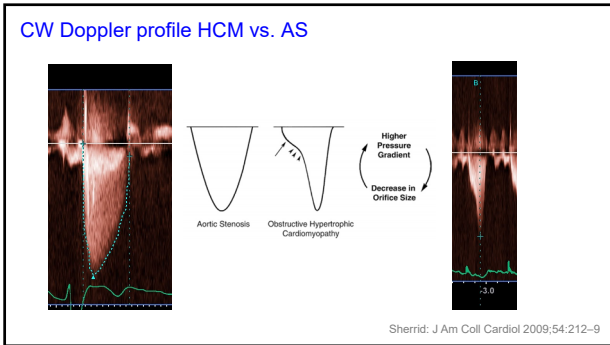
Valsalva: eine klare Empfehlung!

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
In all patients with HCM, at initial evaluation, transthoracic 2D and Doppler echocardiography are recommended, at rest and during Valsalva manoeuvre in the sitting and semi-supine positions—and then on standing if no gradient is provoked—to detect LVOTO. <sup>84,86,365,525,584,587,589–594</sup>	I	B

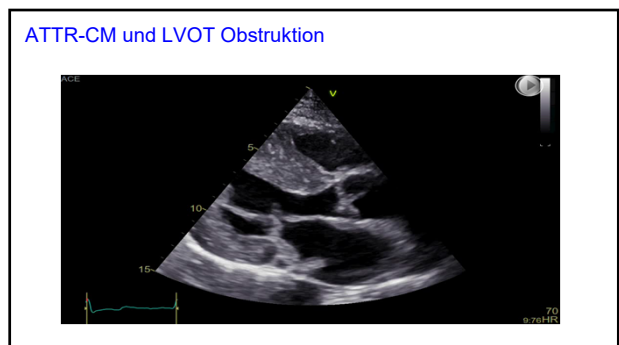
Arbello E. EHJ 2023

An Valsalva denken!

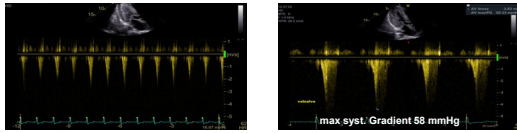




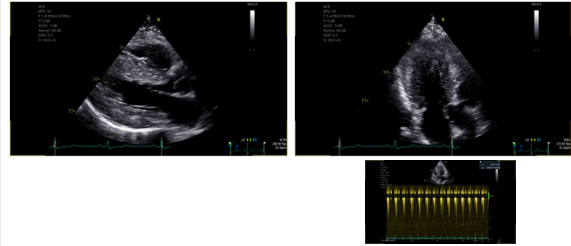
LVOT Obstruktion: andere Ursachen



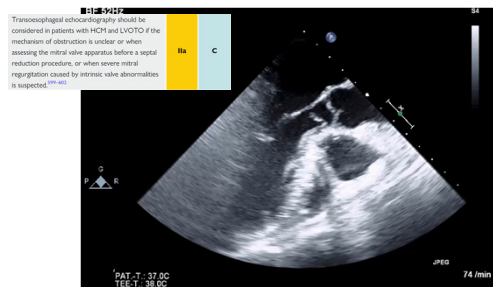
Outflow tract gradient (CW Doppler)



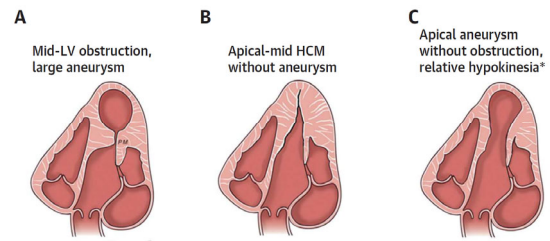
M. Fabry mit Ausflusstrakt-Obstruktion



Subvalvular membrane

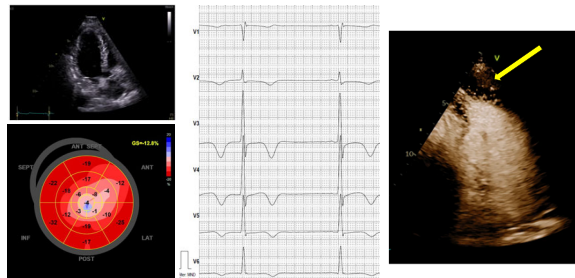


Apical HCM >>> apical aneurysm in HCM

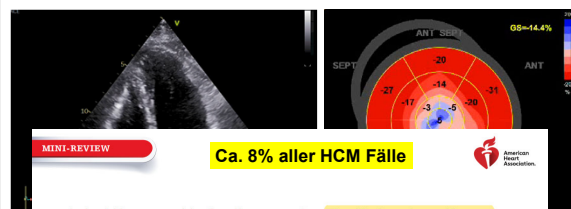


Sherrid MV. J Am Coll Cardiol Img 2023

Apikale HCM - Kontrastmittel



Apikale HCM



Apical Hypertrophic Cardiomyopathy: The Variant Less Known

Rebecca K. Hughes, MBBS, MRCP; Kristopher D. Knott, MBBS, MRCP; James Malcolmson, BSc; Joao B. Augusto, MD; Saidi A. Mohiddin, MD, MChB, FRCP, FESC; Peter Kellman, PhD; James C. Moon, MD, MBBS, MRCP; Gabriella Captur, MD, PhD, MRCP, MSc\*

Blueberry on top: apikale HCM

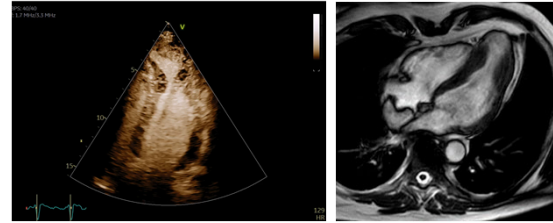


Blueberry-on-Top Phenomenon in Apical Variant Hypertrophic Cardiomyopathy

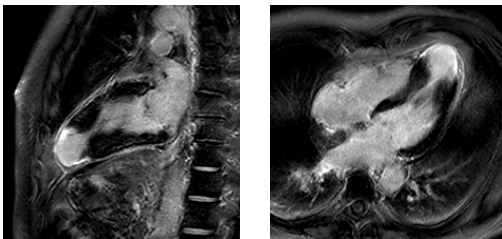
Saed Alnaimat, MD, MS, Mariah Mascara, MD, Georgios Lygouris, MD, and Robert W. W. Biederman, MD, Pittsburgh, Pennsylvania

<https://doi.org/10.1016/j.case.2024.01.006>

HCM with apical aneurysm



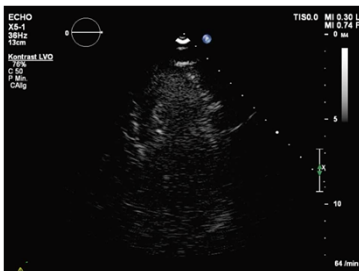
MRT + Gadolinium: HCM with apical aneurysm and scar



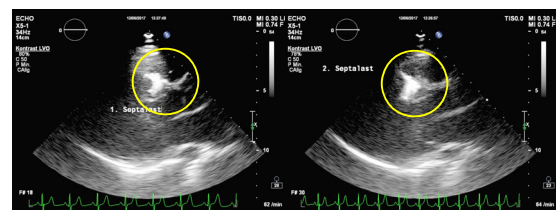
Courtesy: Dr. C. Nauck, Sana Klinikum Berlin-Lichtenberg, Germany

Therapie der HOCM

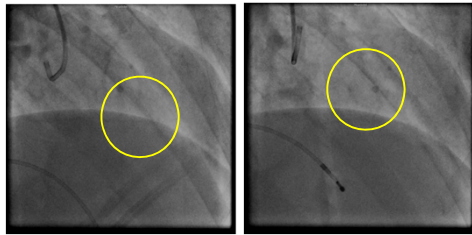
HOCM: Septäläste mit KM



Pre procedure planning: TASH / Myectomy



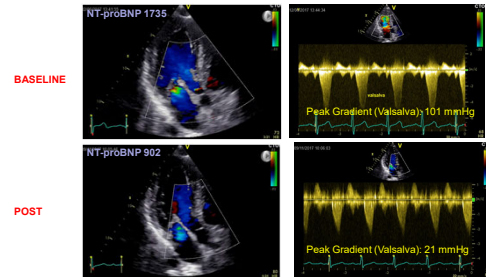
Interventional therapy



Baseline

After TASH

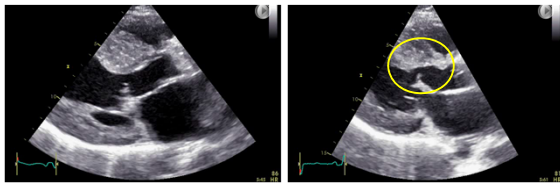
Echo nach TASH



BASELINE

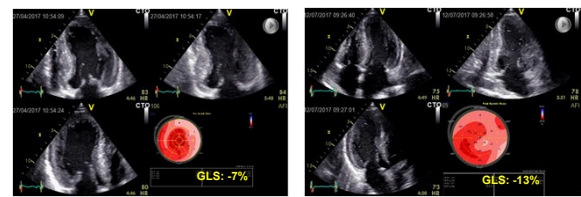
POST

Echo post Myektomie



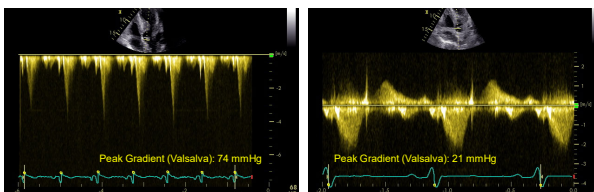
Post Myektomie und MKR

GLS after myectomy



Post Myectomy and MVR

LVOT Obstruktion



Post Myectomy and MVR

72 yo patient with HOCM

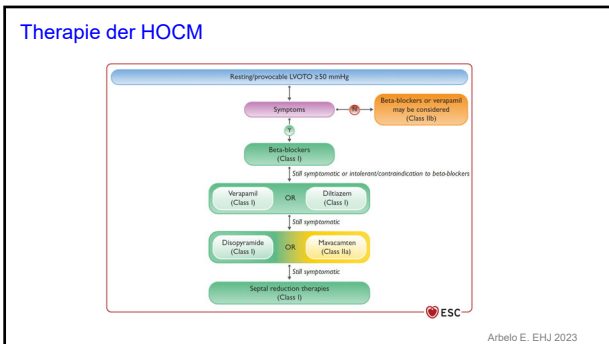
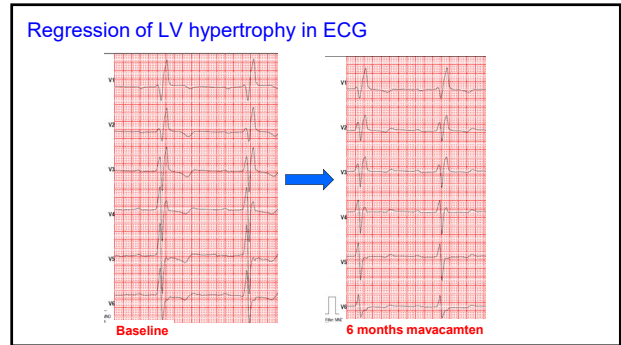
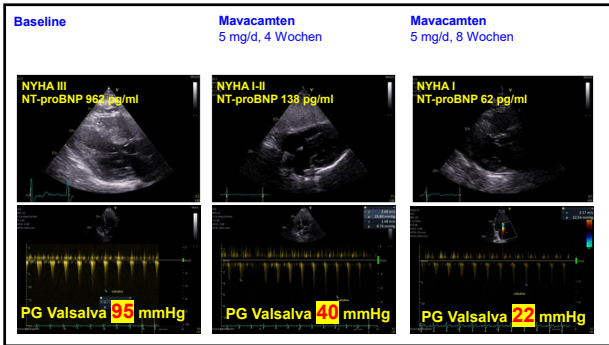
- Syst. gradient 90 mmHg
- BMI 39, OSAS, NIDDM
- „hypertensive heart disease“ since 2012
- CAD excluded, MRT: Fibrose
- Septum-myectomy (Morrow) 2020
- Septal ablation 2022

NYHA III + chest pain

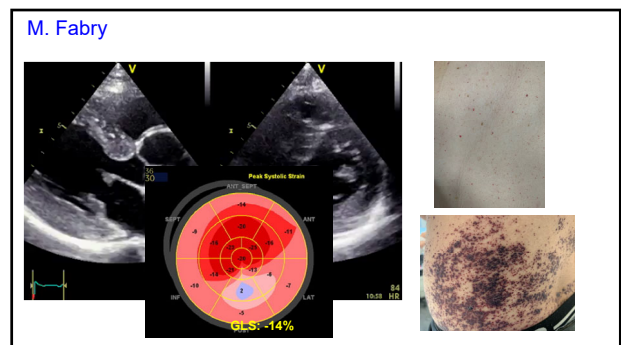
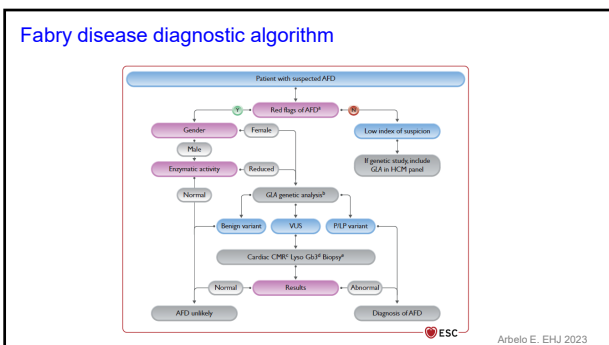
Mavacamten (Compassionate-Use-Program)



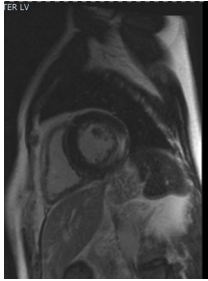




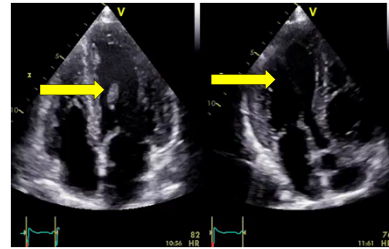
M. Fabry



LGE MRT bei M. Fabry



Thickened papillary muscles

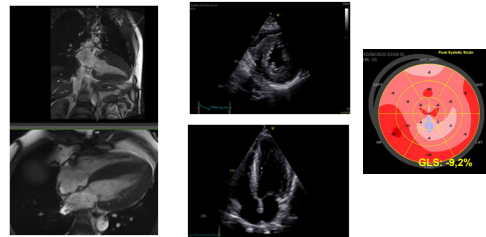


50jähriger Patient

Tinnitus seit Jahren, NYHA II, rez. Synkopen. NT-proBNP 1400. Gesicherter M. Fabry, seit 2019 Therapie. Im MRT vereinbar mit Sarkomerischer HCM, eher untypisch für M. Fabry im T1-Mapping.

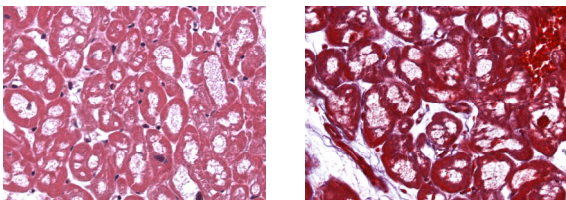


Echo und Biopsie



Valsalva: kein Gradient  
Biopsie: Morbus Fabry, keine HCM, keine Amyloidose, keine Myokarditis

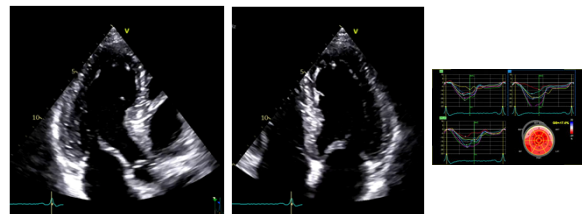
Histologie



C. Prof. K. Klingel, Tübingen

44-jähriger Patient

Genetisch gesicherter Morbus Fabry, ERT  
In der Familie Morbus Fabry auch bei Bruder bekannt.  
Ehemals V.a. HCM. Z.n. PVI bei Vorhofflimmern. MRT: T1 Mapping typisch für M. Fabry



Quelle: eigene Aufnahmen/Abbildungen

EKG: SR+ ventrikuläre Extrasystolen



EKG: Paroxysmales Vorhofflimmern



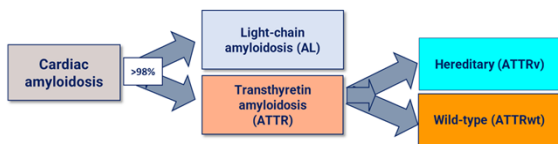
Atriale Tachykardien bei M. Fabry

Recommendations	Class	Level
Maintenance of sinus rhythm rather than rate control is recommended for patients with FD and AF.	I	C
Regular 48 h Holter monitoring is recommended in patients with left atrial enlargement and in case of unexplained palpitations to detect AF.	I	C
The use of CHADS <sub>2</sub> and CHA <sub>2</sub> DS <sub>2</sub> -VASc scores is not recommended to assess the need for anticoagulation in patients with FD and AF.	III	C
All patients with AF and atrial flutter should receive anticoagulation with DOACs or VKAs unless contraindicated.	I	C
DOACs should be considered as the first-line choice in FD patients without contraindications resulting from renal function impairment.	IIa	C
The use of aspirin monotherapy is not recommended to protect against cardioembolic stroke.	III	C
Combination therapy with aspirin 75–100 mg plus clopidogrel 75 mg daily may be considered for stroke prevention in patients for whom OAC therapy is unacceptable or contraindicated and where there is a low risk of bleeding.	IIb	C
Left atrial appendage closure may be considered in patients unable to receive anticoagulation therapy.	IIb	C
Anesthetics may interfere with lysosomal metabolism and its chronic use should be considered only if other treatments are ineffective.	IIa	C
In patients with AF treated with rate control, Holter ECG monitoring should be used to assess rate response and to detect bradycardia.	I	C
Ablation therapy for AF may be considered as for the general population.	IIb	C

Linhart A. Eur J Heart Fail 2020

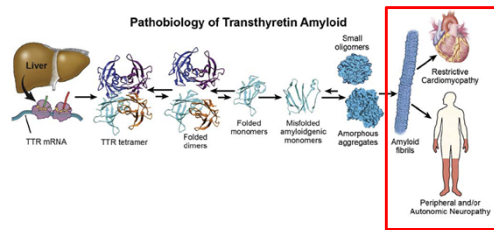
Kardiale Amyloidose

Cardiac amyloidosis

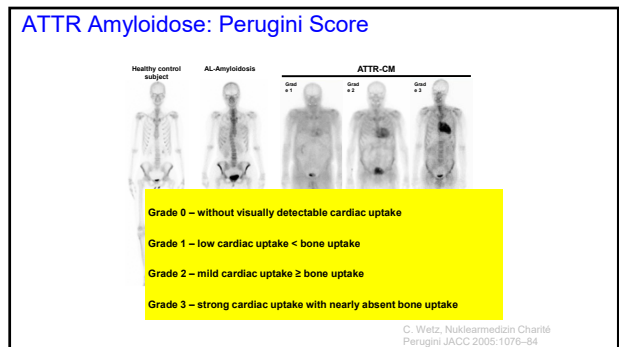
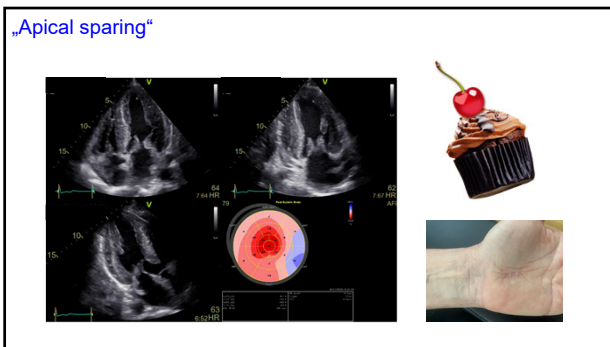
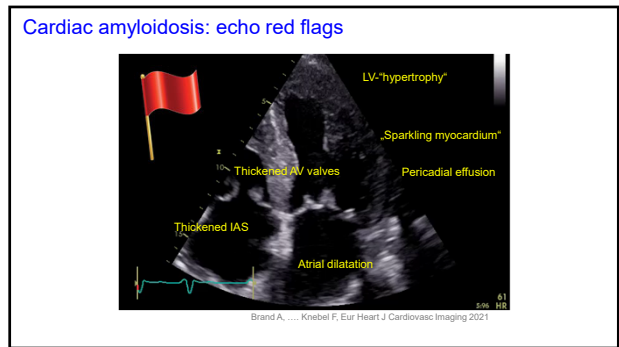
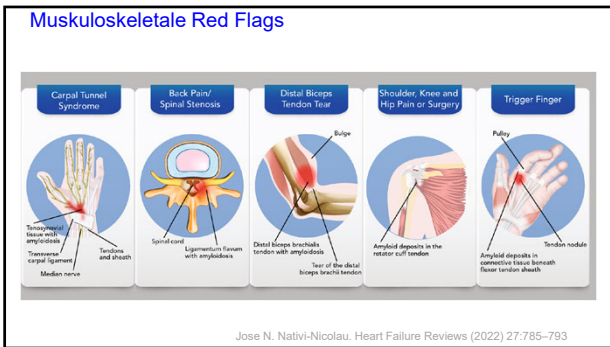
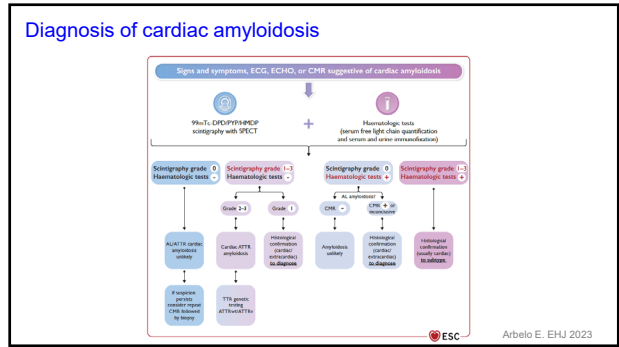
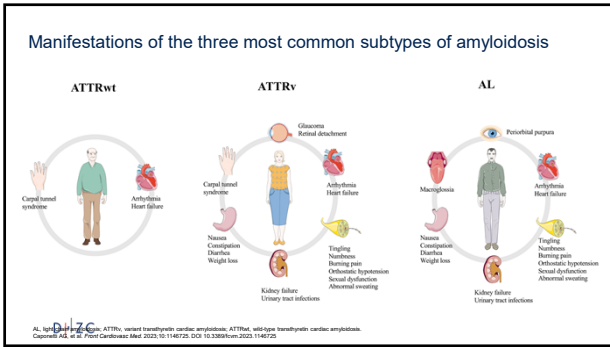


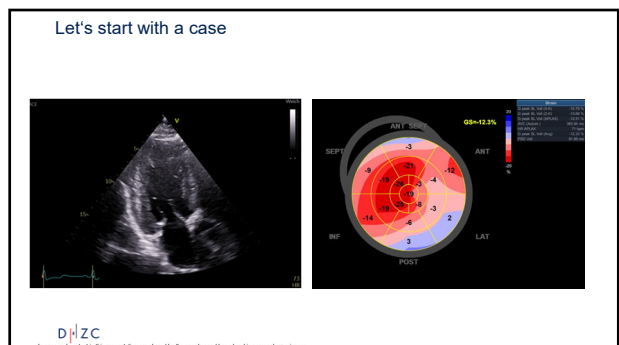
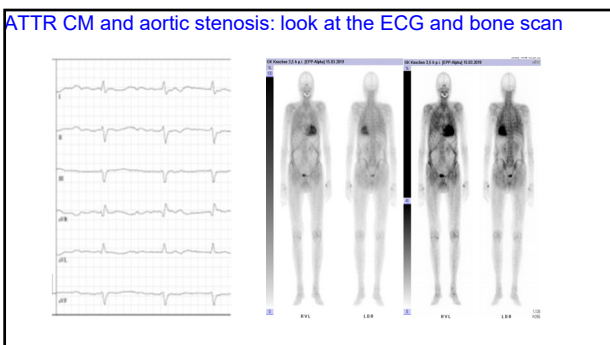
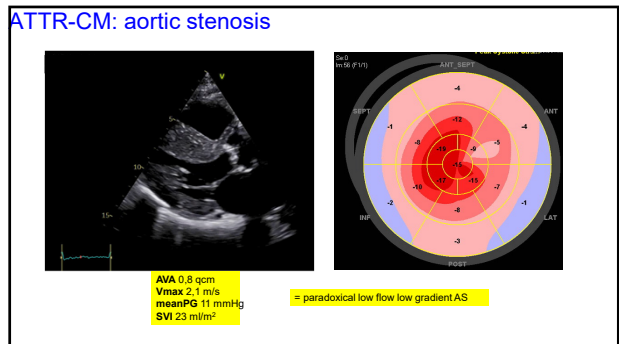
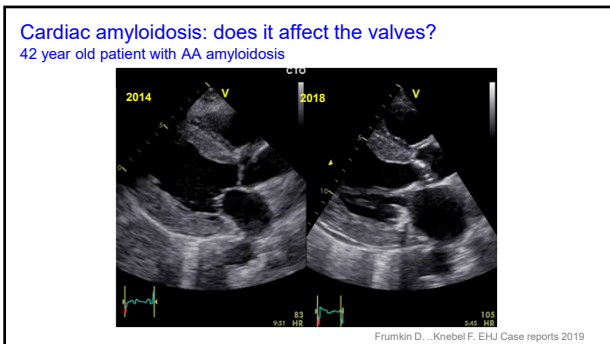
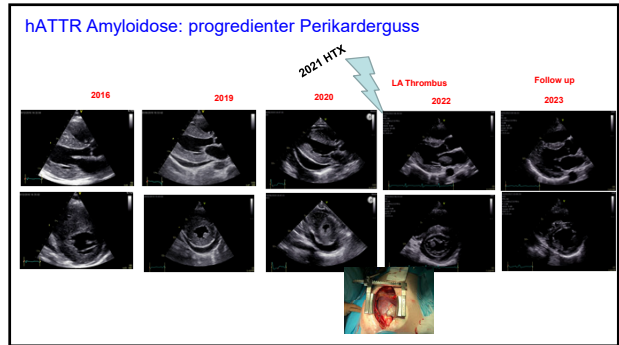
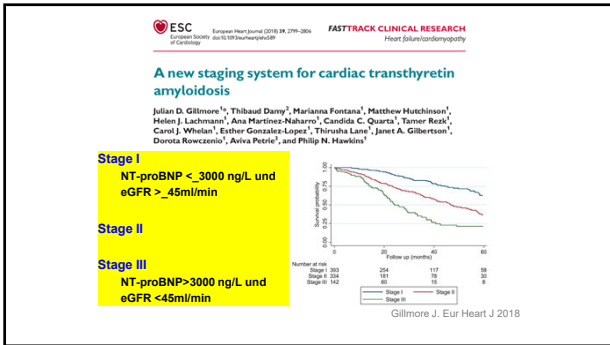
Brzez D. J. Intern Med. 2022; 18(1): 59. DOI: https://doi.org/10.5334/jim.1202

Pathophysiologie der ATTR CM



Ruberg JACC 2019





Another case...

Images and content in the presentation are shared by the speaker and based on his personal experiences

Ist „apical sparing“ wirklich so gut?

Abecasis J. European Heart Journal - Cardiovascular Imaging (2023) 00, 1–10

SPECT-CT + Knochenszintigraphie

Perugini 0

Perugini 3  
Prof. Dr. Dr. Schäfer (Mönchengladbach)

Perugini 0

Perugini 3  
Prof. Dr. Dr. Schäfer (Mönchengladbach)

Genotype vs. phenotype: two patients with p.(Val142Ile) mutation

Patient 1 NT-proBNP 118  
LV biopsy: no amyloid Amyloid, MR: fibrosis  
Perugini 0  
HOCM

Patient 2 NT-proBNP 1704  
Perugini 3  
hATTR Amyloidosis

Endomyocardial Biopsy (EMB)

Courtesy Prof. K. Klingel

Courtesy F aus dem Siepen

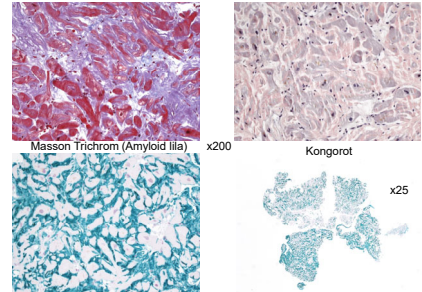
### Aktuelles Fallbeispiel. Es passt nicht immer alles...

67 jähriger Patient mit Leistungsinderung seit einigen Monaten, Art. Hypertonus, NT-proBNP 662, EF normal. In MRT V.a. HCM/Amyloidose. Kein Karpaltunnelsyndrom. DPD, Perugini II. Ausgeprägte Schmerzen im Bein, unter Pregabalin therapierbar. Bislang keine Neuro-Diagnostik



Was jetzt?>> Myokardbiopsie...

### Histologie: ATTR. Genetik: Val 50 Met Mutation



Immunhistologischer Nachweis von Transthyretin

Prof. K. Klingel, Tübingen

### Therapieansätze bei ATTR Amyloidose

**Suppression of TTR**

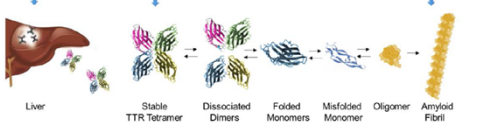
- Liver Transplantation
- TTR Gene silencers (Patisiran/Inotersen)

**TTR Stabilization**

- Tafamidis
- Diffusional
- Green Tea
- AG10

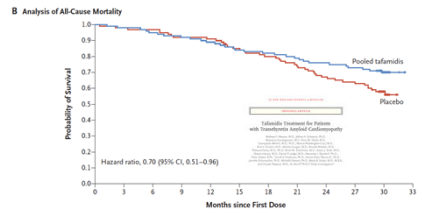
**TTR disruption/resorption**

- Doxycycline/TUDCA
- Monoclonal antibodies



Kittleson MM. Circulation. 2020;141

### Tafamidis bei ATTR Kardiomyopathie



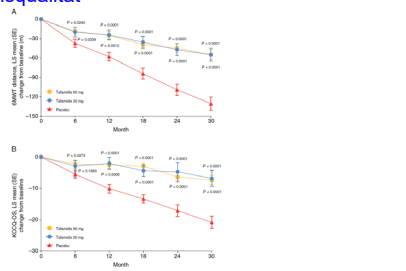
**B Analysis of All-Cause Mortality**

Hazard ratio, 0.70 (95% CI, 0.51-0.96)

Months since First Dose	0	3	6	9	12	15	18	21	24	27	30	33
<b>No. at Risk (cumulative no. of events)</b>												
Pooled tafamidis	284 (0)	259 (3)	232 (12)	244 (20)	215 (29)	222 (42)	216 (48)	209 (53)	200 (64)	193 (71)	99 (78)	0 (78)
Placebo	177 (0)	173 (6)	171 (6)	163 (14)	161 (16)	150 (17)	141 (16)	131 (46)	118 (59)	113 (64)	51 (75)	0 (76)

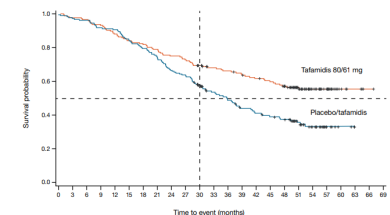
Maurer MS. NEJM 2018

### ATTR-ACT: Lebensqualität



Damy. European Journal of Heart Failure (2020)

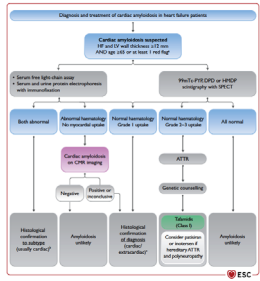
### All-cause mortality at 51-month follow-up



Significant 41.1% reduction in risk of all-cause mortality with tafamidis 80/62 mg compared with placebo/tafamidis (P=0.0004)

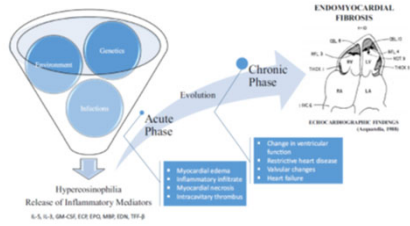
HR 0.688 (95% CI, 0.627-0.752)  
Damy T, et al. Presentation at European Society of Cardiology Congress 2020 - The Digital Experience, August 29-September 2, 2020.  
CI, confidence interval; HR, hazard ratio.

ESC Guideline 2021: Algorithmus Amyloidose

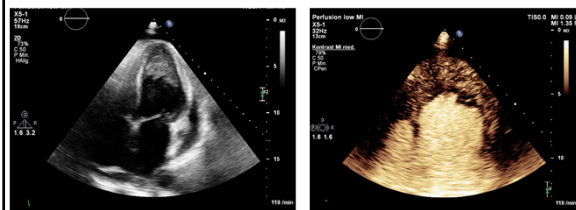


Noch ein paar seltene Ursachen...

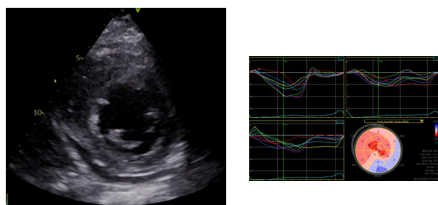
Endomyokardfibrose / Eosinophiles Infiltrat



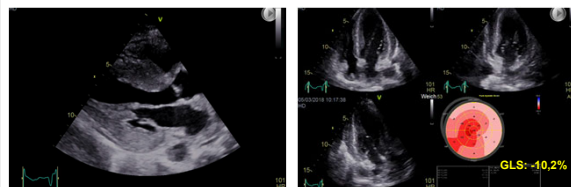
Endomyocardial fibrosis



Akute Myokarditis (TnT-hs > 11.000)



Mitochondrial encephalomyopathy, lactic acidosis and stroke (MELAS)





### Eosinophilic myocarditis (Churg Strauss)

10 days i.v. steroid therapy

### Konstriktion und Restriktion

### Konstriktion und Restriktion

Problem: Das Perikard      Problem: Das Myokard

	Restriktion	Konstriktion
E/A	restriktiv	restriktiv
DT	erniedrigt	erniedrigt
Atria	stark dilatiert	gering dilatiert
sPAP	gering erhöht	stärker erhöht
Vena cava inferior	dilatiert	dilatiert
<b>Differenzierung</b>		
Annulus reversus	Nein	Ja
E' septal	erniedrigt	normal (> 8 cm/s)
2D Strain	reduziert, typische Muster	im unteren Normbereich
Atemabhängigkeit des Einstroms in LV	eher normal	verstärkte Variation
Syst. LV-Funktion	meist reduziert	normal
S'(Mitral-Annulus)	reduziert	oft normal
Perikard	normal	echoreich, verdickt
Septumbewegung	normal	„bounce“

### Restriktive Kardiomyopathie

Small, thick-walled ventricles with normal systolic function

Abnormal diastolic function

↑TR-jet velocity

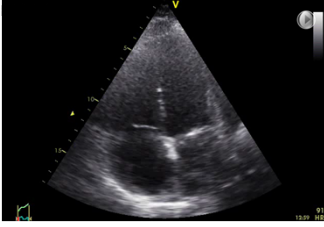
© C. Otto, Saunders

### Restriktive Kardiomyopathie

- Infiltrativ (Amyloidose, Sarkoidose, Karzinoid, Hämochromatose, Speicherkrankheiten, z.B. M. Fabry)
- Post-Radiatio
- Endokarditis fibroplastica (Löffler)

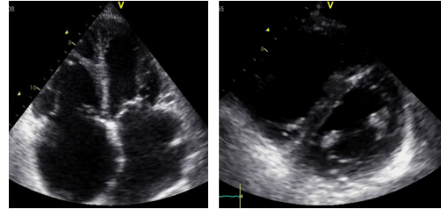
Amyloidose      M. Fabry

Konstriktion: „Septal bounce“

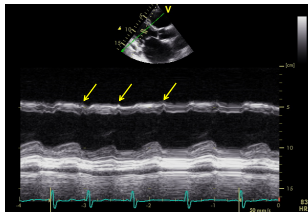


abnorme Septumbeweglichkeit durch die abrupte Ventrikel­füllung in der frühen Diastole (kombiniert mit verstärkter Interaktion beider Ventrikel während der Atmung)

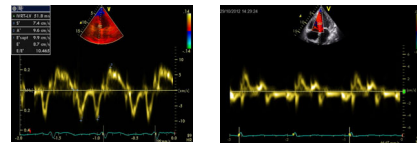
Konstriktion: „Septal bounce“



Konstriktion: „Septal bounce“



Gewebedoppler: Konstriktion / Restriktion



**Konstriktion**  
S' 7.4 cm/s  
E' septal 9.9 cm/s

**Restriktion**  
S' 3.4 cm/s  
E' septal 2.1 cm/s

„Annulus reversus“

