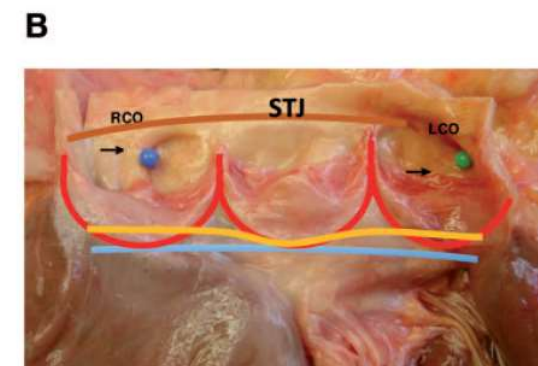
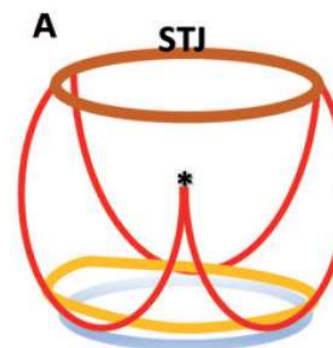
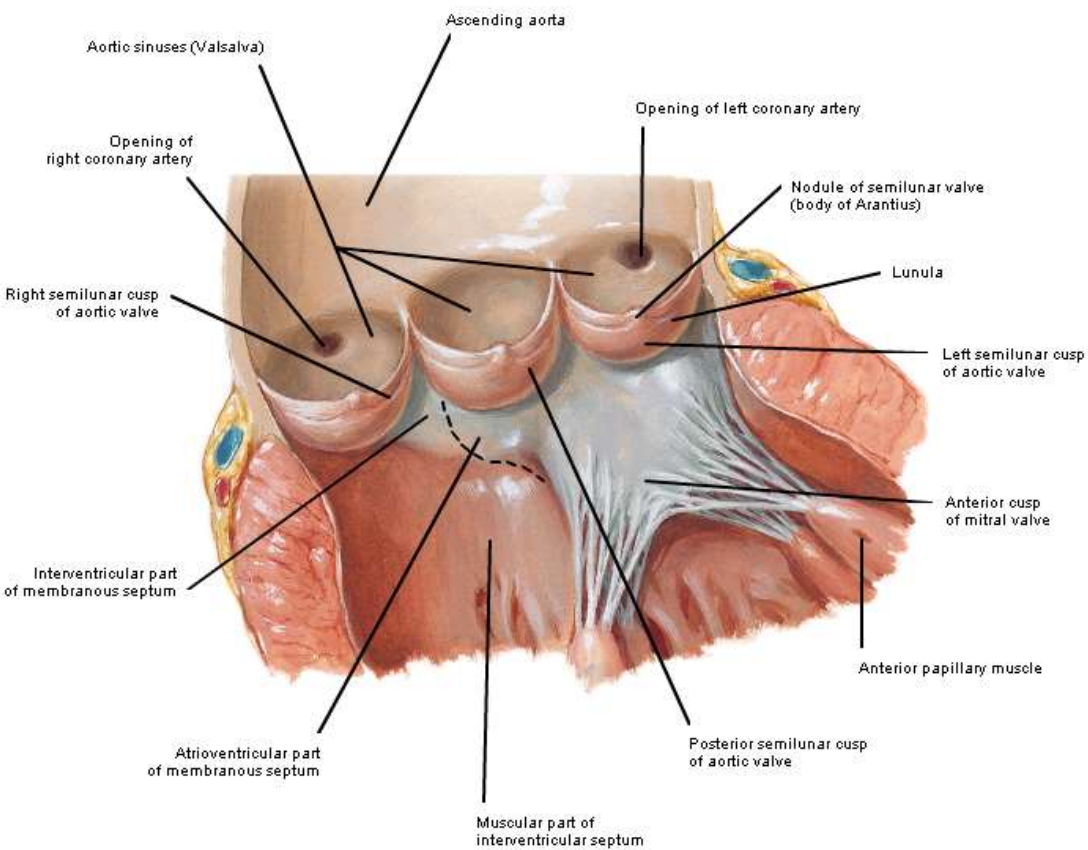


Aortenklappe

Dr. med. Andreas Niedeggen

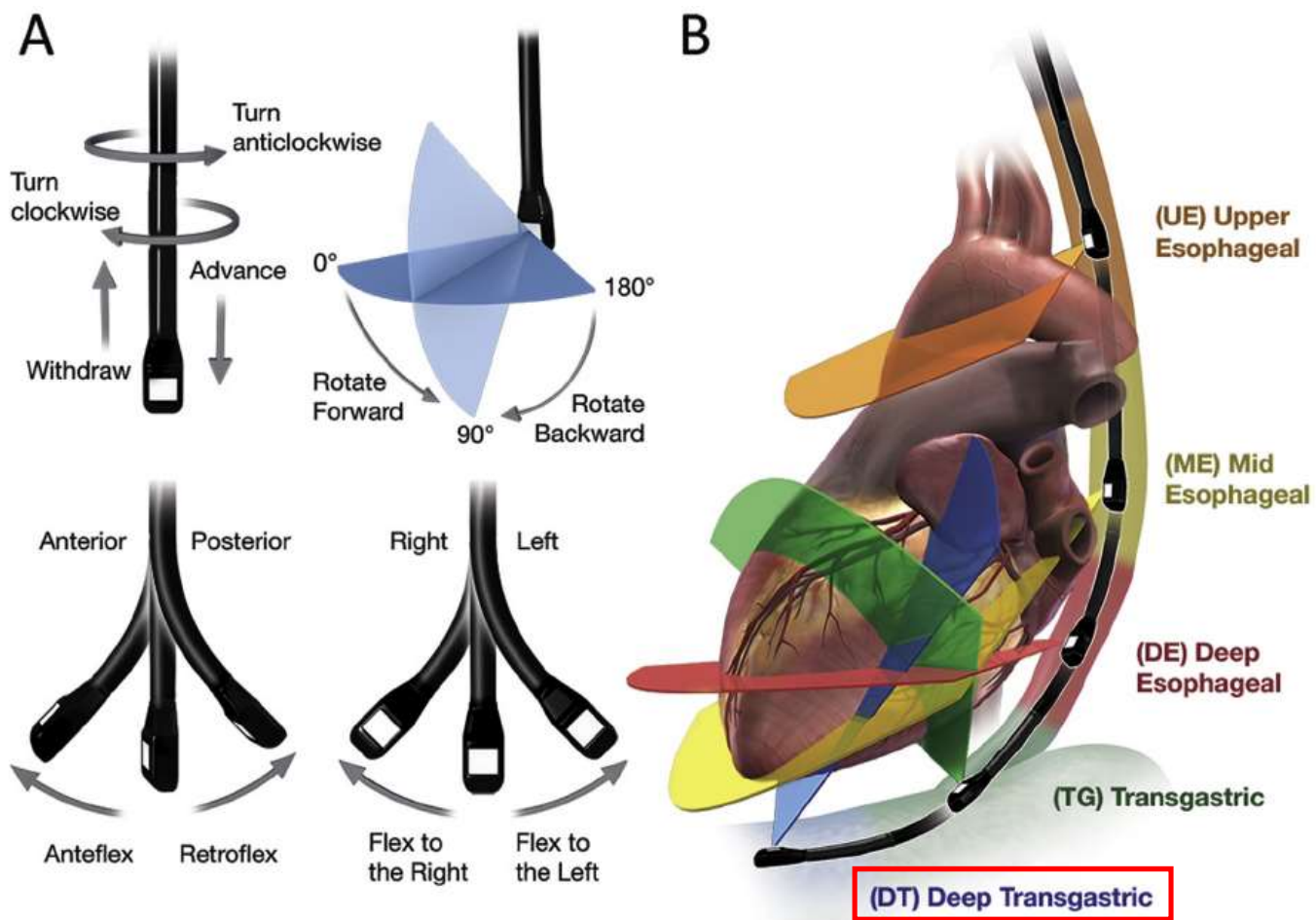
- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz










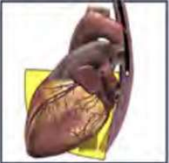

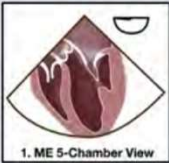
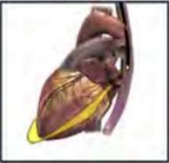

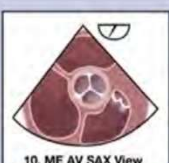
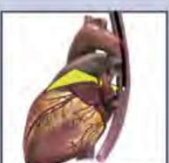

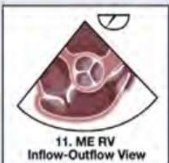
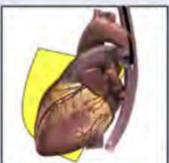

- Sino-tubular junction (STJ)
- Ventriculo-aortic junction
- Virtual basal-ring (aortic annulus)

European Journal of Cardio-Thoracic Surgery 60 (2021) 448–476

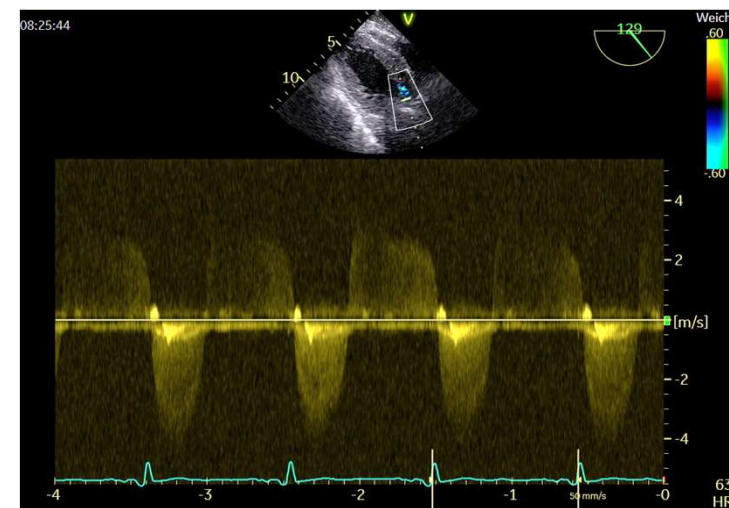
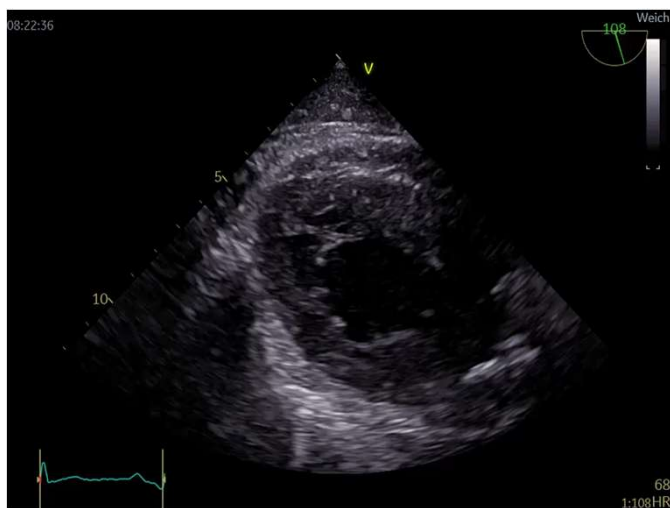
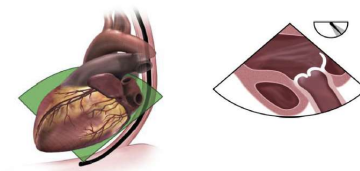
- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz



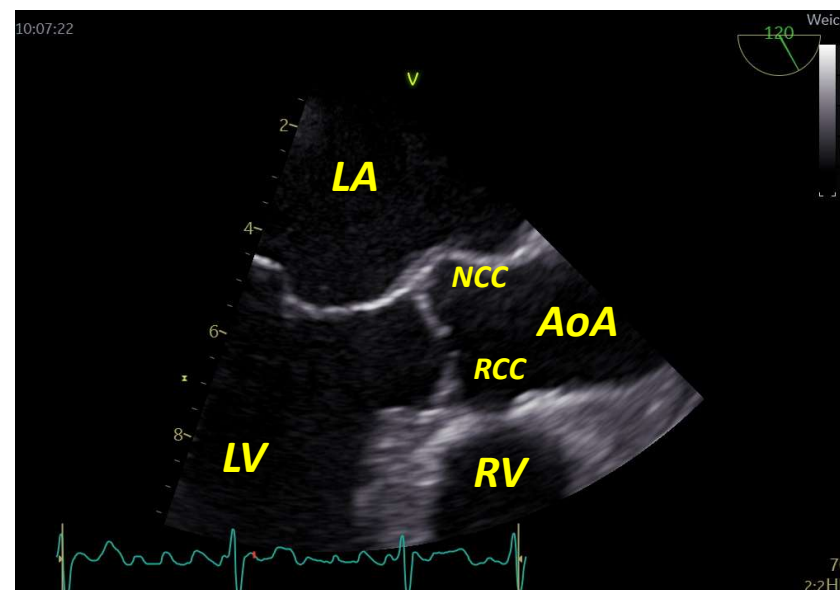
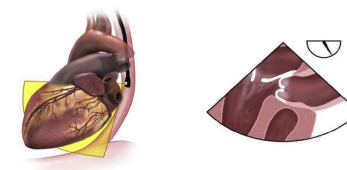
Schnitte zur Beurteilung der Aortenklappe

 <p>21. Deep TG 5-chamber View</p>			<p>Transducer Angle: ~ 0 - 20° Level: Transgastric</p>	<p>Left ventricle Left ventricular outflow tract Right ventricle Aortic valve Aortic root Mitral Valve</p>
 <p>24. TG LAX View</p>			<p>Transducer Angle: ~ 120 - 140° Level: Transgastric</p>	<p>Left ventricle Left ventricular outflow tract Right ventricle Aortic valve Aortic root Mitral valve</p>
 <p>6. ME AV LAX View</p>			<p>Transducer Angle: ~ 120 - 140° Level: Mid-esophageal</p>	<p>Left atrium LVOT RVOT Mitral valve (A₂-P₂) Aortic valve Proximal ascending aorta</p>
 <p>1. ME AV 5-Chamber View</p>			<p>Transducer Angle: ~ 0 - 10° Level: Mid-esophageal</p>	<p>Aortic valve LVOT Left atrium/Right atrium Left ventricle/Right ventricle/IVS Mitral valve (A₂A₁-P₁) Tricuspid valve</p>
 <p>10. ME AV SAX View</p>			<p>Transducer Angle: ~ 25 - 45° Level: Mid-esophageal</p>	<p>Aortic valve Right atrium Left atrium Superior IAS RVOT Pulmonary Valve</p>
 <p>11. ME RV Inflow-Outflow View</p>			<p>Transducer Angle: ~ 50 - 70° Level: Mid-esophageal</p>	<p>Aortic valve Right atrium Left atrium Superior IAS Tricuspid Valve RVOT Pulmonary Valve</p>

Transgastrisches Fenster 120-140°

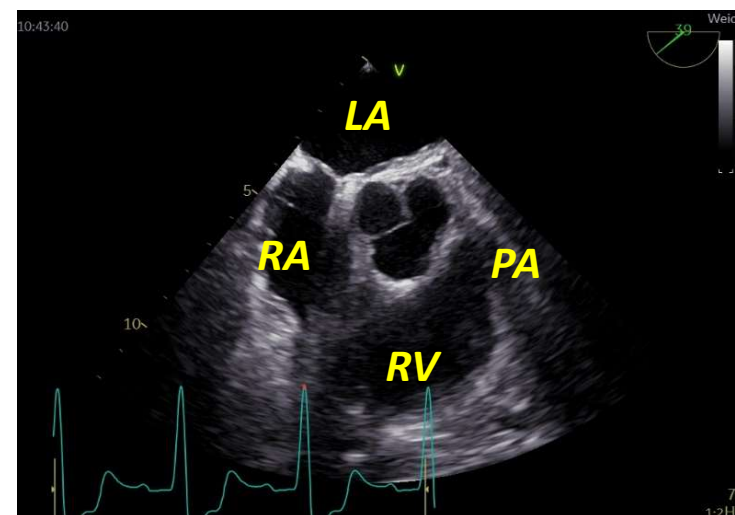
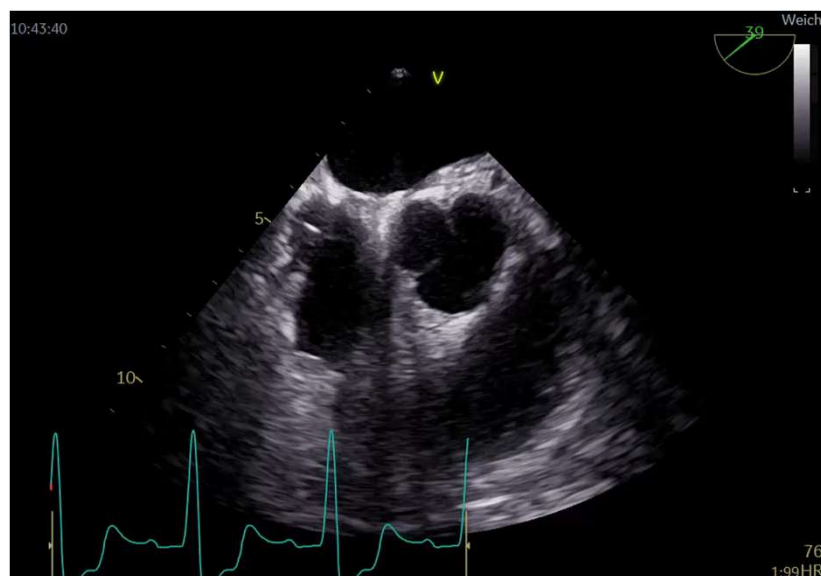
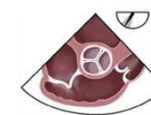


Mittleres transösophageales Fenster 120-140°



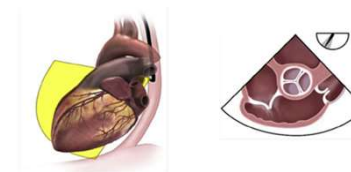
LV, LVOT, Mitral- und Aortenklappe, Aortenwurzel

Mittleres transösophageales Fenster (SAX) 25-45°

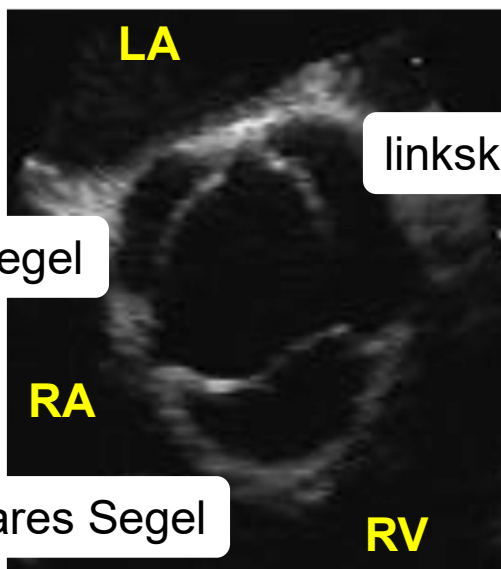


Aortenklappe, Interatr. Septum, RA, Trikuspidalklappe,
LAA, RVOT, Pulmonalklappe

Aortenklappe SAX 25-45°



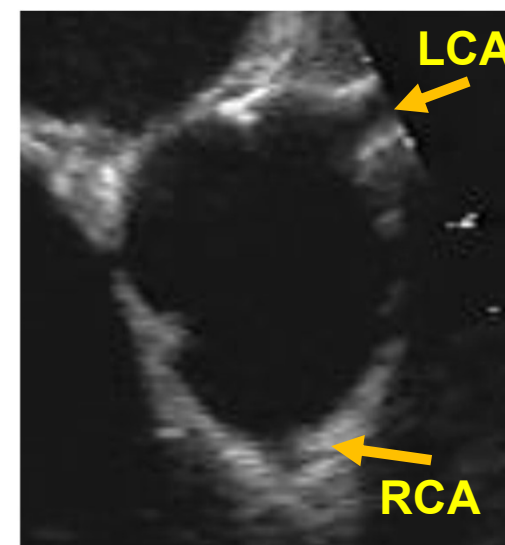
Aortenklappe



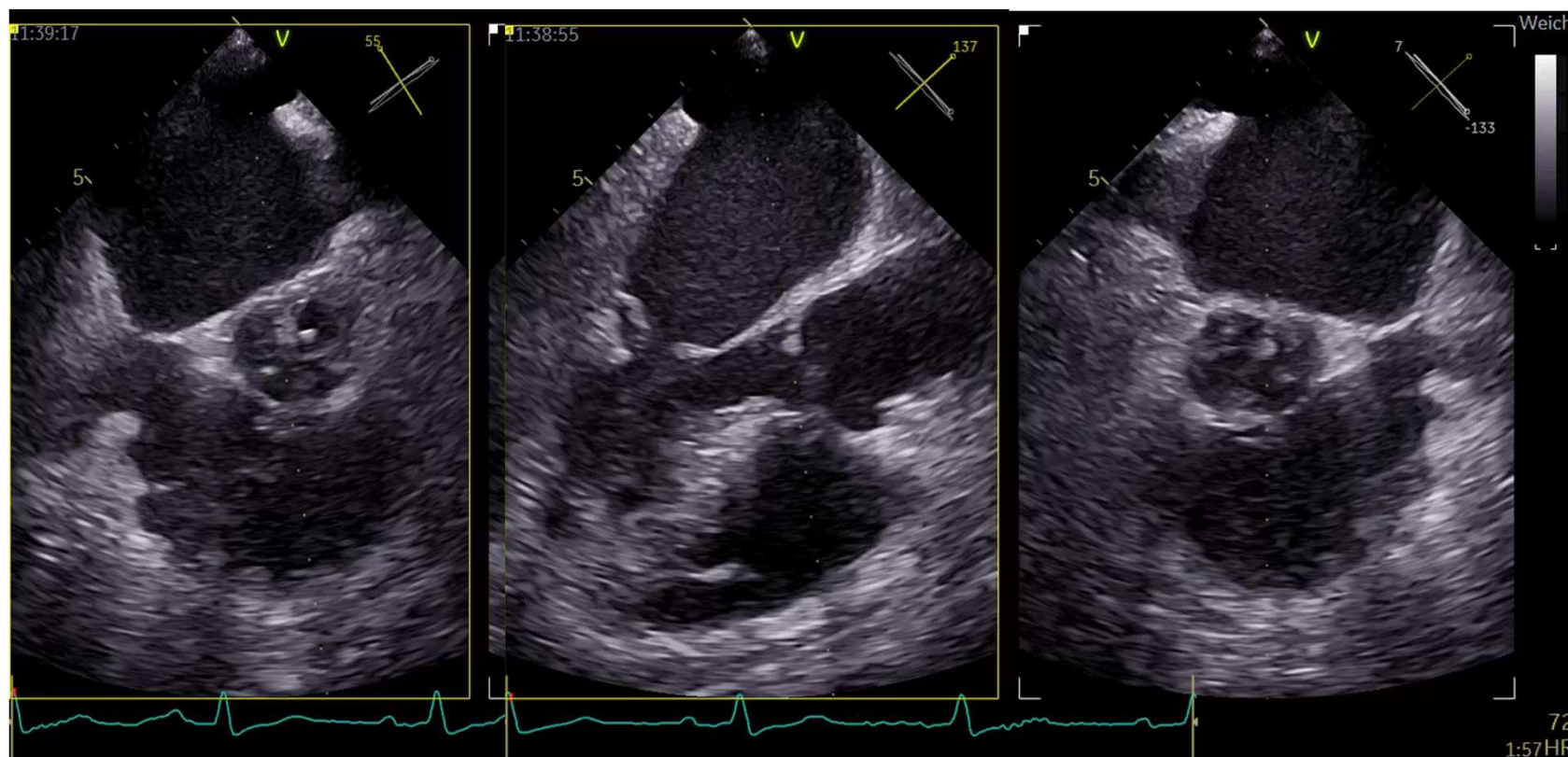
linkskoronares Segel

rechtskoronares Segel

Koronarostien



Aortenklappe- biplane Darstellung

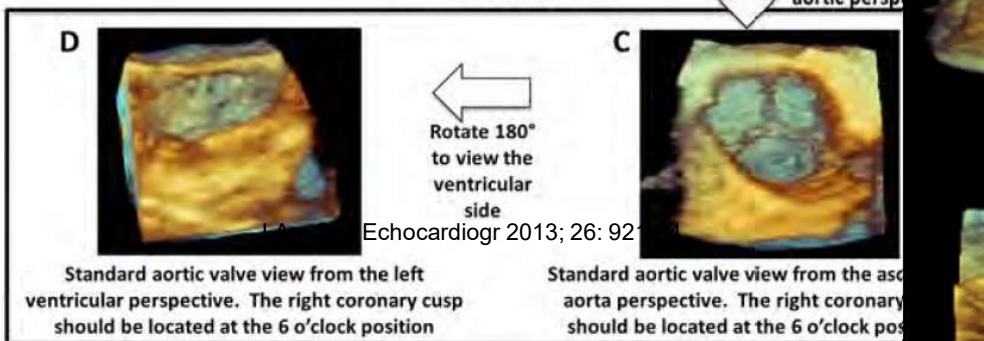


Aortenklappe 3D

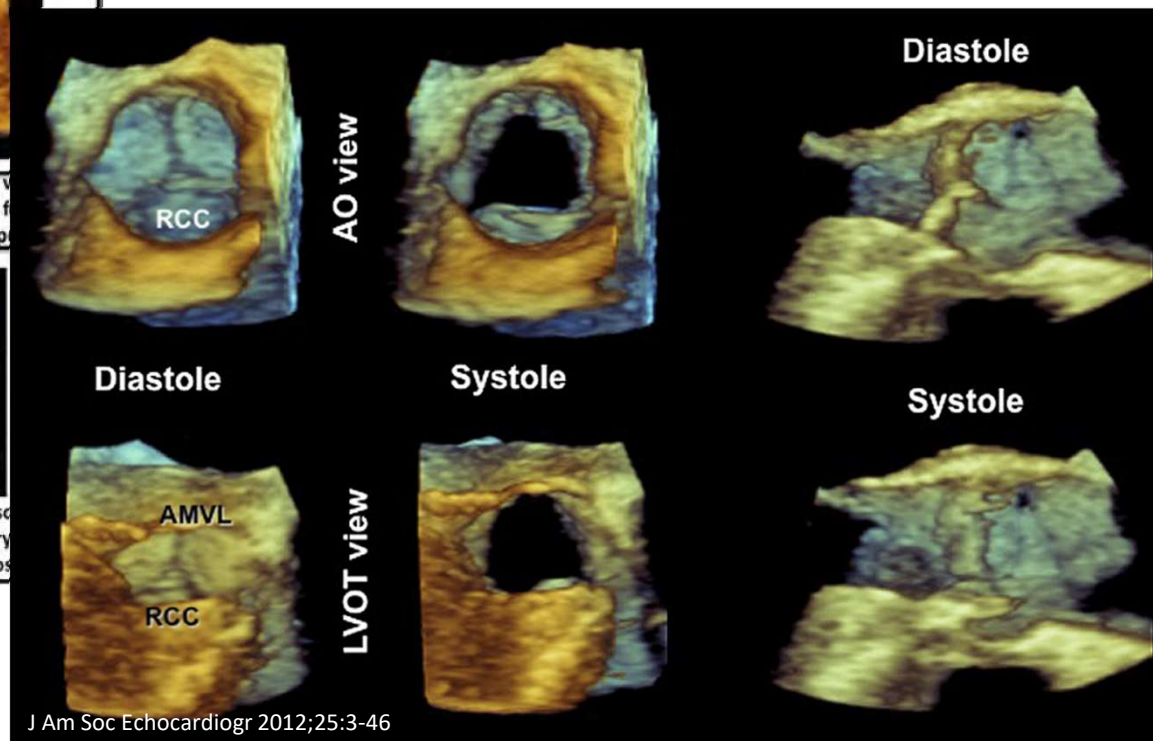
ACQUISITION

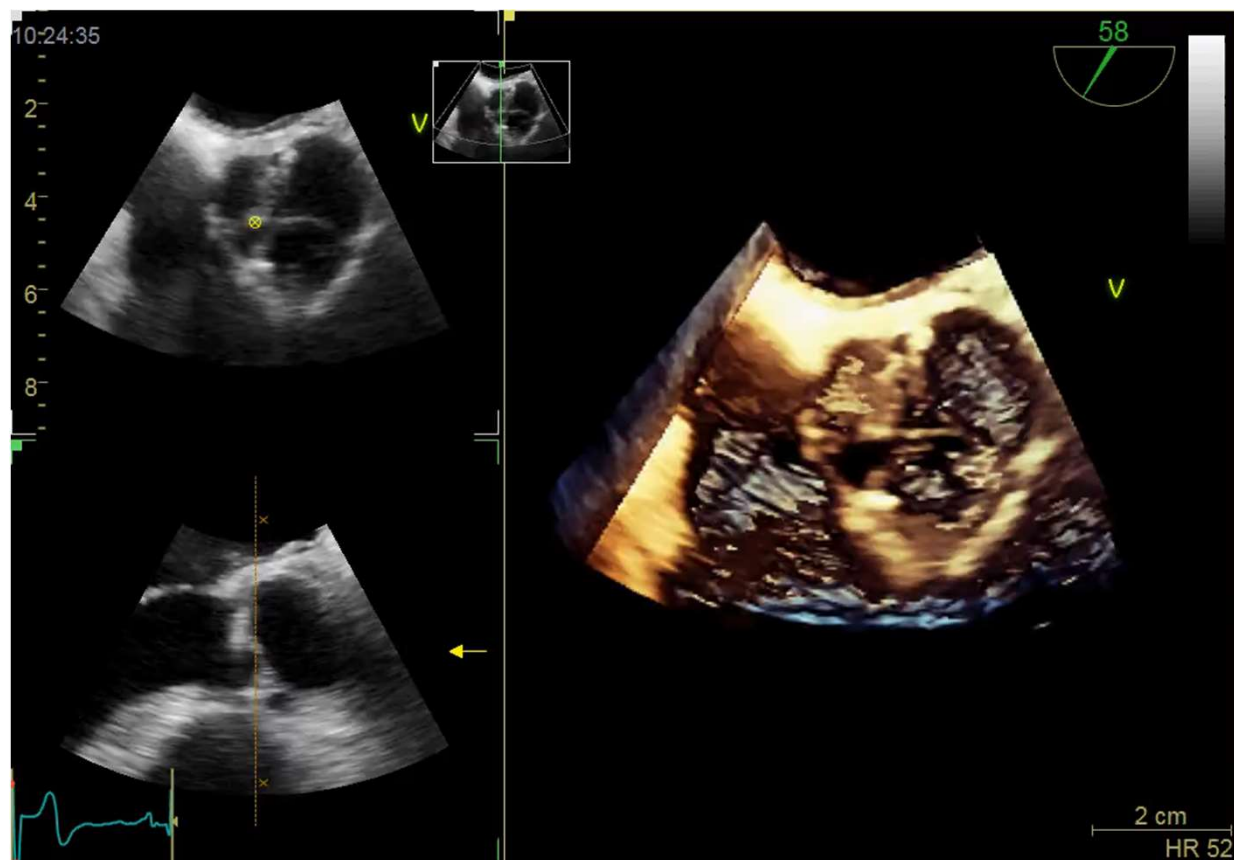


PRESENTATION



Echocardiogr 2013; 26: 92



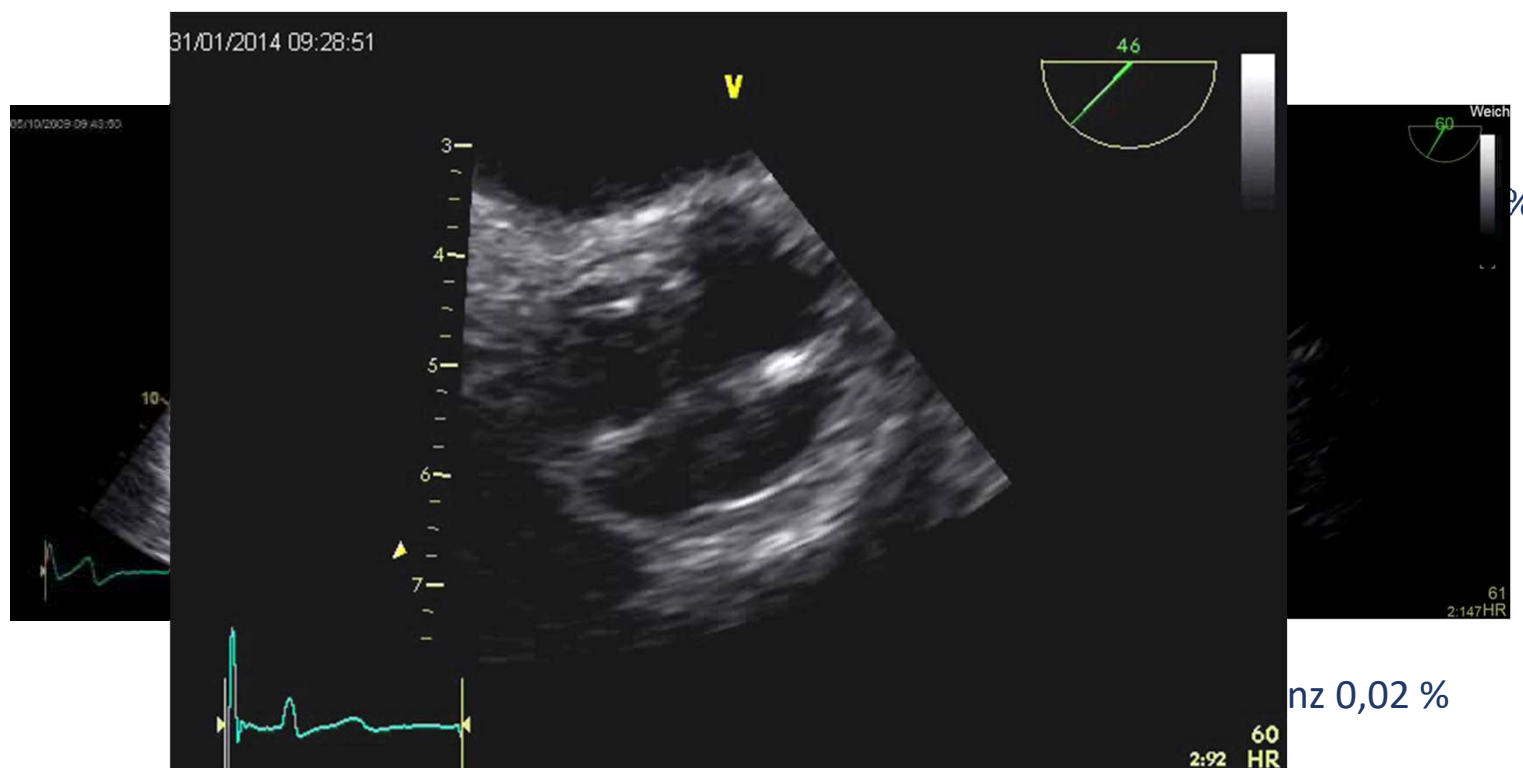




- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ **Morphologie**
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz

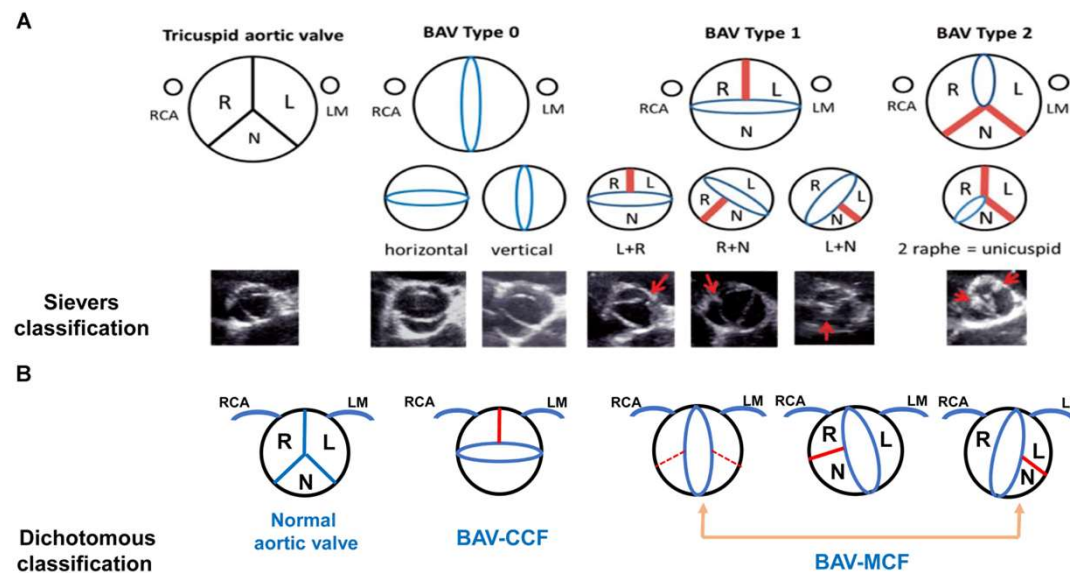
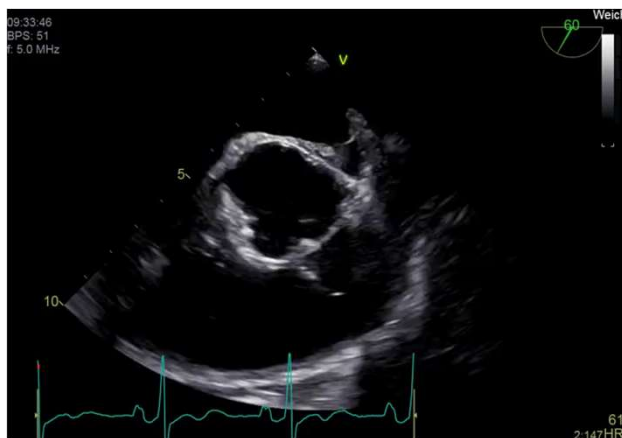
Aortenklappe – Morphologie

Anzahl der Taschen und Taschenkonfiguration



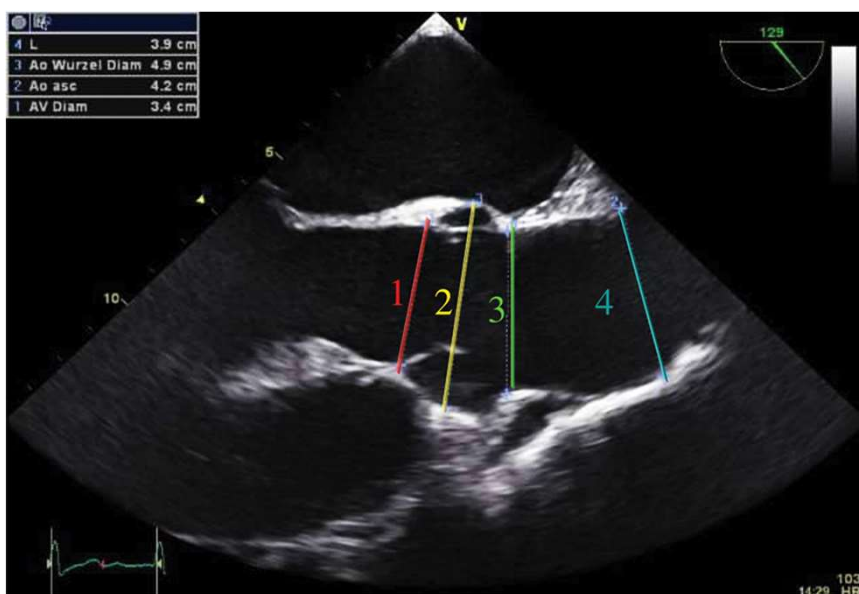
Venkata Thota and Farouk Mookadam (2011). Unicuspid Aortic Valve, Aortic Valve, Prof. Chen Ying-Fu (Ed.), ISBN: 978-953-307-561-7, InTech, Available from: <http://www.intechopen.com/books/aortic-valve/unicuspid-aortic-valve>

Bikuspide Aortenklappe



- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz

Bestimmung des Aorten-Diameter

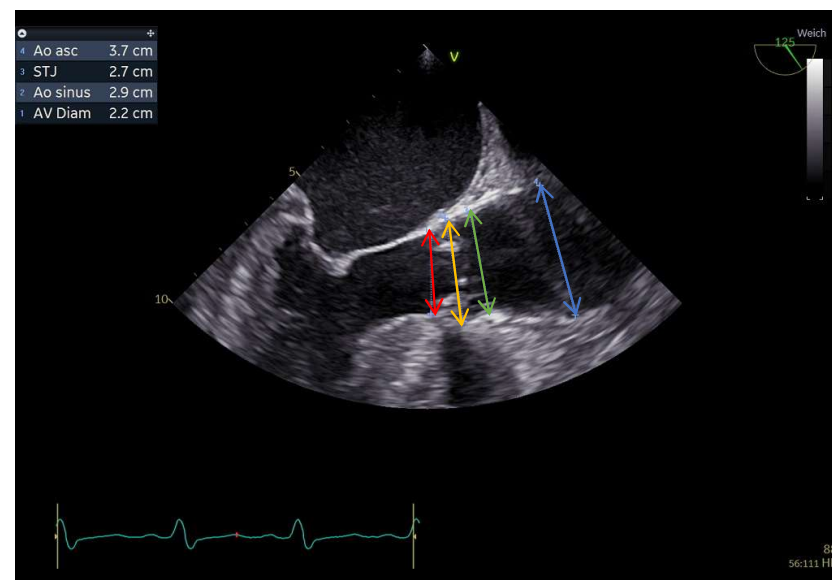
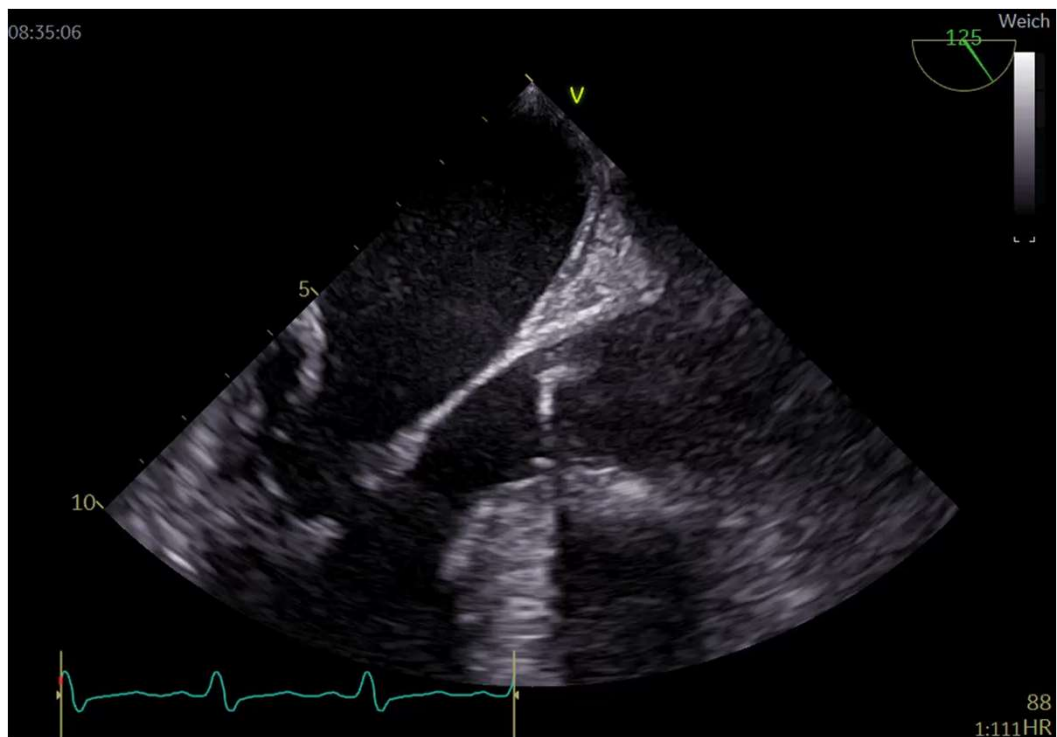


- 1. Aortenannulus
- 2. Aortensinus
- 3. sinutubulärer Übergang
- 4. proximale Aorta ascendens

Normwerte [JASE 2022 ; 35(3): 267–274]

	Männer		Frauen	
		BSA		BSA
Aortenannulus	21.2 ± 2.2	11.3 ± 1.3	19.5 ± 2.1	11.9 ± 1.4
Aortensinus	32.2 ± 3.7	17.2 ± 2.5	29.3 ± 3.6	18.0 ± 2.6
STJ	27.7 ± 3.7	14.8 ± 2.3	25.5 ± 3.3	15.6 ± 2.4
prox. Aorta asc.	29.3 ± 3.1	17.9 ± 2.7	27.1 ± 3.1	17.0 ± 2.1

European Heart Journal – Cardiovascular Imaging 2013; 14, 611–644



- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz

Klappenveränderungen / Aortenvitien

Degenerativ

- Sklerose
- Kalzifikation

Rheumatisch

- Verklebung nach Streptokokken-Infekt

Infektiöse Endokarditis

- Direkte Schädigung durch Bakterien

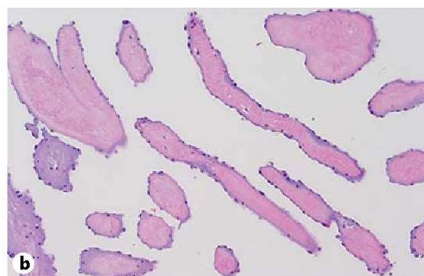
Krankheiten des Herzmuskels/Aorta mit sekundärem Klappenfehler

- Beeinträchtigung der Klappenaufhängung, z.B. Herzinfarkt, Aortenaneurysma

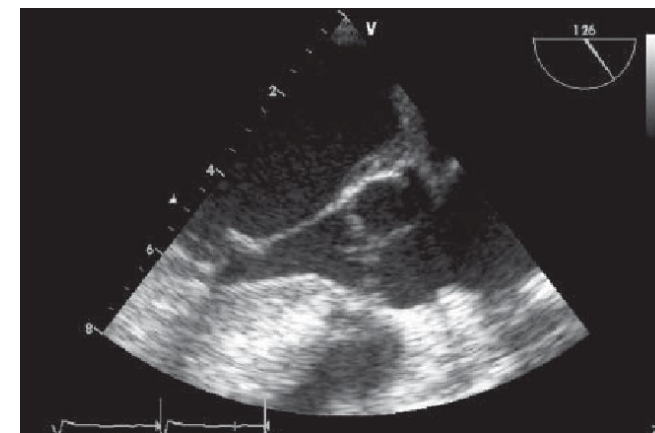
Degenerative Veränderungen

Lambl Exkreszenzen

- stromabwärts den Taschen angeheftete, flottierende bis zu 5 Millimeter lange, sehr dünne fadenförmige Struktur
- Inzidenz bis 5,5%
- Embolisieren nur gelegentlich bei „Giant Lambl Exkreszenz“ (Einzelfallberichte)



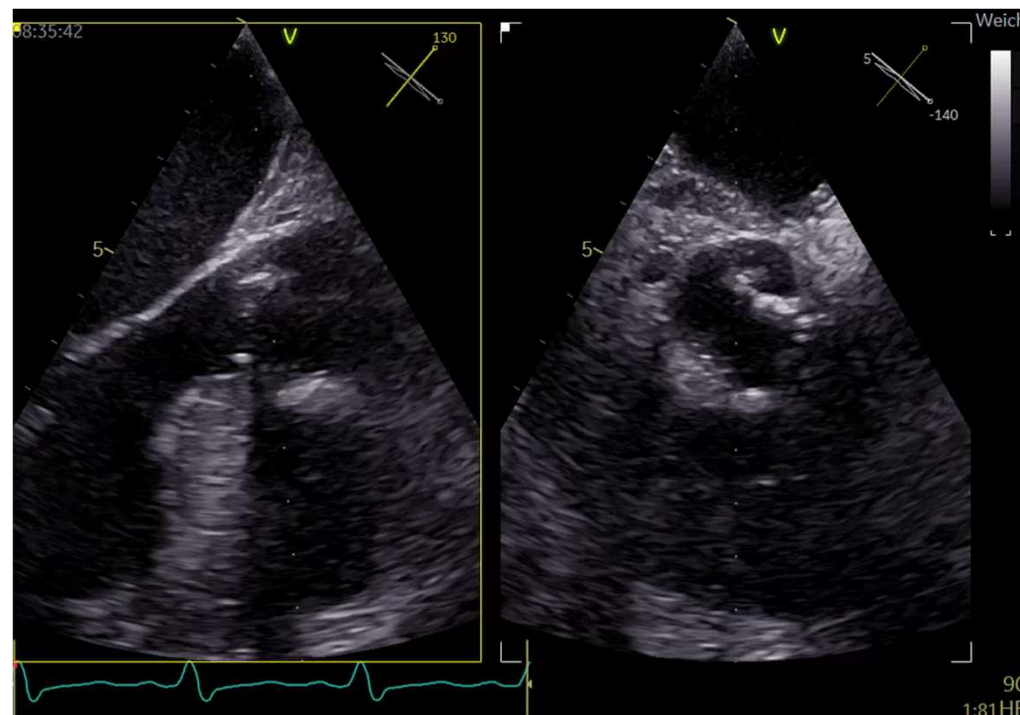
Cerebrovasc Dis 2015;40:18–27



Degenerative Veränderungen

Aortenklappensklerose

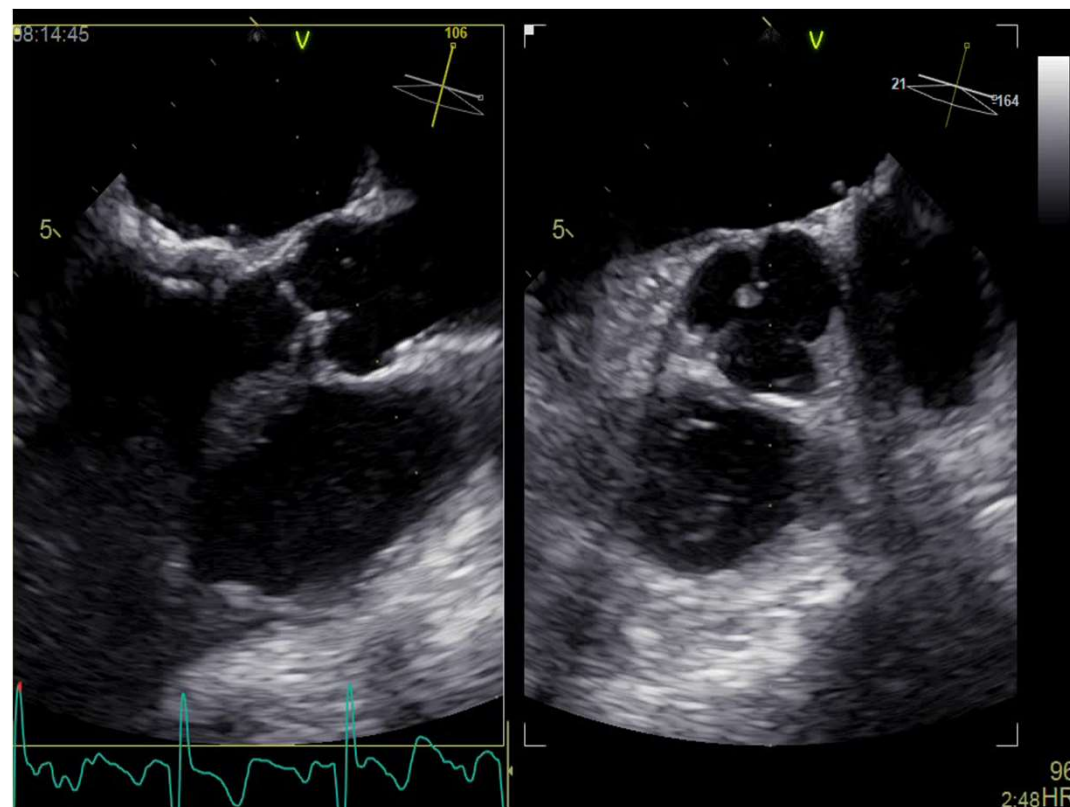
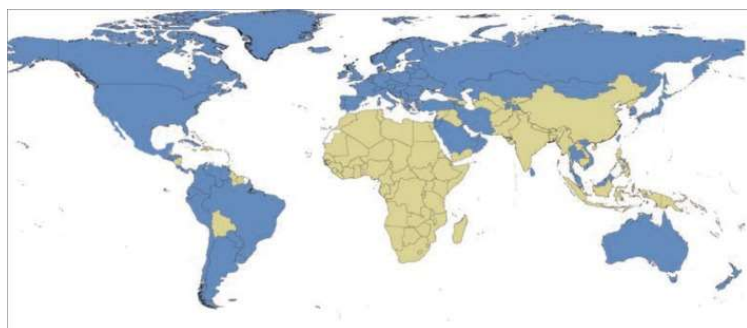
- Prävalenz:
 - 35-44 J. 7%
 - 75-84 J. 65%
- Pathogenese:
 - ähnlich wie Atherosklerose
(Lipideinlagerung, Inflammation und
Kalzifizierung)
- Charakteristisch sind noduläre Verkalkung
und Verdickungen der Taschen



Rheumatische Veränderungen

Rheumatische postinflammatorische Läsionen

- verdickte, fibrotische, geschrumpfte Taschen, in der Regel mit Verschmelzung der Kommissuren
- Prävalenz 10-15:1.000 in endemischen Ländern



Endokarditis



Prävalenz von Aortenvitien

OxVALVE Population Cohort Study

Table 2 New diagnosis of valvular heart disease n = 25000 ≥ 65 yrs

	None/trivial	Mild	Significant (moderate/severe)
Any VHD	1231 (49.2%)	1110 (44.4%)	159 (6.4%)
Left-sided VHD			
Mitral regurgitation	1948 (77.9%)	494 (19.8%)	58 (2.3%)
Mitral stenosis	2491 (99.6%)	7 (0.3%)	2 (0.1%)
Aortic regurgitation	2118 (84.7%)	341 (13.6%)	41 (1.6%)
Calcific aortic valve disease—AoScI and stenosis	1617 (64.7%)	866 (34.6%) ^a	17 (0.7%)
Right-sided VHD			
Tricuspid regurgitation	2433 (97.3%)	67 (2.7%)	
Pulmonary regurgitation	2493 (99.7%)	7 (0.3%)	

Heart of New Ulm (HONU Valve)

- Prospective, population cohort of 928 community volunteers without VHD, who received echocardiogram screening (02/2019-12/2021)
- Median age 74 yrs (IQR: 64-79), 99% Caucasian
- Significant VHD present in 16% - predominantly regurgitationlesion (AR 4,5%, MR 6,9%, TR 7,2%, AS 7,6%)

M Gössl et al. , JACC 2023 in press

European Heart Journal (2016) 37, 3515–3522

Aorteninsuffizienz häufiger als gedacht ...

- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz

Aortenstenose - Ursachen

Common

- Calcific disease of a tricuspid valve
- Calcific disease of a bicuspid valve
- Rheumatic heart disease

Rare

- Homozygous familial hypercholesterolemia
- Congenital heart disease (other than bicuspid aortic valve)
- Radiation exposure to the chest
- Renal failure
- Paget disease of bone

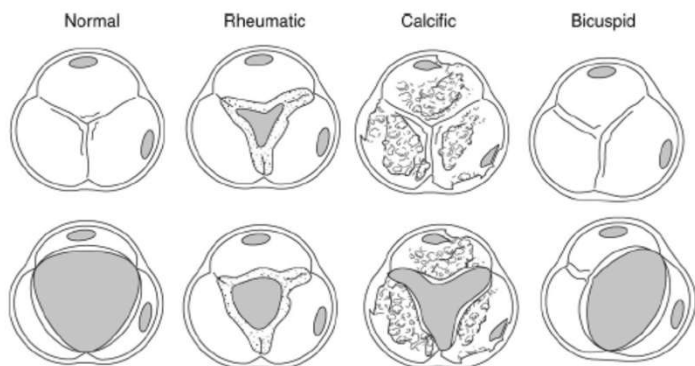
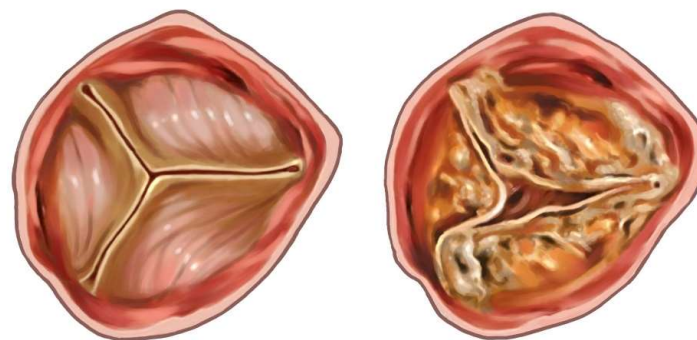
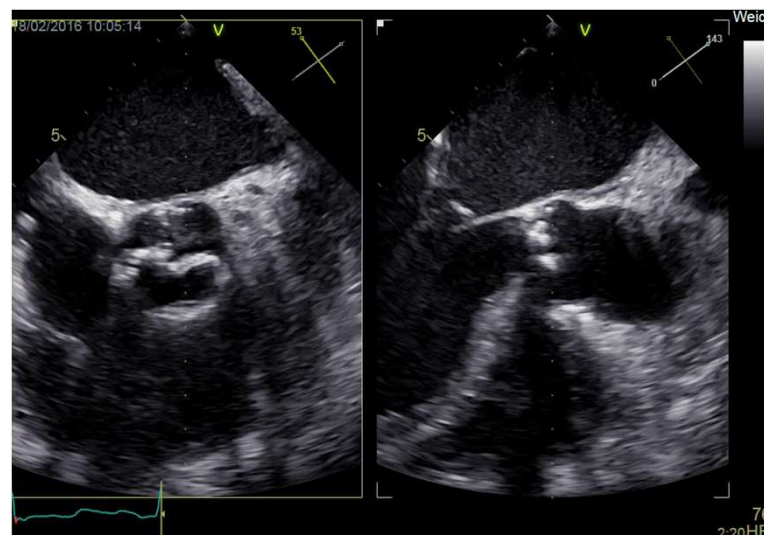


Figure 1 Aortic stenosis aetiology: morphology of calcific AS, bicuspid valve, and rheumatic AS (Adapted from C. Otto, Principles of Echocardiography, 2007).

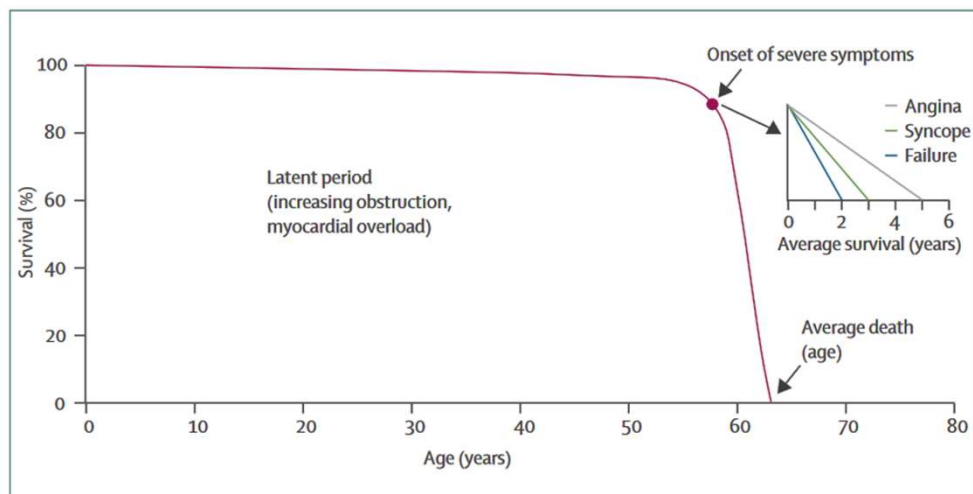




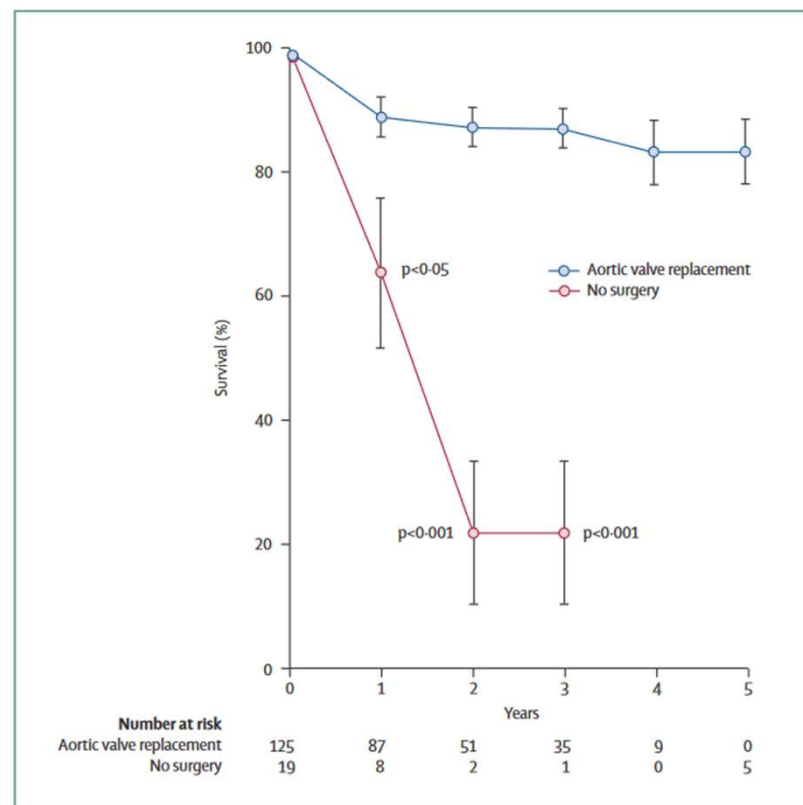
Legends of Cardiology:
Dr Eugene M. Braunwald

Rate of Progression (annual)

AVA	decrease by 0,12 cm ²
Jet velocity	increase by 0,32 m/sec
Mean gradient	increase by 7 mmHg



Braunwald E. Aortic stenosis. Circulation. 1968; 38 (suppl): 61–67



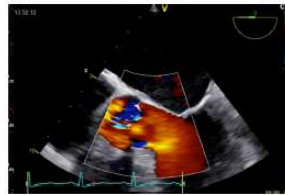
Schwarz F, Baumann P, Manthey J, et al. The effect of aortic valve replacement on survival. Circulation 1982; 66: 1105–10.

Beurteilung der Aortenstenose im TEE

5 Kammerblick, mid-ösophageales Fenster, 2D: Kalzifizierung und Mobilität der Taschen



5 Kammerblick, mid-ösophageales Fenster, 2D und Farbe: Nachweis von Turbulenzen und Regurgitationen



SAX, mid-ösophageale Fenster 40-60 Grad: Klappenmorphologie, Taschen Mobilität und Kalzifikation



SAX, mid-ösophageale Fenster 40-60 Grad: Farbdoppler hilfreich bei Morphologiebeurteilung (trikuspide Klappe)



3D Datensatz: Überblick und Optimierung der Bilder für die Planimetrie



LAX 120-140 Grad, mid-ösophageales Fenster, 2D: Kalzifizierung und Mobilität der Taschen, LV Größe Funktion, LV Masse



LAX 120-140 Grad, mid-ösophageales Fenster, 2D-Zoom: Inner-edge to inner-edge: enddiast. Sinus (rot), ST (grün), Ascend. (blau)



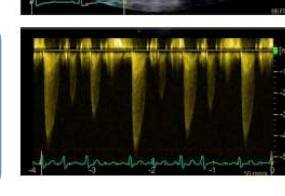
SAX, transgastrisch 0 Grad, Farb-Doppler: Nachweis von Turbulenzen oder Aortenregurgitation



LAX, mid-ösophageale Fenster 120-140 Grad, Farb-Doppler: Nachweis von Turbulenzen oder Aortenregurgitation



Transgastrisch, cw-Doppler: Doppler des Gradienten (Cave: Winkelfehler)



Quantifizierung Aortenstenose - TEE

Transesophageal Echocardiography

TEE is rarely indicated in the assessment of AS because of the accuracy and widespread availability

Indikationen für die TEE bei Aortenstenose

- Bestimmung des Aortenring Durchmessers zur Vorbereitung bzw. Klappengrößenwahl bei TAVI
- Planimetrie einer stenosierten Aortenklappe bei klinischem Zweifel am transthorakalen Untersuchungsbefund
- transösophageale Doppler-Untersuchung, insbesondere von transgastrisch bei transthorakal unzureichender Schallqualität (z. B. beatmete Patient); schwierig!

- V.a. infektiöse Endokarditis

- Beurteilung einer begleitenden Mitralinsuffizienz

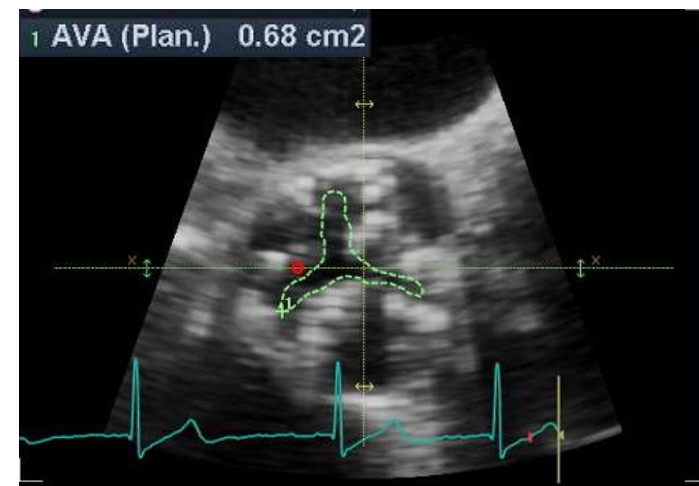
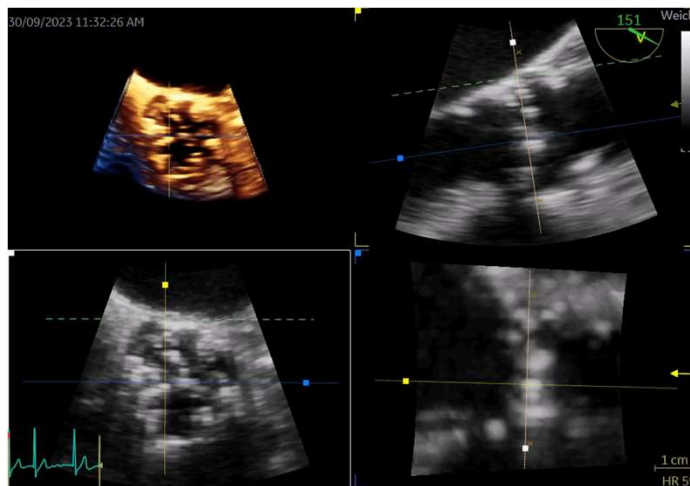
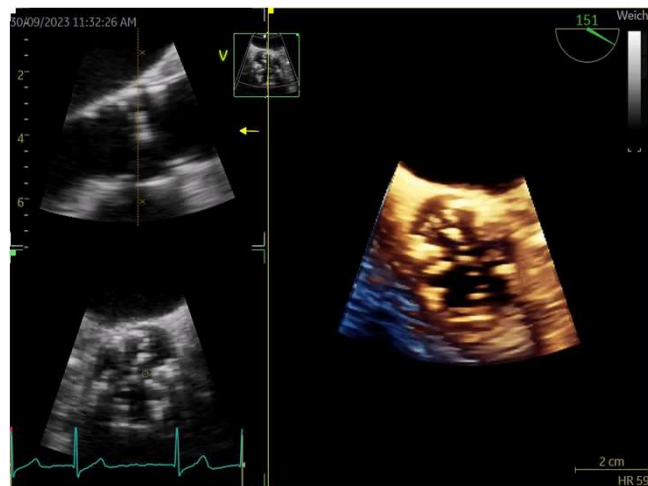
ne 89(6): 349-379

Aortenstenose - Quantifizierung

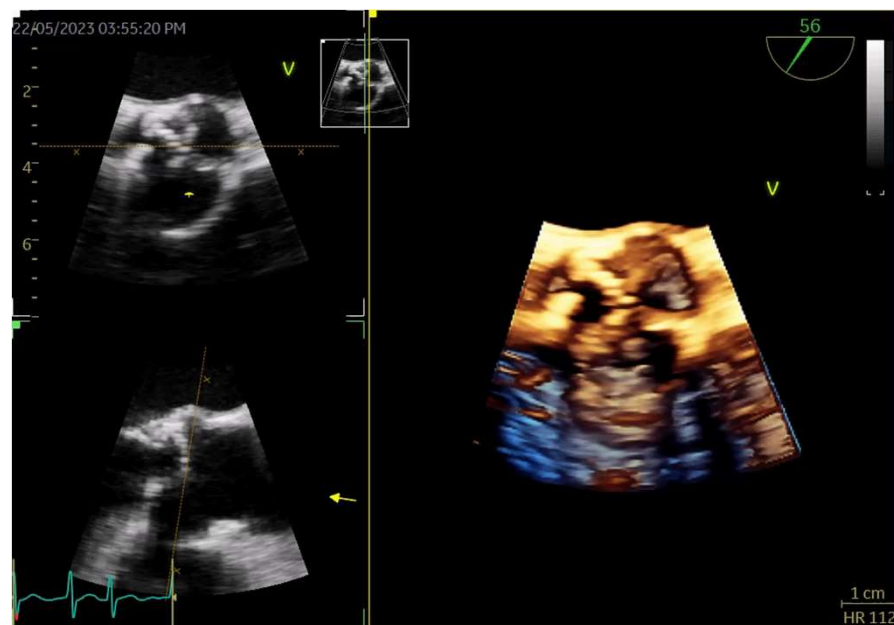
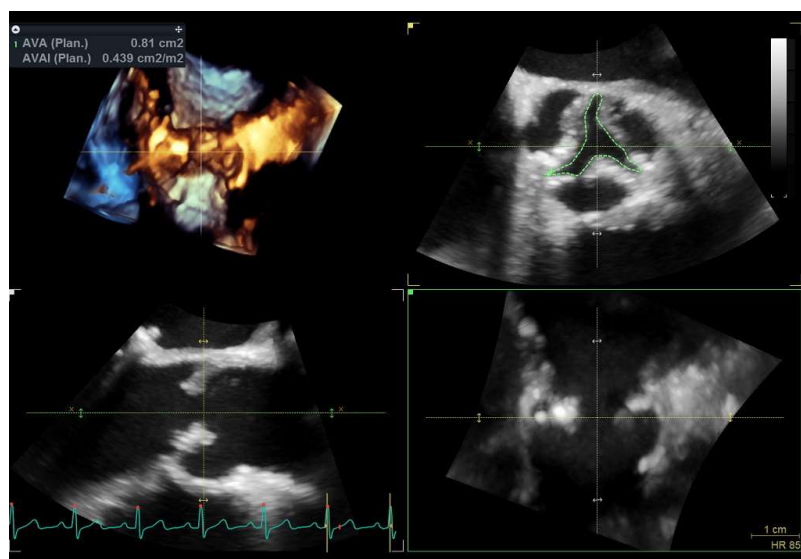
Table 2 Measures of AS severity obtained by Doppler-echocardiography

	Units	Formula/method	Cut-off for severe	Concept	Advantages	Limitations
AS jet velocity ¹²⁻¹⁵	m/s	Direct measurement	4.0	Velocity increases as stenosis severity increases	Direct measurement of velocity. Strongest predictor of clinical outcome	<ul style="list-style-type: none"> Correct measurement requires parallel alignment of ultrasound beam Flow dependent.
Mean gradient ¹²⁻¹⁴	mmHg	$\Delta P = \sum 4v^2 / N$	40	Pressure gradient calculated from velocity using the Bernoulli equation	<ul style="list-style-type: none"> Mean gradient is obtained by tracing the velocity curve Units comparable to invasive measurements 	<ul style="list-style-type: none"> Accurate pressure gradients depend on accurate velocity data Flow dependent
Continuity equation valve area ¹⁶⁻¹⁸	cm ²	$AVA = (CSA_{LVOT} \times VTI_{LVOT}) / VTI_{AV}$	1.0	Volume flow proximal to and in the stenotic orifice is equal	<ul style="list-style-type: none"> Measures effective orifice area Feasible in nearly all patients Relatively flow independent 	Requires LVOT diameter and flow velocity data, along with aortic velocity. Measurement error more likely
Simplified continuity equation ^{18,19}	cm ²	$AVA = (CSA_{LVOT} \times V_{LVOT}) / V_{AV}$	1.0	The ratio of LVOT to aortic velocity is similar to the ratio of VTIs with native aortic valve stenosis	Uses more easily measured velocities instead of VTIs	Less accurate if shape of velocity curves is atypical
Velocity ratio ^{19,20}	None	$VR = \frac{V_{LVOT}}{V_{AV}}$	0.25	Effective AVA expressed as a proportion of the LVOT area	Doppler-only method. No need to measure LVOT size, less variability than continuity equation	Limited longitudinal data. Ignores LVOT size variability beyond patient size dependence
Planimetry of anatomic valve area ^{21,22}	cm ²	TTE, TEE, 3D-echo	1.0	Anatomic (geometric) CSA of the aortic valve orifice as measured by 2D or 3D echo	Useful if Doppler measurements are unavailable	Contraction coefficient (anatomic/effective valve area) may be variable. Difficult with severe valve calcification
LV % stroke work loss ²³	%	$\%SWL = \frac{\Delta P}{\Delta P + SBP} \cdot 100$	25	Work of the LV wasted each systole for flow to cross the aortic valve, expressed as a % of total systolic work	Very easy to measure. Related to outcome in one longitudinal study	Flow-dependent, Limited longitudinal data

Aortenstenose – Planimetrie (FlexiSlice)

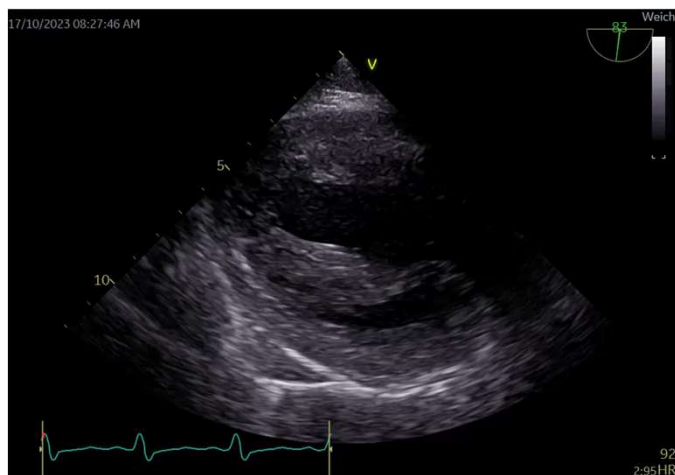


Aortenstenose – Planimetrie (flexiSlice)



Aortenstenose - Paradoxe Low Flow, Low Gradient

- Ca. 35 % der Patienten mit Aortenstenose
- Definition:
 - $AVA < 1,0 \text{ cm}^2$
 - $P \text{ mean} < 40 \text{ mmHg}$
 - $SVI \leq 35 \text{ mL/m}^2$
 - $EF \geq 50\%$



22/02/2012 14:21:01



124



120



-54

93
HR

41:58

22/02/2012 14:21:08



124



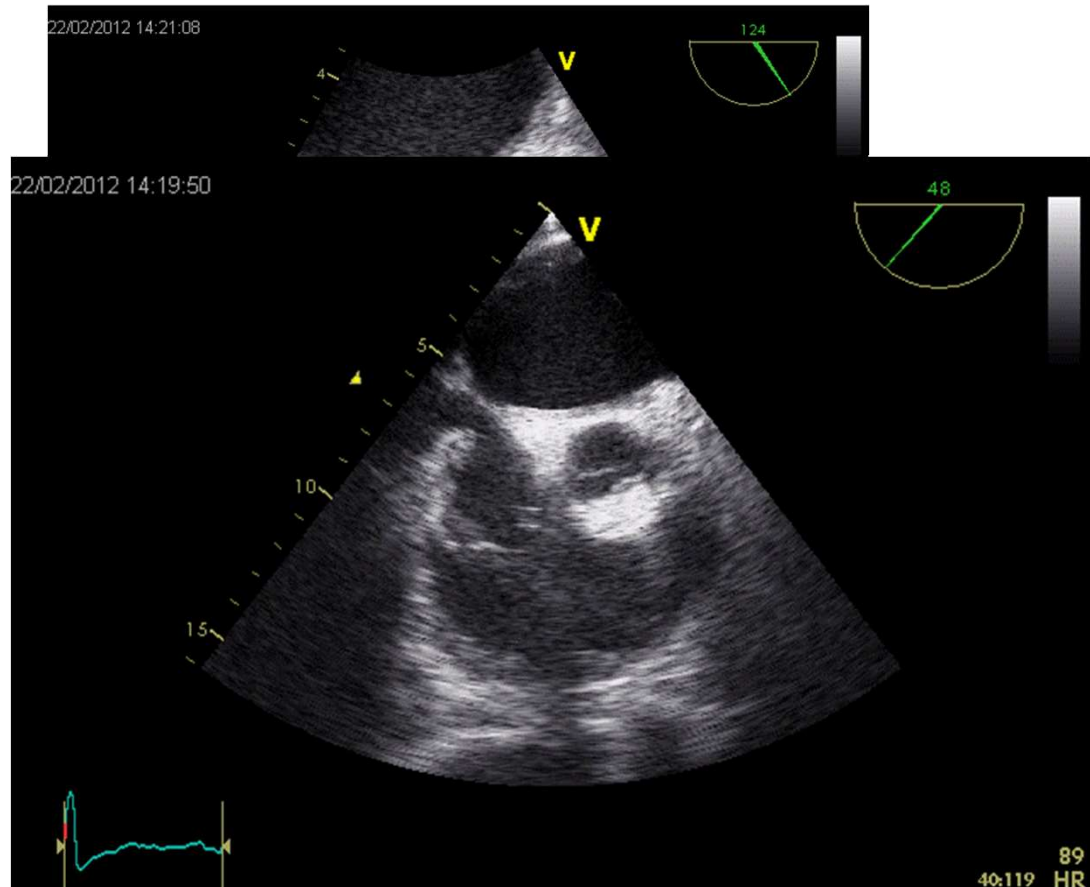
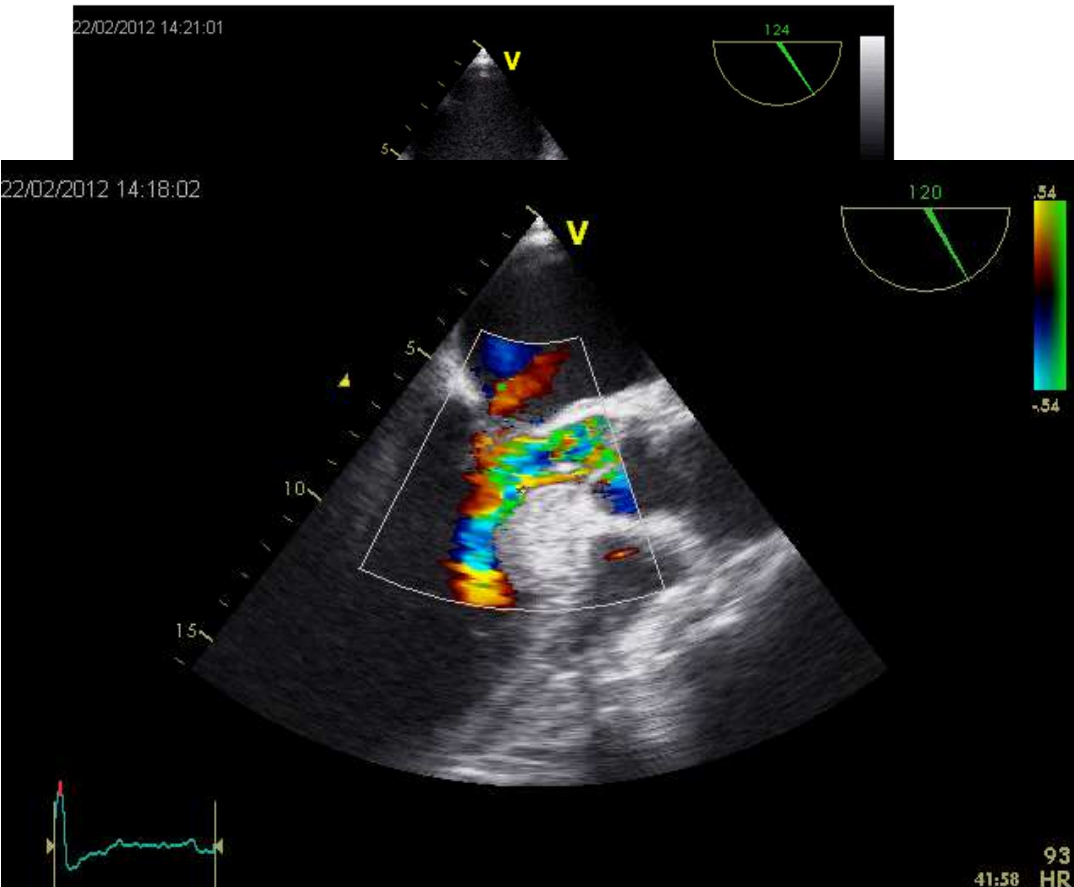
48

89
HR

40:19

22/02/2012 14:19:50

22/02/2012 14:18:02



- ✓ Anatomie
- ✓ Darstellung im TEE (Schnittebene)
- ✓ Morphologie
- ✓ Dimensionen
- ✓ Klappenveränderungen/Vitien
 - ✓ Aortenstenose
 - ✓ Aorteninsuffizienz

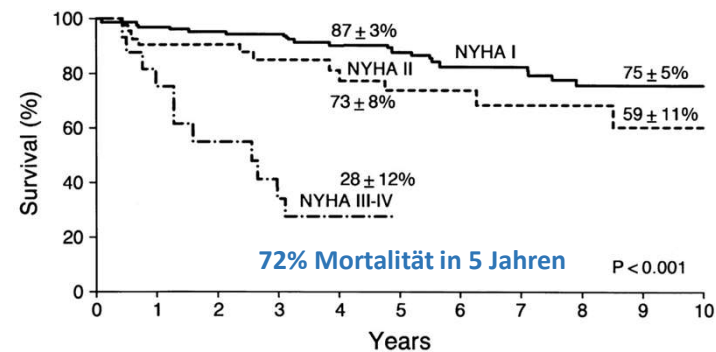
Aorteninsuffizienz Prognose

TABLE 2. Outcome With Conservative Management of 246 Patients With Severe Aortic Regurgitation

Event	No. of Events	Event Rates (Observed ± SE)		Linearized Yearly Rate, %/y	P vs Expected
		5 y	10 y		
Death from any cause	43	23 ± 4	34 ± 5	4.7	0.001
Death from cardiac cause	33	18 ± 3	27 ± 5	3.6	...
Congestive heart failure	54	27 ± 4	47 ± 6	6.2	...
Vascular complications*	13	7 ± 2	15 ± 5	1.5	...
New atrial fibrillation	11	3 ± 1	8 ± 3	0.9	...
New endocarditis	2	...	4 ± 3	0.2	...
Aortic valve surgery	132	50 ± 3	62 ± 4	14.6	...
Aortic valve surgery or death	175	61 ± 3	75 ± 3	19.3	...
Cardiovascular events†	187	64 ± 3	83 ± 3	20.6	...
Mortality in subgroups of patients					
Symptomatic	25	40 ± 7	52 ± 9	9.4	0.001
Asymptomatic	18	12 ± 4	24 ± 5	2.8	0.37
NYHA class					
III or IV	11	72 ± 12	...	24.6	0.001
II	12	30 ± 8	44 ± 12	6.3	0.02
I	20	13 ± 3	25 ± 5	3.0	0.38
Asymptomatic and EF < 55%	8	20 ± 9	47 ± 13	5.8	0.03
Asymptomatic and EF ≥ 55%	10	10 ± 4	17 ± 5	2.0	0.81
Asymptomatic and LVS/BSA < 25 mm/m ²	8	8 ± 3	14 ± 5	1.6	0.91
Asymptomatic and LVS/BSA ≥ 25 mm/m ²	8	28 ± 11	54 ± 14	7.8	0.004

*Aortic dissection and thromboembolism.

†Cardiovascular death, surgery, heart failure, vascular complications, new atrial fibrillation, new endocarditis.



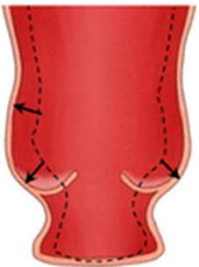

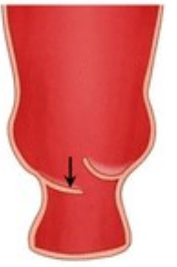
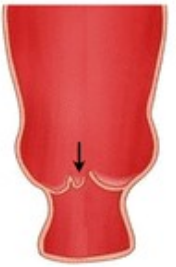

	0	1	2	3	4	5	6	7	8	9	10
NYHA I	122	100	91	88	81	71	55	48	37	31	16
NYHA II	64	37	31	26	21	19	16	9	9	6	4
NYHA III-IV	60	11	8	5	4	2					

NYHA I, 34% Mortalität in 10 Jahren (pro Jahr 4,7%)
 NYHA II, 9,4% pro Jahre
 NYHA III/IV, 24,6% pro Jahr

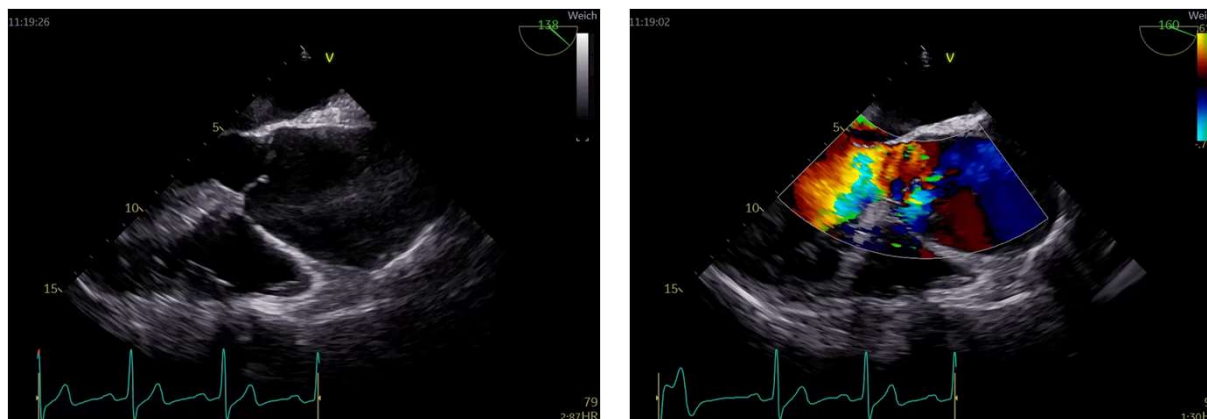
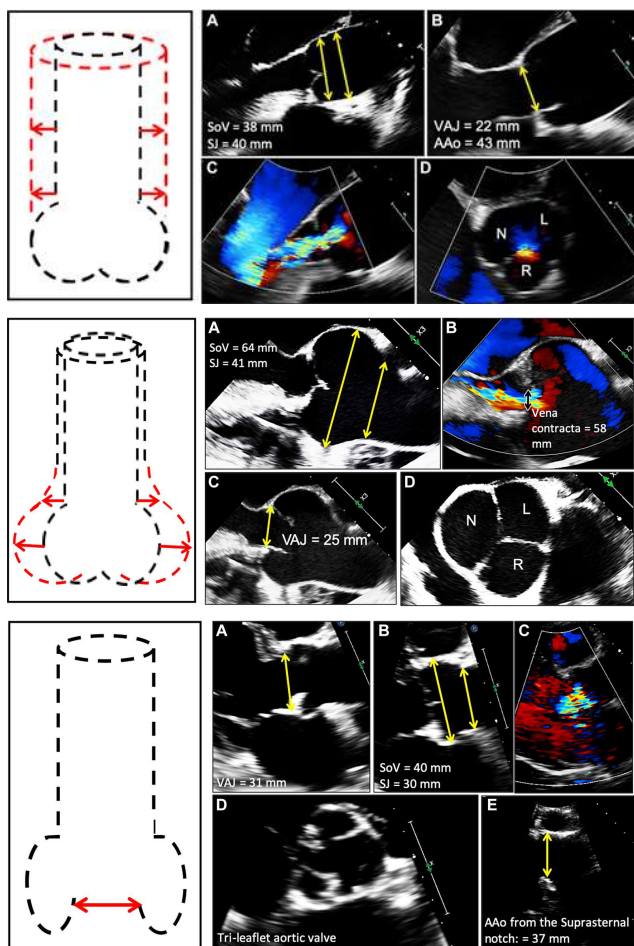
Anatomie der Aorteninsuffizienz

- Proximale Aortendilatation
 - Normalerweise zentrale Regurgitation
- Verdickung oder Retraktion der Taschen
 - Fusion/Raphe der BAV
 - Degenerative Veränderungen
 - Rheumatische Erkrankung
 - Oft kombiniert mit Aortenstenose
- Zerstörung der Taschen
 - Endokarditis
 - Trauma
- Taschenprolaps
 - Anulus- oder Aortenwurzeldilatation
 - Dissektion
 - Normalerweise exzentrisches Regurgitation

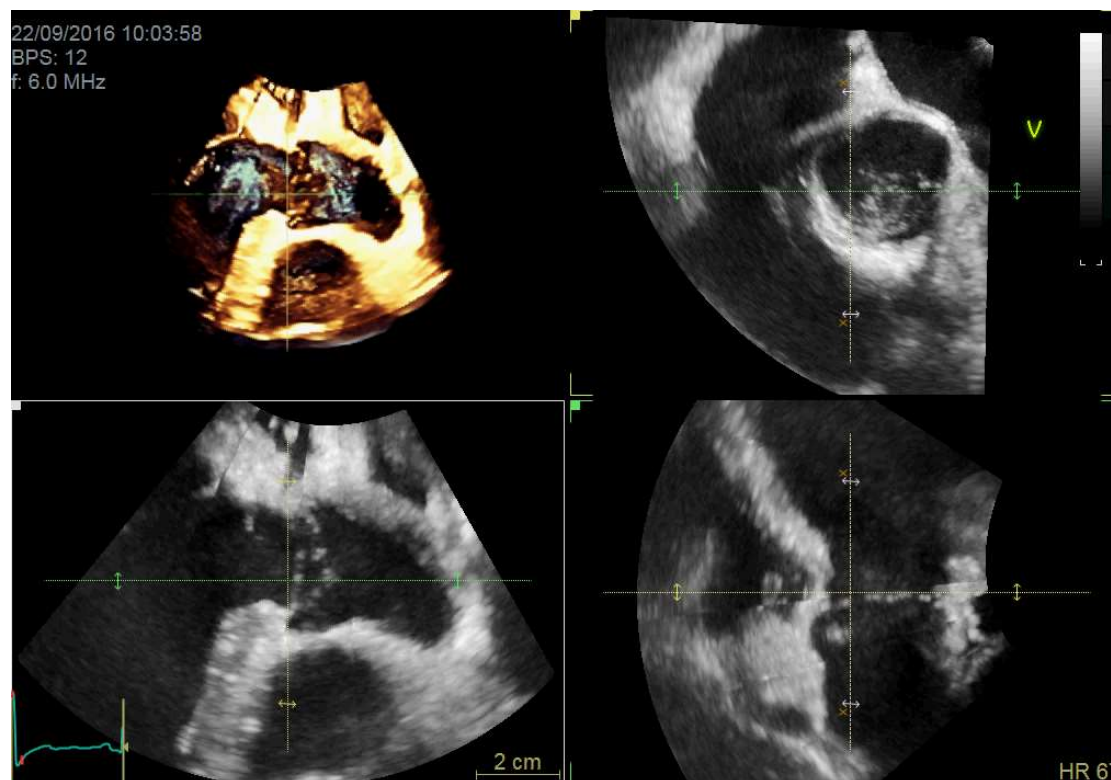
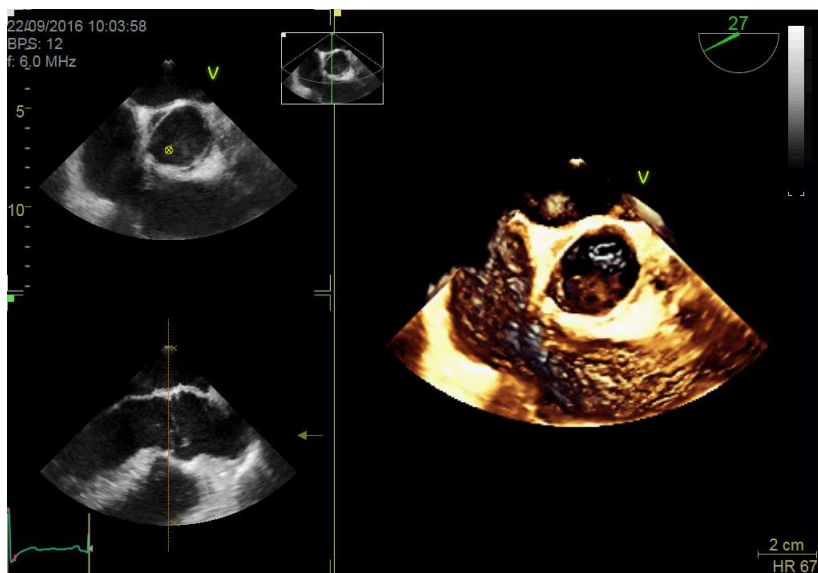
Aorteninsuffizienz - Carpentier Klassifizierung

	Typ I ohne Bewegungsstörung der Taschen		Typ II erhöhte Bewegung		Typ III verminderte Bewegung
Mechanismus					
	Dilatation von Aortenring, Sinus und/oder Wurzel	Perforation der Tasche jeglicher Ursache	Total Prolaps der Tasche	Partieller Prolaps	Retraktion mit Verkürzung der Tasche

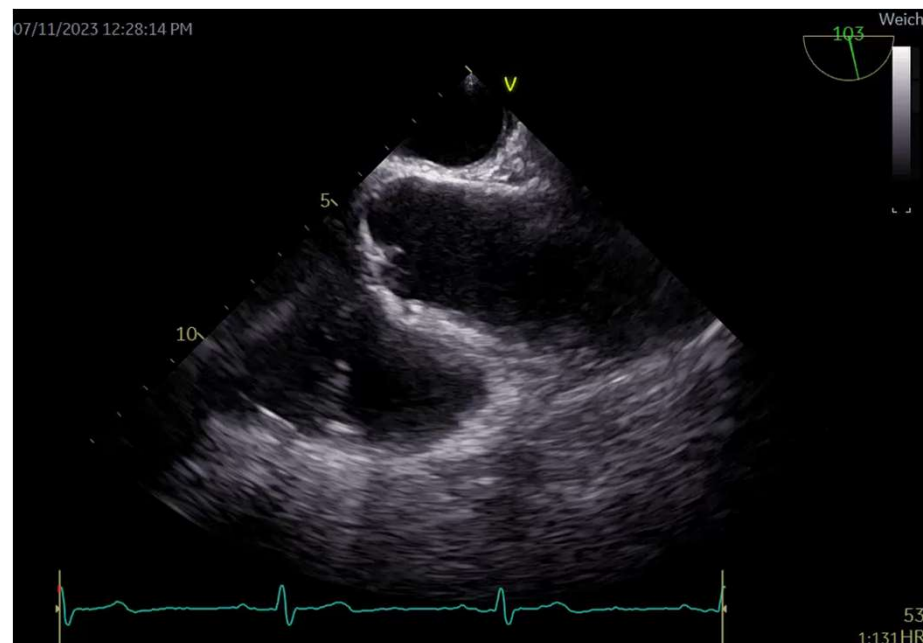
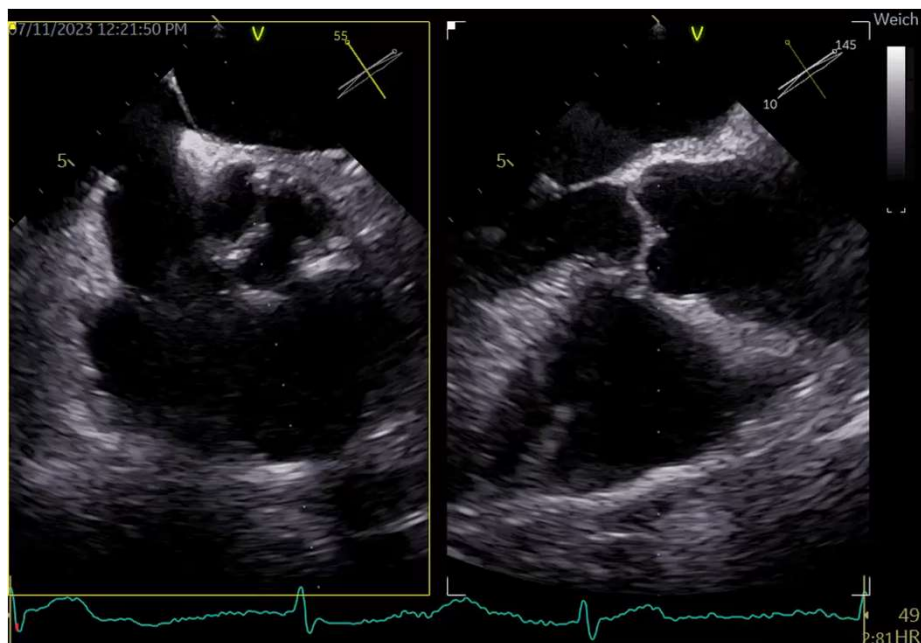
Mechanismus Aortenregurgitation



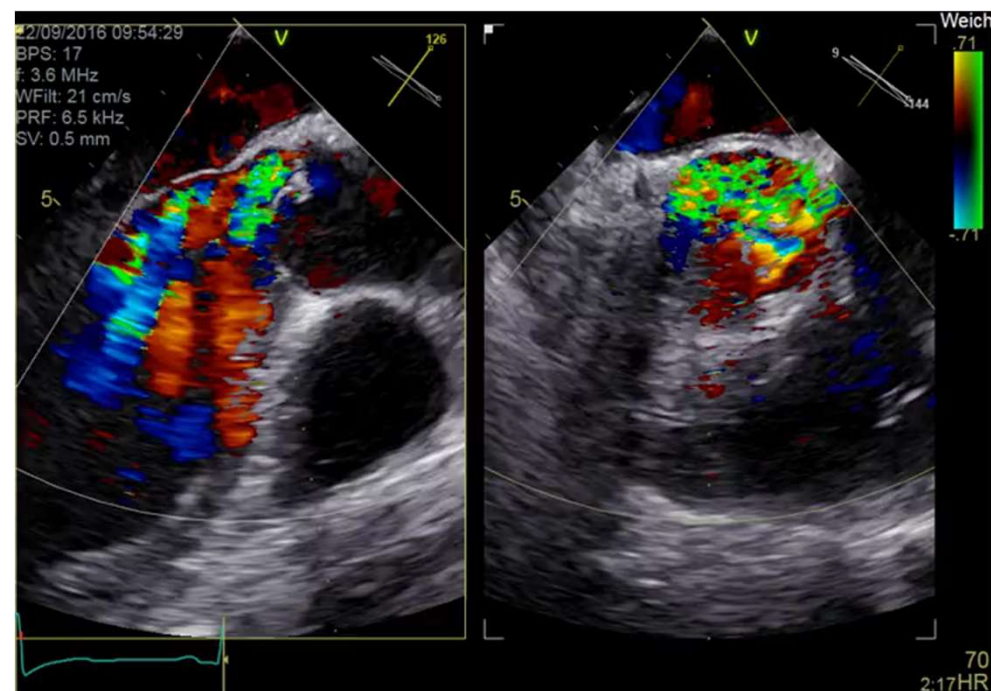
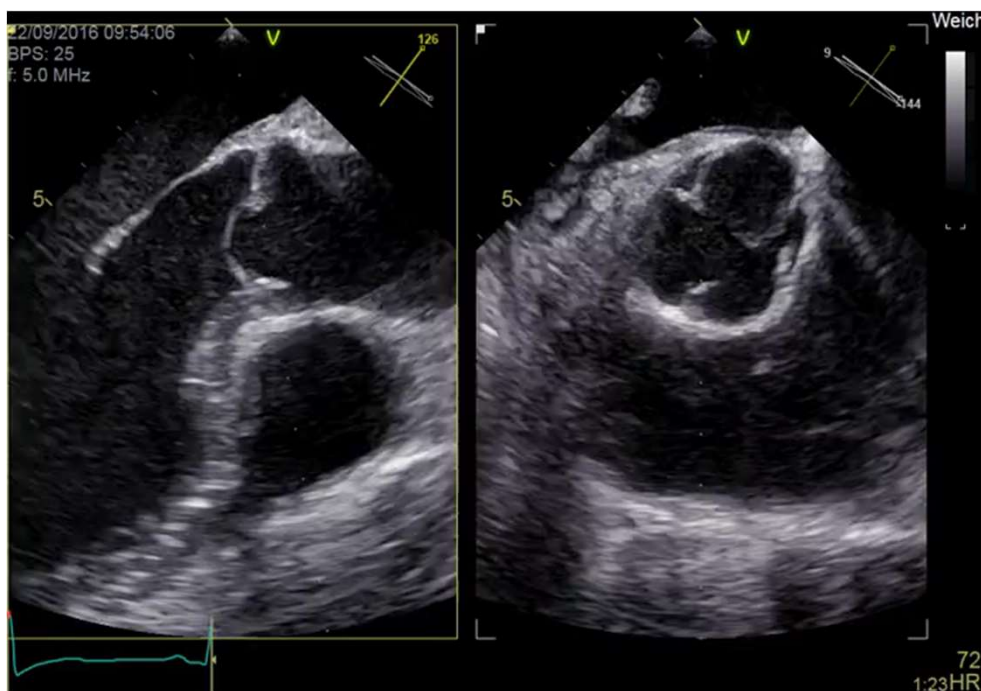
Mechanismus Aorteninsuffizienz



Mechanismus Aorteninsuffizienz

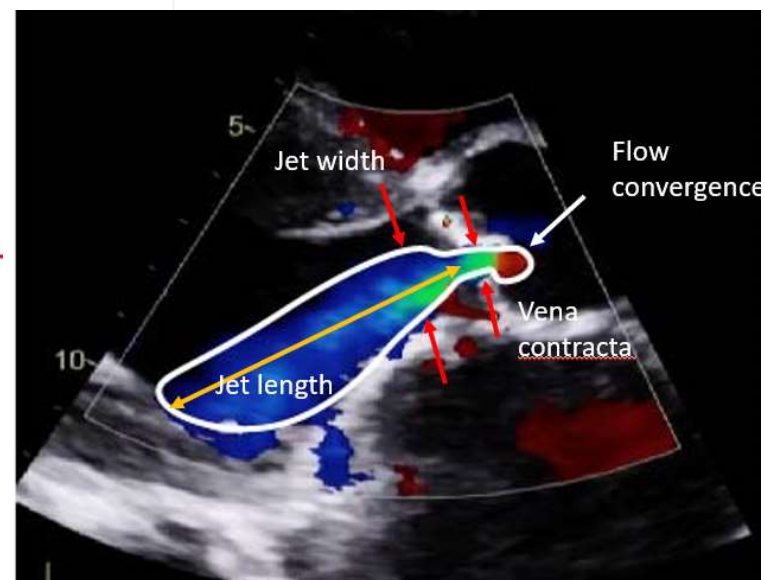


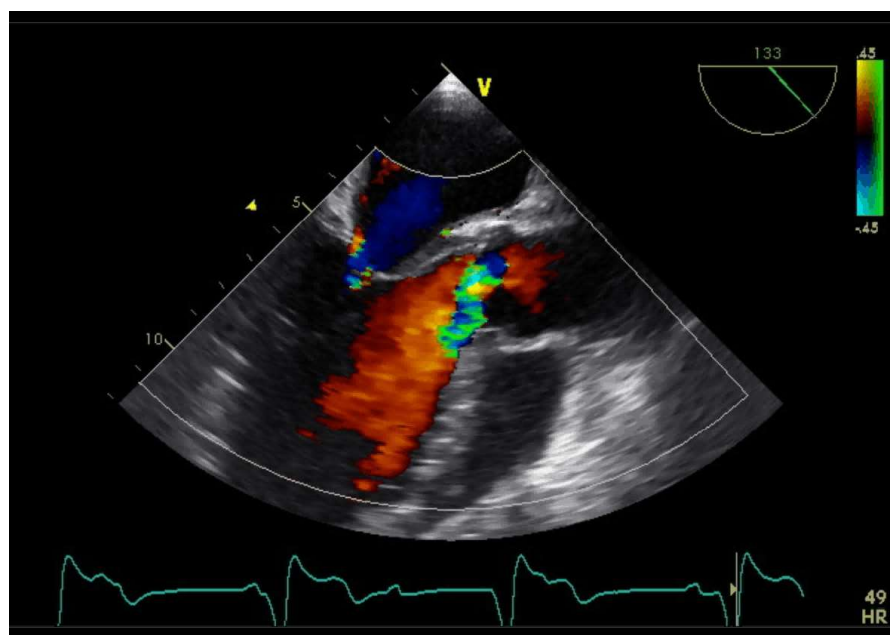
Mechanismus Aorteninsuffizienz



Quantifizierung der Aorteninsuffizienz im Doppler

Parameters	Mild	Moderate	Severe
Qualitative			
Aortic valve morphology	Normal/Abnormal	Normal/Abnormal	Abnormal/flail/large coaptation defect
Colour flow AR jet width ^a	Small in central jets	Intermediate	Large in central jet, variable in eccentric jets
CW signal of AR jet	Incomplete/faint	Dense	Dense
Diastolic flow reversal in descending aorta	Brief, protodiastolic flow reversal	Intermediate	Holodiastolic flow reversal (end-diastolic velocity >20 cm/s)
Semi-quantitative			
VC width (mm)	<3	Intermediate	>6
Pressure half-time (ms) ^b	>500	Intermediate	<200
Quantitative			
EROA (mm ²)	<10	10–19; 20–29 ^c	≥30
R Vol (mL)	<30	30–44; 45–59 ^c	≥60
+LV size ^d			





Semiquantitative AR Graduierung

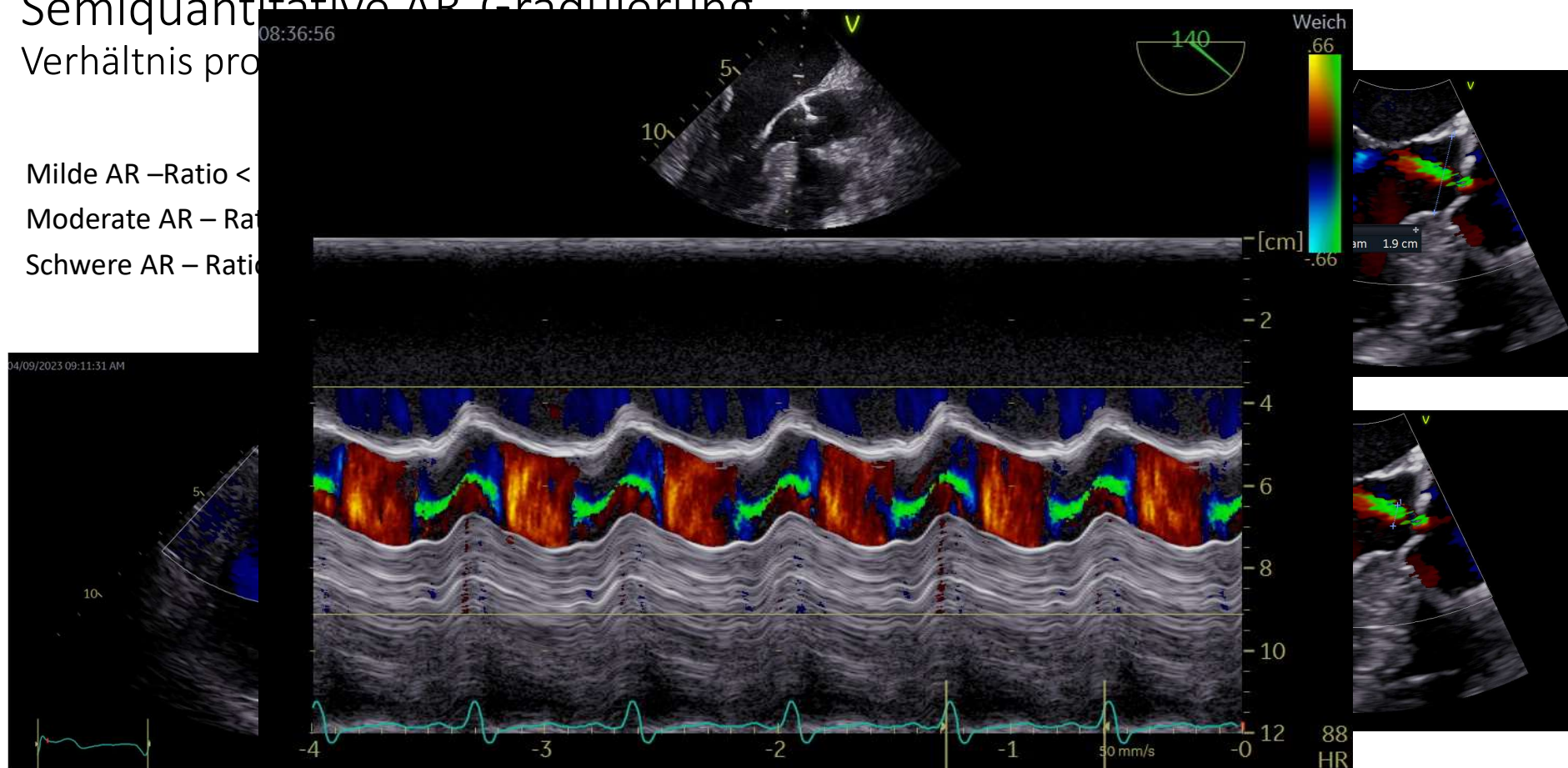
Verhältnis pro

Milde AR – Ratio <

Moderate AR – Ra

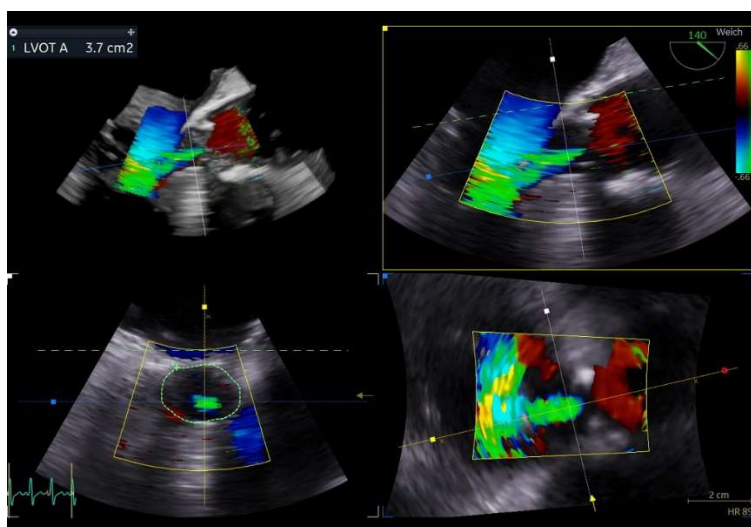
Schwere AR – Rati

04/09/2023 09:11:31 AM



Semiquantitative AR-Graduierung

RR-ratio proximale AR-Jet-Area in Relation zur LVOT-Area



Fläche des proximalen AR-Jet im Kurzachsenansicht = EROA (Planimetrie der effektive Regurgitationsfläche) Ursache der Klappenläsion in diesem Fall:
→ Prolaps und Anulusdilatation

LVOT-Area
= 3,7 cm²

prox. AR-Jet-Area
= 0,4 cm²

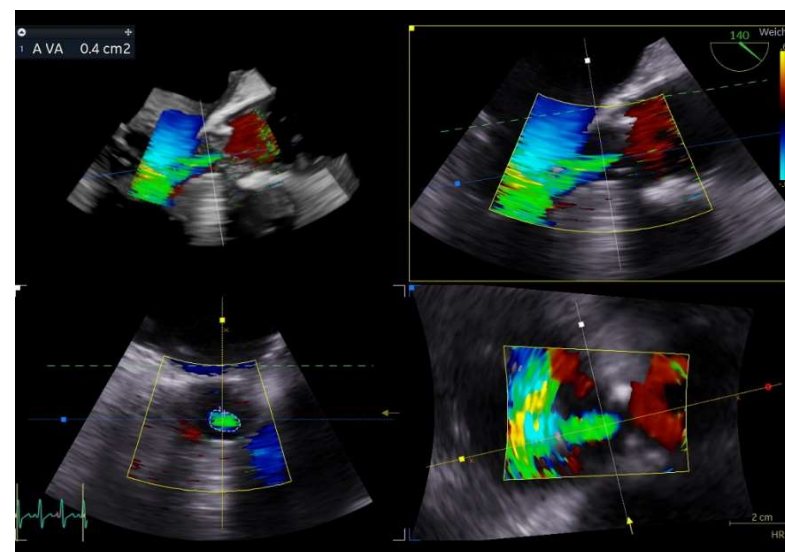
$D_{AR-Jet-A} / D_{LVOT-A}$
= 15%

Milde AR – Ratio < 30%

Moderate AR – Ratio = 30-50 %

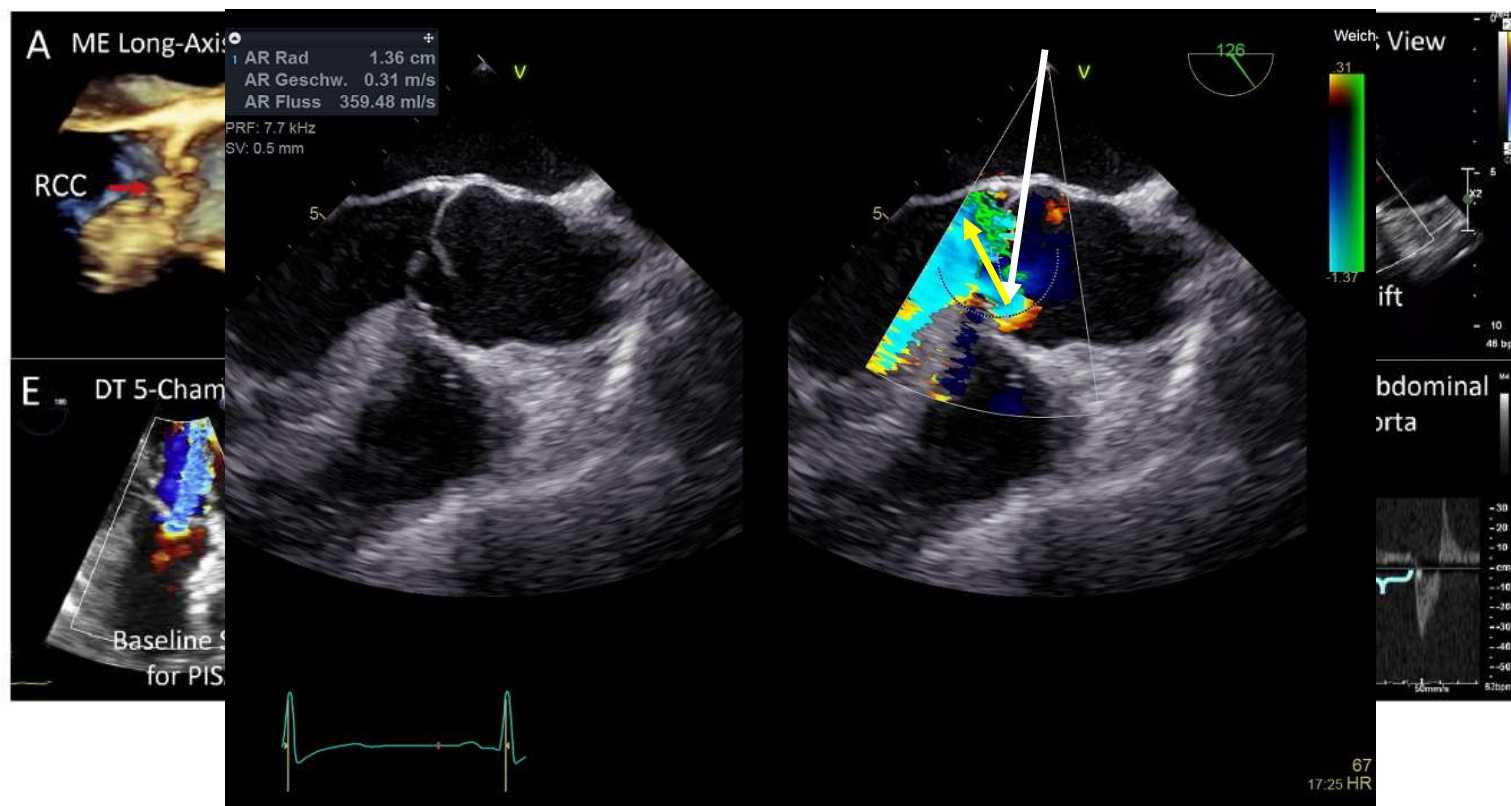
Schwere AR – Ratio > 50%

Dieser Ansatz ist wegen der geringeren intraoperativer Variabilität besser als die Diameter-Ratio

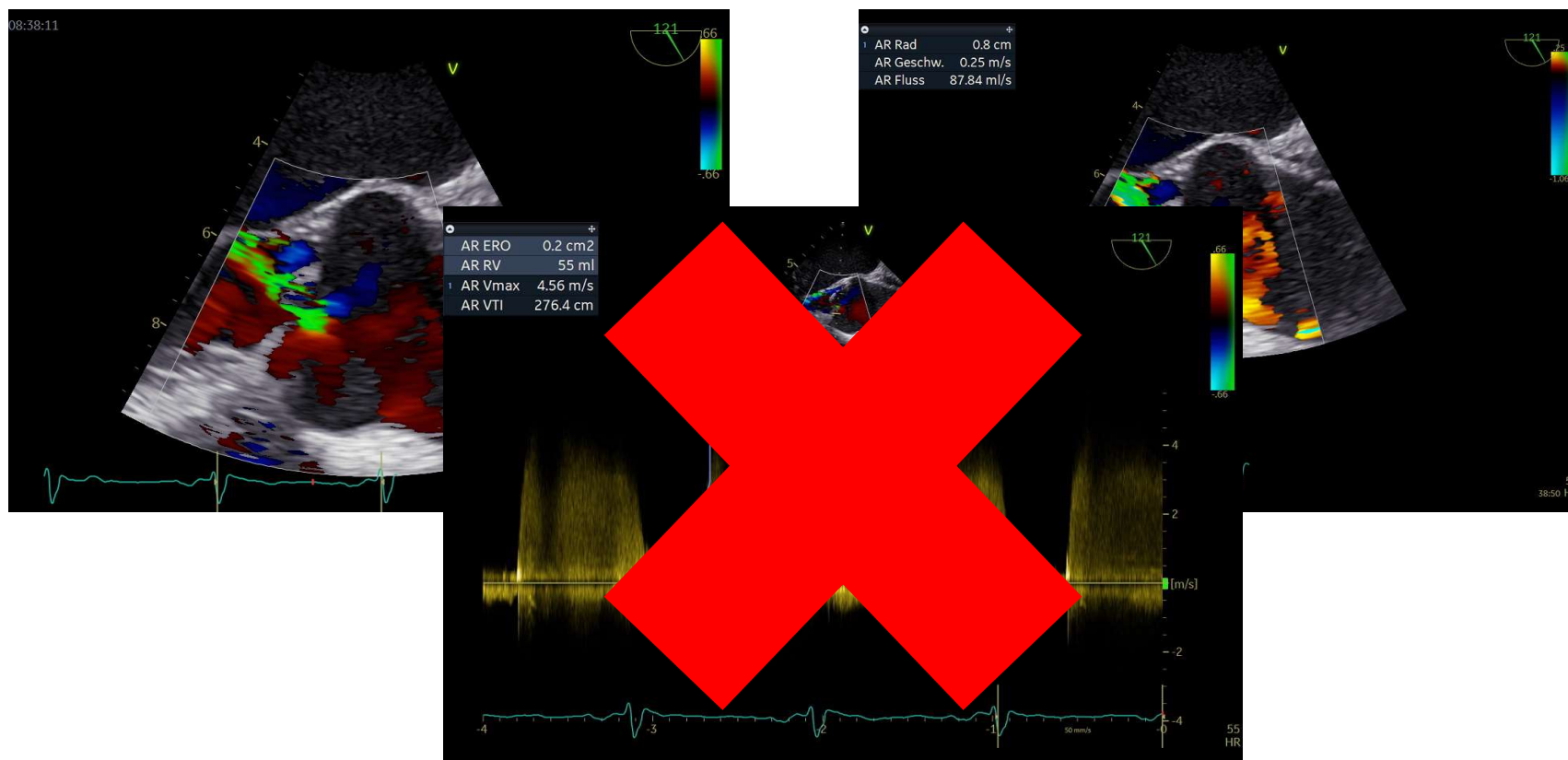


Quantitative AR-Graduierung

PISA Methode (EROA, R Vol)



Quantitative AR-Graduierung: PISA Methode (EROA, R Vol)



Aorteninsuffizienz

Wann Rekonstruktion, wann operativer Ersatz, wann TAVI?

Rekonstruktion	operativer Ersatz
trikuspidale / bikuspidale Aortenklappe mit: <ul style="list-style-type: none"> • Wurzel Dilatation • Wurzel Dilatation und Prolaps der Tasche • Taschenprolaps • (Taschenperforation) • (unikuspidale Aortenklappe ohne Kalzifikation) 	Jeder Aortenklappe mit: <ul style="list-style-type: none"> • Kalzifikationen • Retraktionen • mehrere /größere Fenestrationen • Endokarditiden

Dank zunehmender Klappengröße (JenaValve 23 mm, 25 mm und 27 mm) erste erfolgversprechende Ergebnisse der TAVI-Implantation bei Aorteninsuffizienz europäische Kohortenstudie mit 58% (Alter 76,5 ± 9 Jahre)

AKE

Klappentypen



St. Jude



Medtronic Hall



Starr-Edwards



Medtronic Mosaic



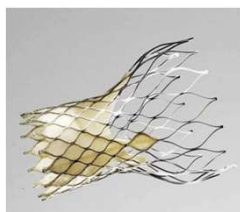
Carpentier-Edwards
Magna



Medtronic Freestyle



Edwards Sapien



CoreValve

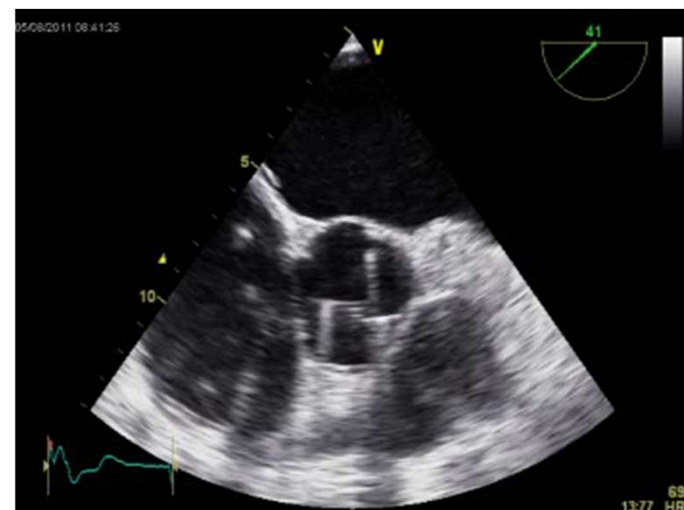
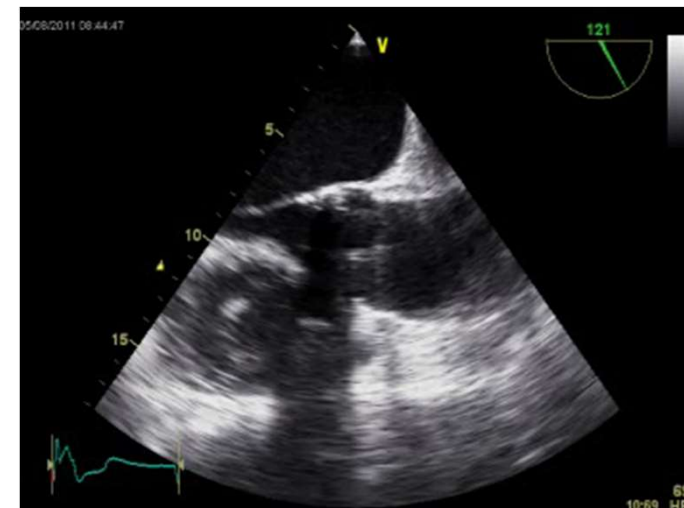


JenaValve

- Mechanische Klappen
 - Doppelflügelprothesen
 - St. Jude Medical, Carbomedics, ATS Medical, Sorin Bicarbon
 - Kippscheiben
 - Björk-Shiley, Medtronic-Hall, Omnicarbon
 - Kugelprothesen
 - Starr-Edwards
- Bioprothesen
 - Schweine-Klappen
 - Hancock Porcine, Carpentier-Edwards, Medtronic Mosaik
 - Rinderperikard
 - Carpentier Edwards Pericardial, Ionescu-Shiley, Mitroflow
 - Gerüstfreie Bioprothesen
 - Medtronic Freestyle, Edwards PRIMA Stentless, Biacor Stentless
- Perkutane Bioprothesen
 - CoreValve, Edwards Sapien, JenaValve

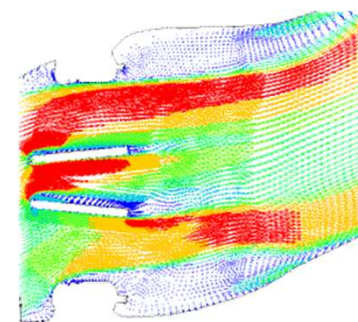
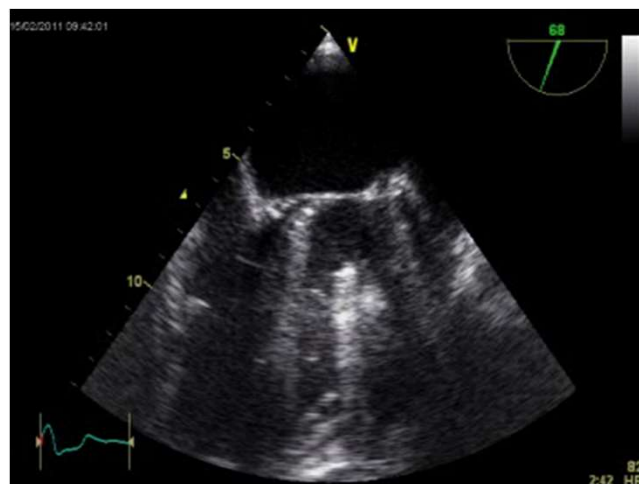
Beurteilung der Prothesenfunktion

- Implantation
 - Datum,
 - Art und Größe der Klappe
- 2D Echo
 - Flügelbeweglichkeit
 - Verkalkungen
 - Zusatzstrukturen
- Doppler
 - Kontur des Flussprofils
 - Maximale Geschwindigkeit und Gradient
 - Mittlerer Gradient
 - PHT bei MV und TV
 - Regurgitationen
 - Ausdehnung
 - Lokalisation
- Andere Echo-Befunde
 - Größe LV und RV, Hypertrophie
 - Größe LA und RA
 - Begleitende Vitien
 - Pulmonale Hypertonie



Doppelflügelprothese

Flussprofil



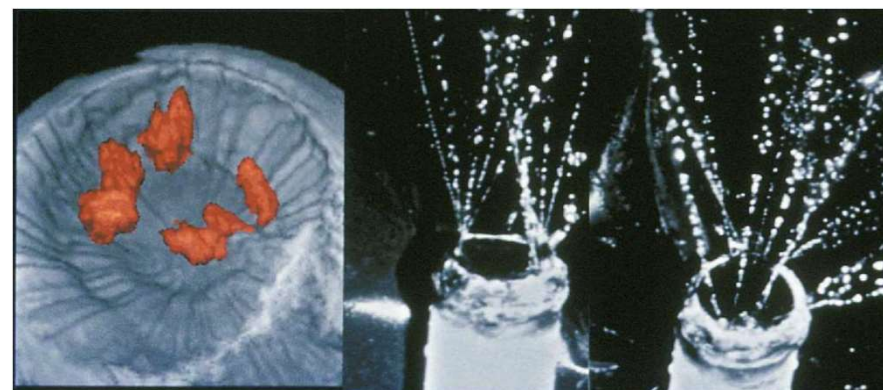
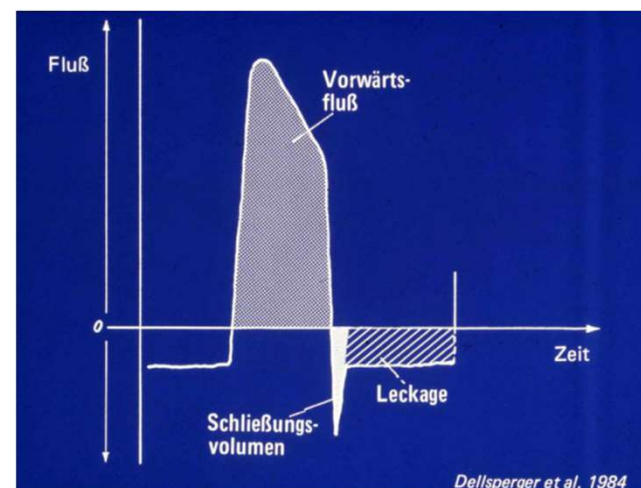
http://bme.sunysb.edu/people/faculty/d_bluestein.html

- Öffnungswinkel 75-90°
- Durchstrom wird wenig behindert
 - 3 Öffnungen: eine zentral zwischen den Flügeln, 2 große durch die Flügel
- normale transversale Regurgitation
 - Notwendig zum Klappenschluss
 - Verhinderung von Thromben

Doppelflügelprothese

transvalvuläre Regurgitation

- normale transvalvuläre Regurgitation bei mechanischen Prothesen
- pathologische transversale Regurgitation
 - im pw-Doppler während der gesamten Schließungsphase nachweisbar
 - nicht der normalen Gestalt und dem erwartetem Ausmaß entsprechend



SJM: Mitsystol. Standbilder im vgl. zu invitro tests (Flachskampf et al.)

Wertigkeit der TEE bei Klappenprothese

TEE der TTE eindeutig überlegen

- Mitralsuffizienz (qualitativ und quantitativ; Ursprung)
- Klappenspiel bei mechanischen Prothesen Mitralposition
- Morphologie von Bioprothesen

TEE prinzipiell der TTE überlegen, bei entsprechenden Fragestellungen TEE indiziert

- Thromben
- Vegetationen [TEE: Sensitivität 86%-94%, und Spezifität 88%-100%]
- Abszesse [TEE: Sensitivität 87% und Spezifität 95%]
- Fistulöse Kommunikationen

TEE prinzipiell der TTE nicht überlegen, nur bei schlechter TTE-Qualität indiziert

- Aorteninsuffizienz (bezüglich Mechanismus und Lokalisation ggf. TEE überlegen)

TEE liefert in der Regel keine Beantwortung

- Klappenspiel bei Aortenprothesen

