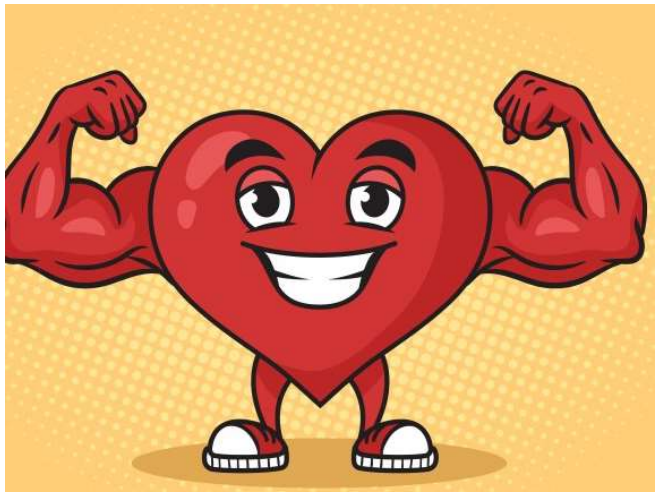
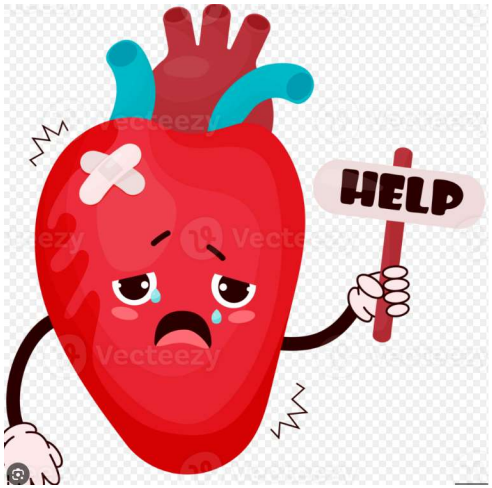
# Linksventrikuläre Funktion

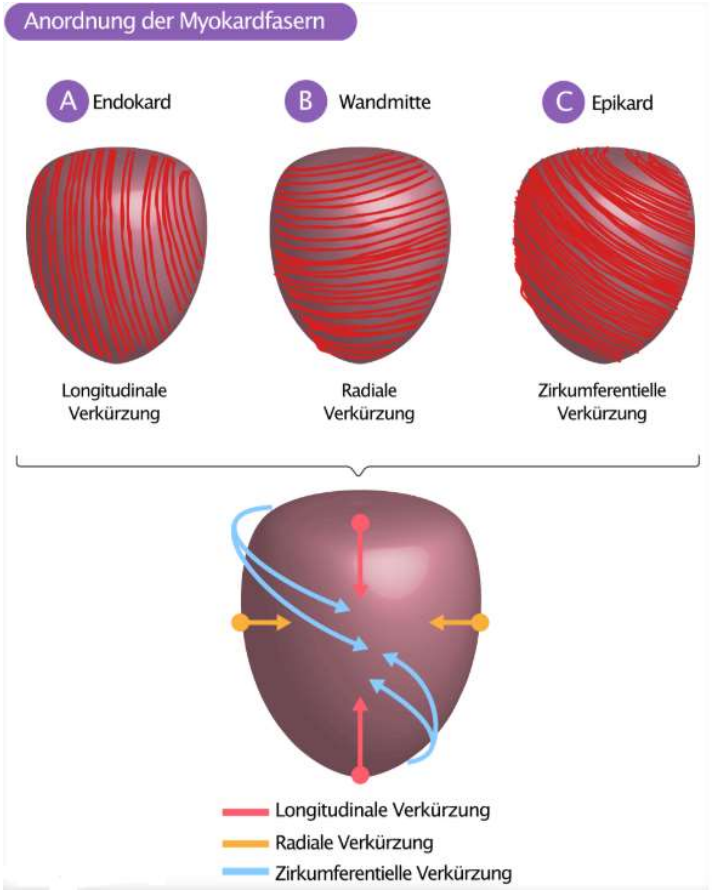




# Linksventrikuläre Kontraktilität

Komplexer myokardialer Kontraktionsablauf

- **Konzentrische** Bewegung
- Bewegung der Klappenebene nach **apikal**
- **Rotation** des Myokards
- Wand**dickenzunahme**



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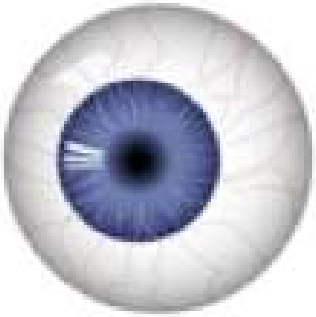
# Linksventrikuläre Funktion LVEF

- Bestimmung der Linksventrikulären Auswurffraktion

$$EF\ (\%) = [(EDV-ESV)/EDV] \cdot 100$$

| Funktion | Ejektionsfraktion |
|---|---|
| Normal | 55-70% |
| Hyperdyname LVEF | > 70% |
| Leichtgradig eingeschränkte LVEF | 40-50% |
| Mittelgradig eingeschränkte LVEF | 30-40% |
| Hochgradig eingeschränkte LVEF | <30% |

# «Eyeballing» – visuelle Einschätzung der LV Funktion



- "…visual estimation of LV function can provide accurate and reliable information at the bedside"

ELSEVIER

International Journal of Cardiology
Volume 101, Issue 2, 25 May 2005, Pages 209-212

## Visually estimated left ventricular ejection fraction by echocardiography is closely correlated with formal quantitative methods

Petri Gudmundsson [1], Erik Rydberg [2], Reidar Winter [2], Ronnie Willenheimer [2]

ELSEVIER

Journal of the American Society of Echocardiography
Volume 23, Issue 12, December 2010, Pages 1225-1230

American Society of Echocardiography Consensus Statement

## Focused Cardiac Ultrasound in the Emergent Setting: A Consensus Statement of the American Society of Echocardiography and American College of Emergency Physicians

Arthur J. Labovitz MD, FASE (Chair) [a *], Vicki E. Noble MD, FACEP [b **], Michelle Bierig MPH, RDCS, FASE [a *], Steven A. Goldstein MD [c *], Robert Jones DO, FACEP [d **], Smadar Kort MD, FASE [e *], Thomas R. Porter MD, FASE [f *], Kirk T. Spencer MD, FASE [g *], Vivek S. Tayal MD, FACEP [h **], Kevin Wei MD [i *]

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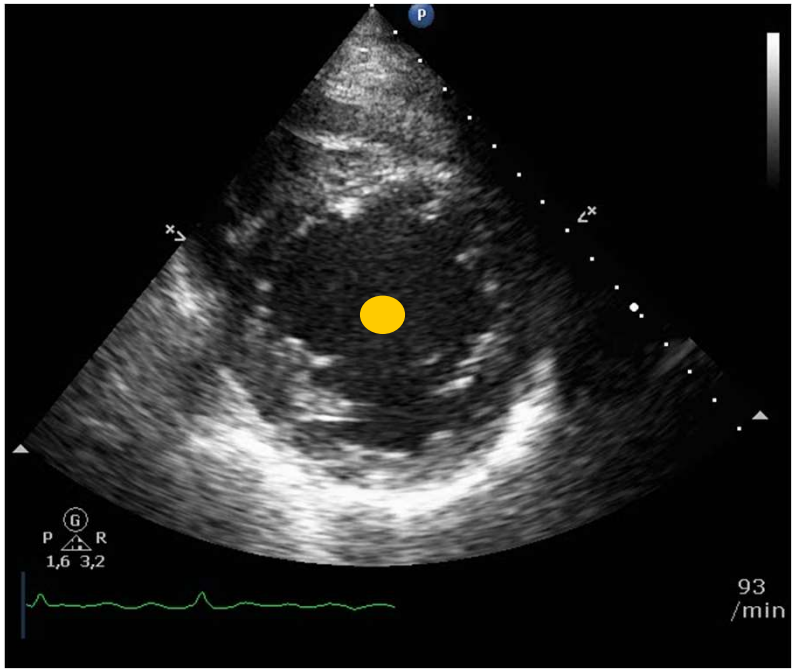
# Beurteilung der LV Funktion…auf was schauen?

- Symmetrische **Wanddickenzunahme** in Systole
- Symmetrische Bewegung aller Segmente **nach zentral**
- **«Cavumverkleinerung»** des LV zwischen Diastole und Systole



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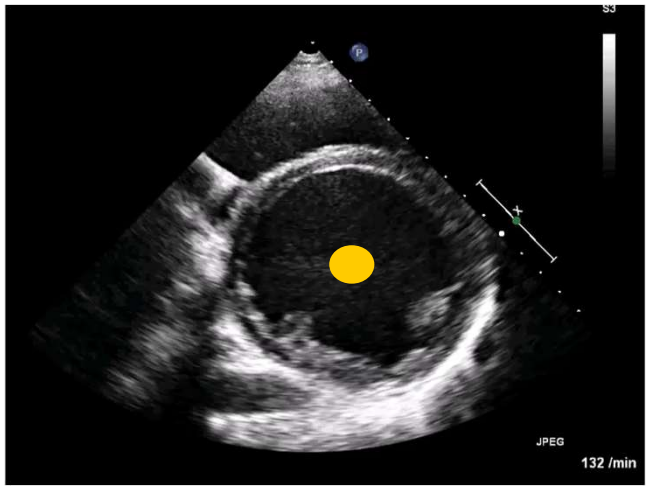
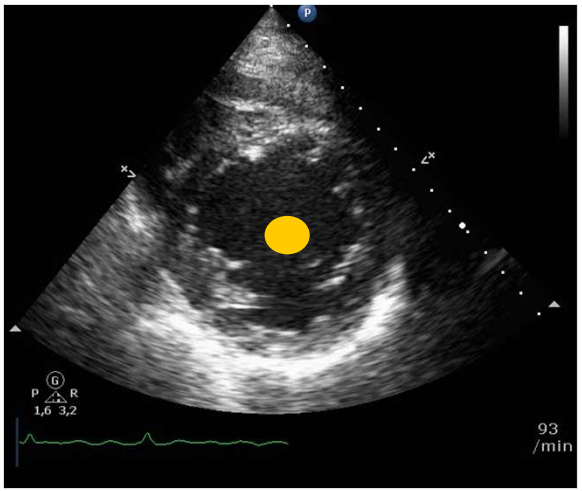
# «Eyeballing» – visuelle Einschätzung der LV Funktion




Steht

EF < 40%

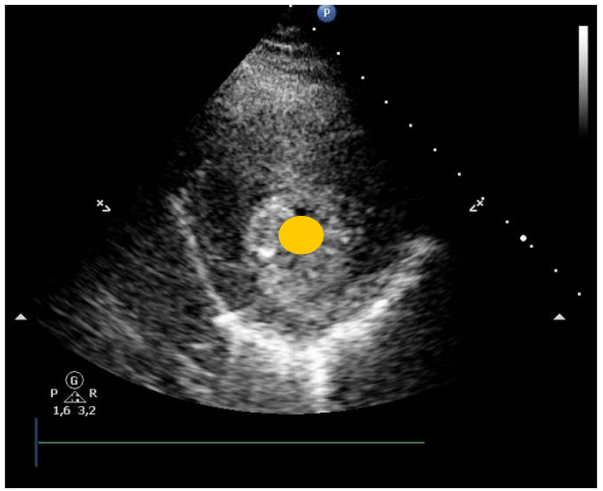
Mittel- bis hochgradig reduzierte Funktion




Geht

EF 40-70%

Normale Funktion

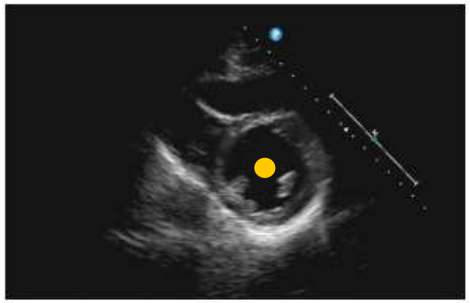


Klatscht

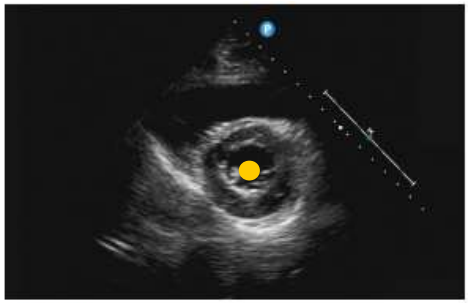
EF>70%

Hyperdyname Funktion

# Beurteilung der LV Funktion

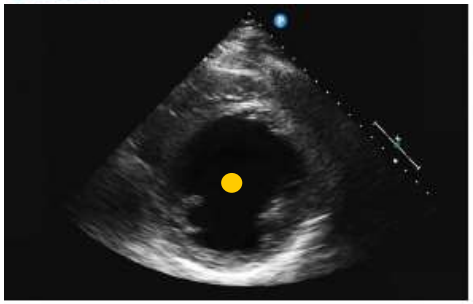


Diastole

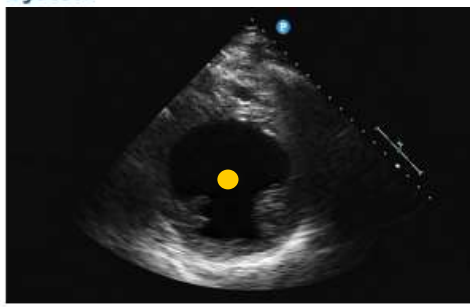


Systole

Normale LV Funktion

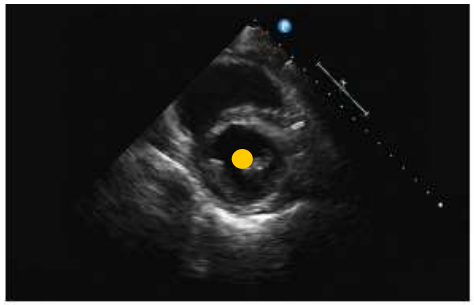


Diastole

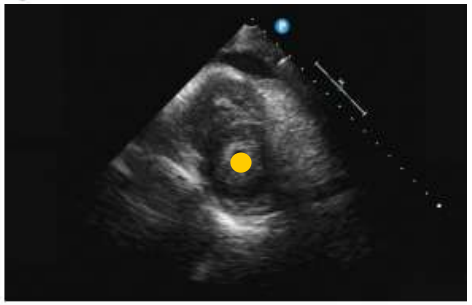


Systole

Schwer eingeschränkte LV Funktion



Diastole

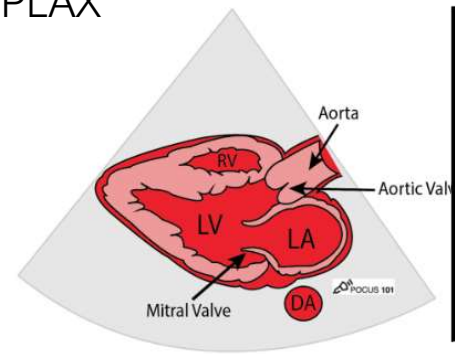


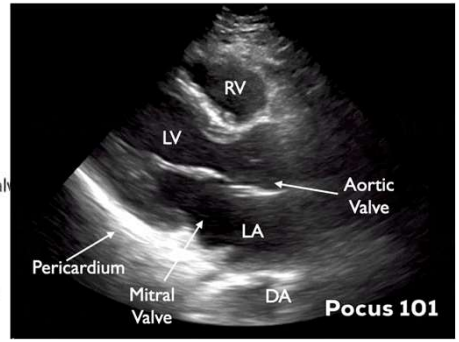
Systole

Hyperdyname LV Funktion

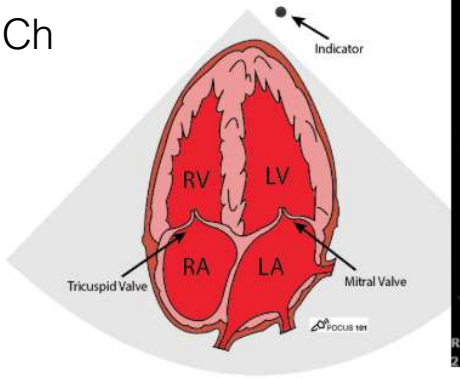
# Welche Anlotung zur schnellen Beurteilung der LV Funktion?

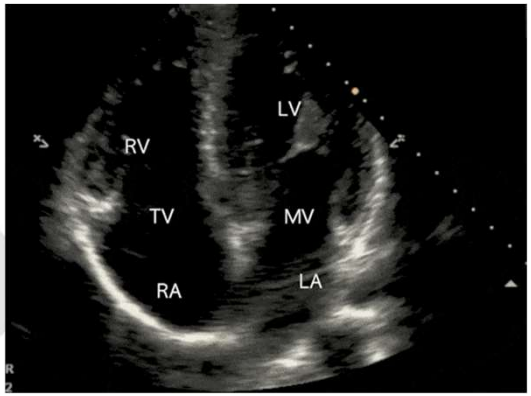
PLAX



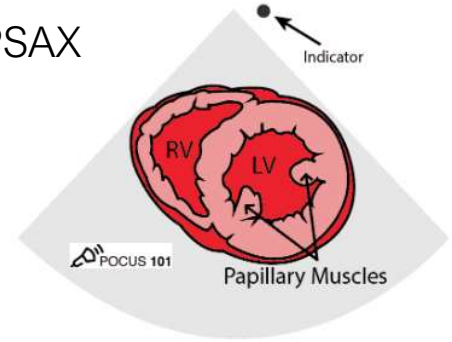



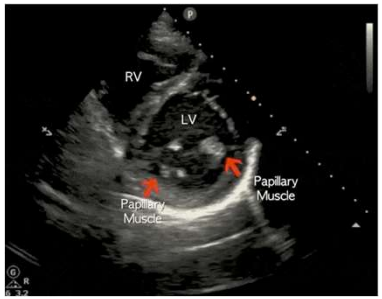

A4Ch



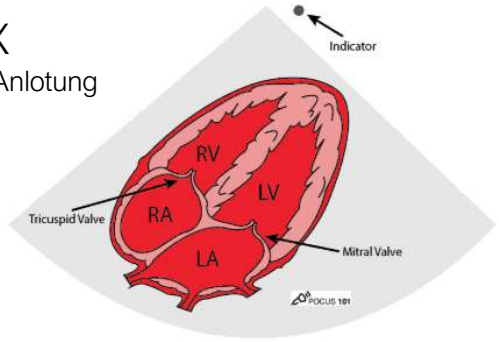

PSAX




SLAX

Notfall Anlotung

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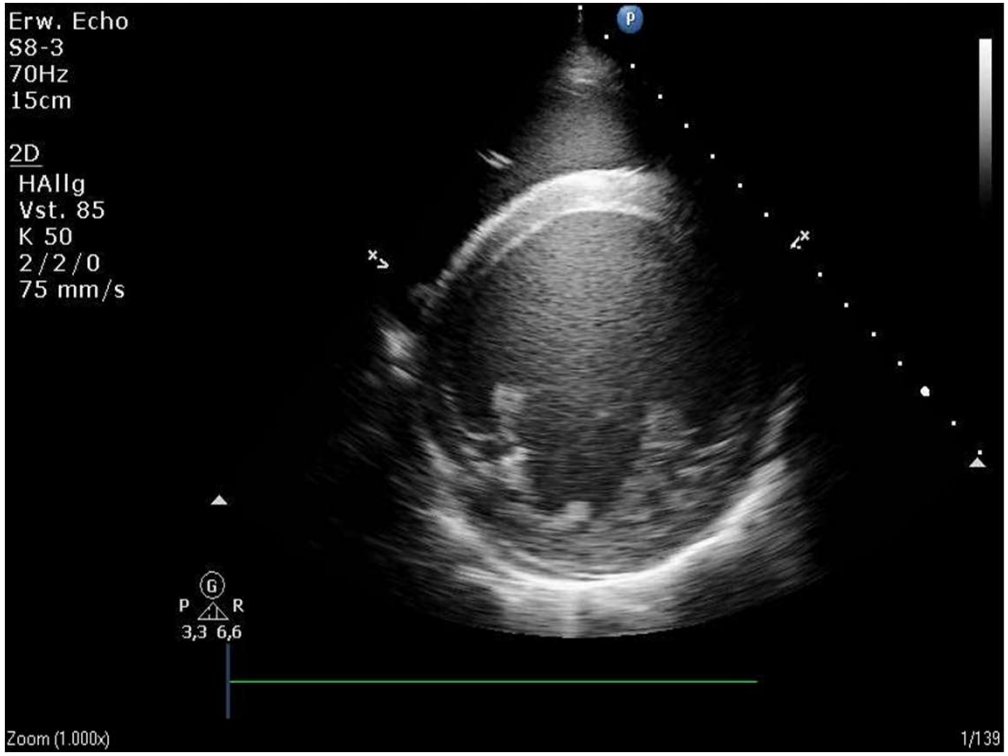
# ?? Geht – Steht –Klatsch ??



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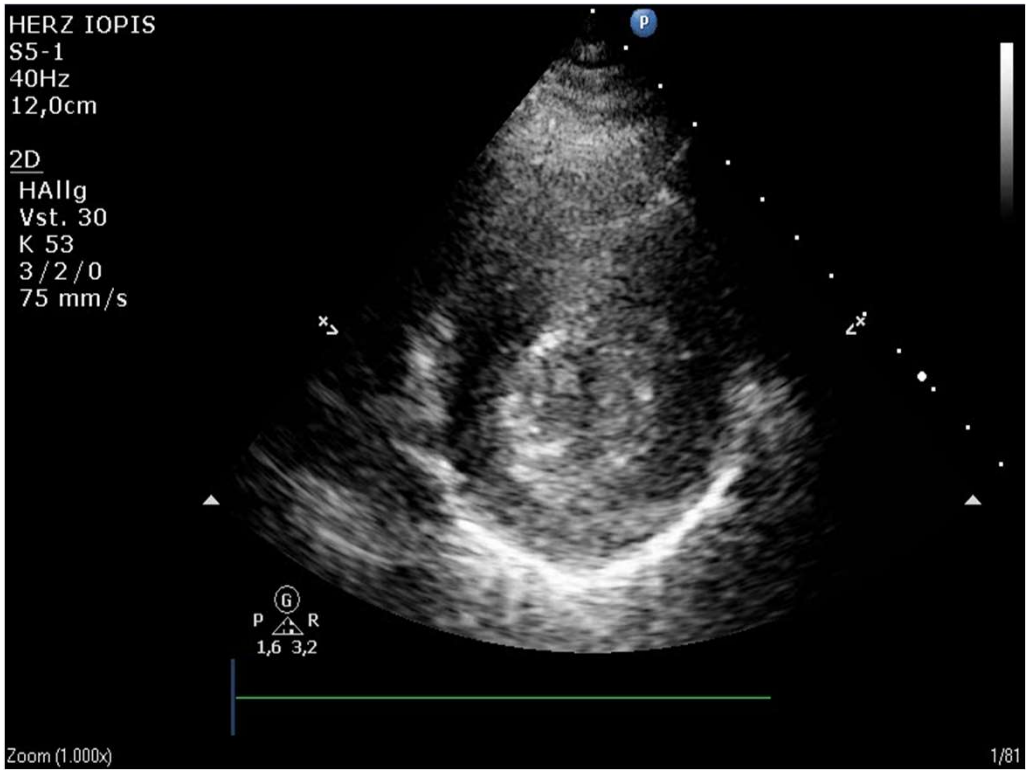
# ?? Geht – Steht –Klatsch ??



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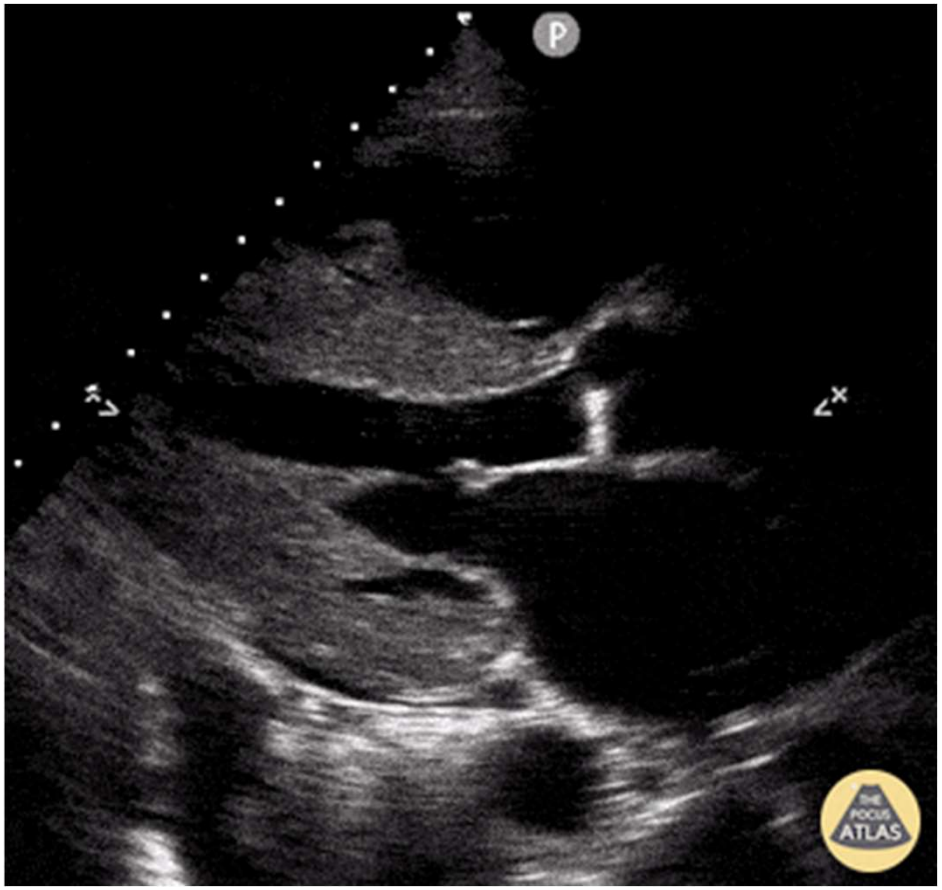
# ?? Geht – Steht –Klatsch ??



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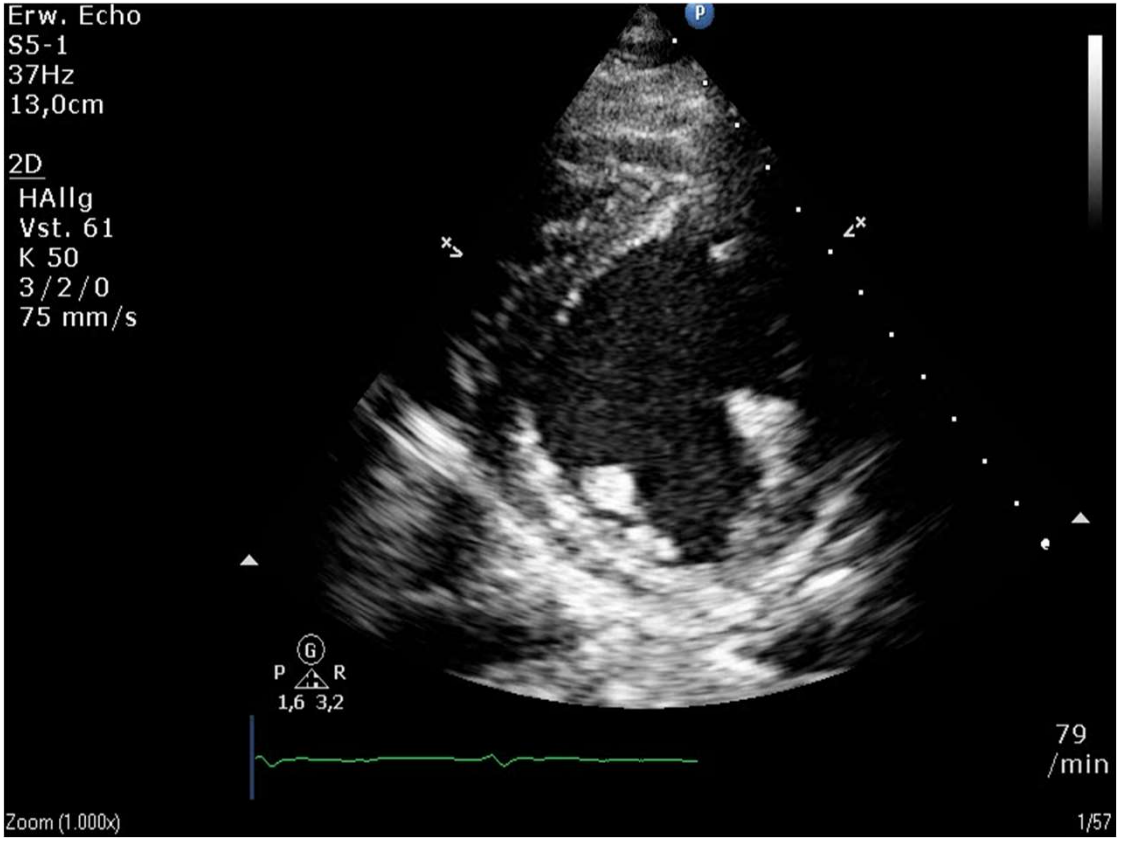
# ?? Geht – Steht –Klatsch ??



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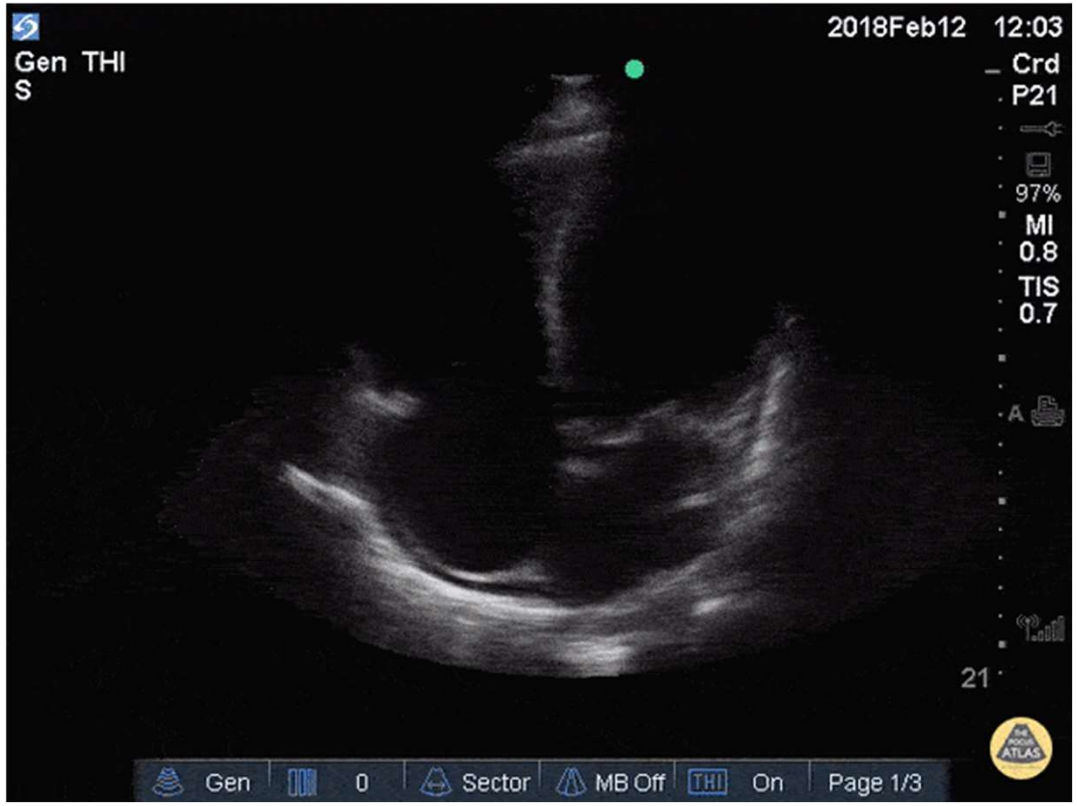
# ?? Geht – Steht –Klatsch ??



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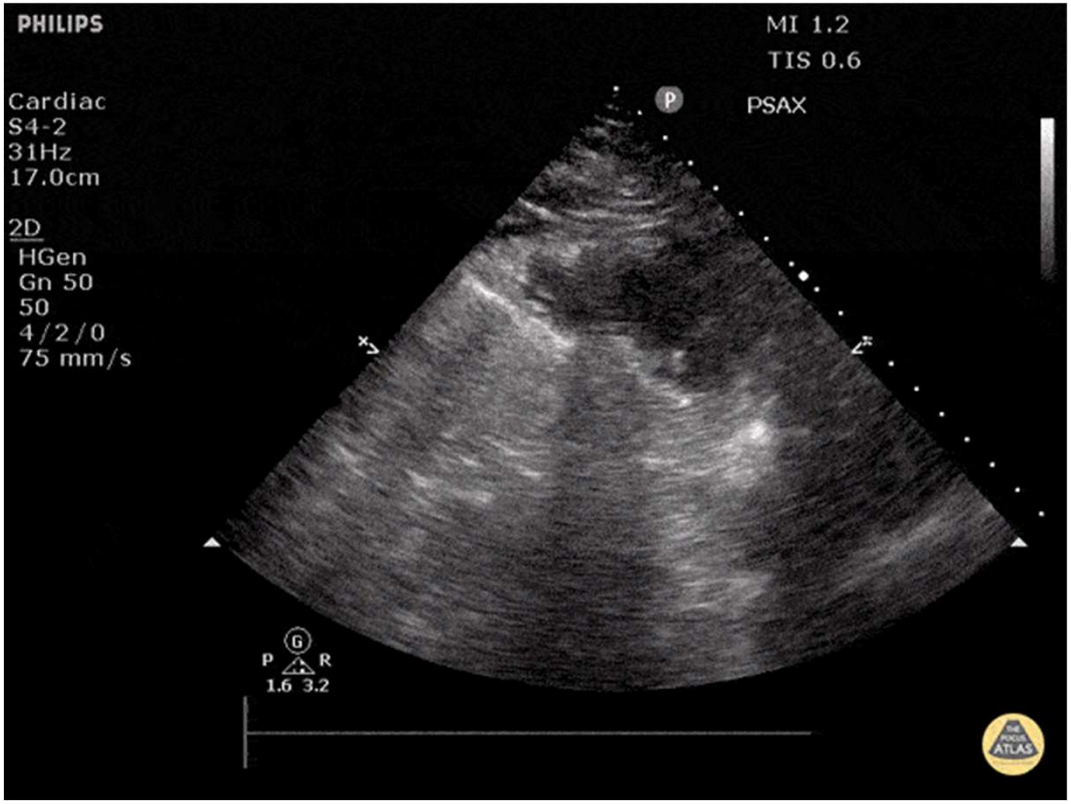
# ?? Geht – Steht –Klatsch ??



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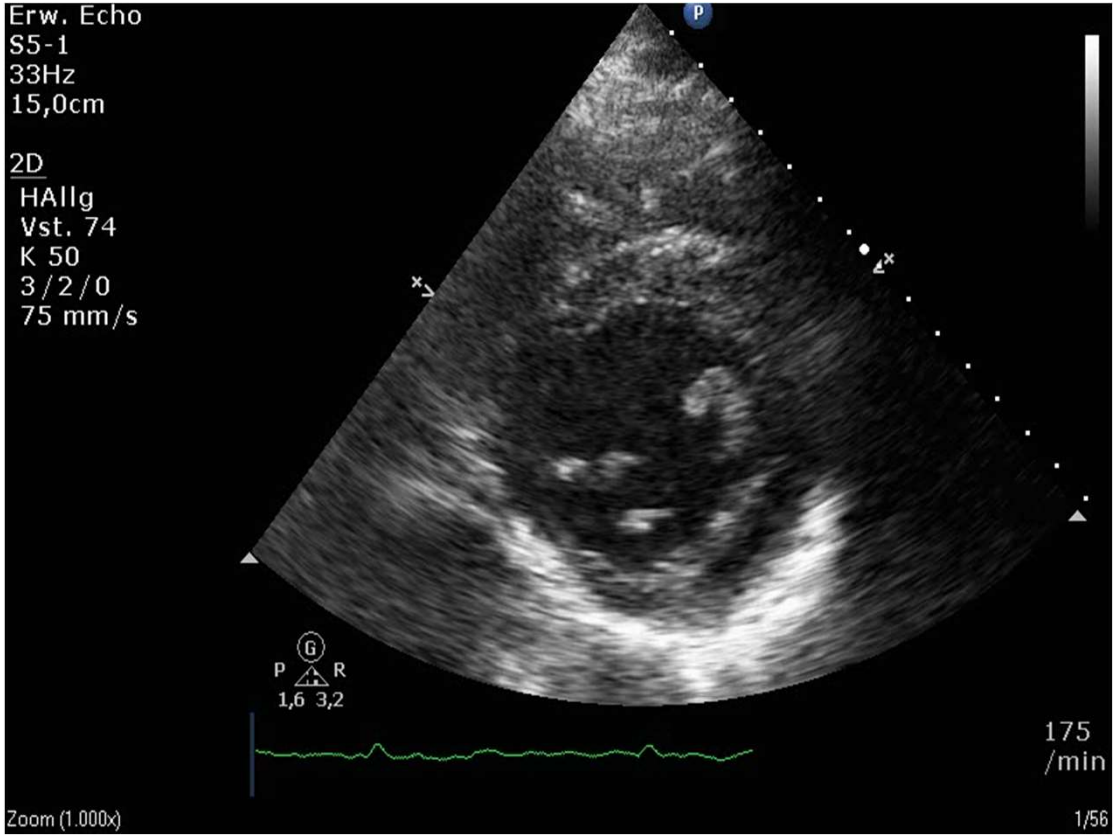
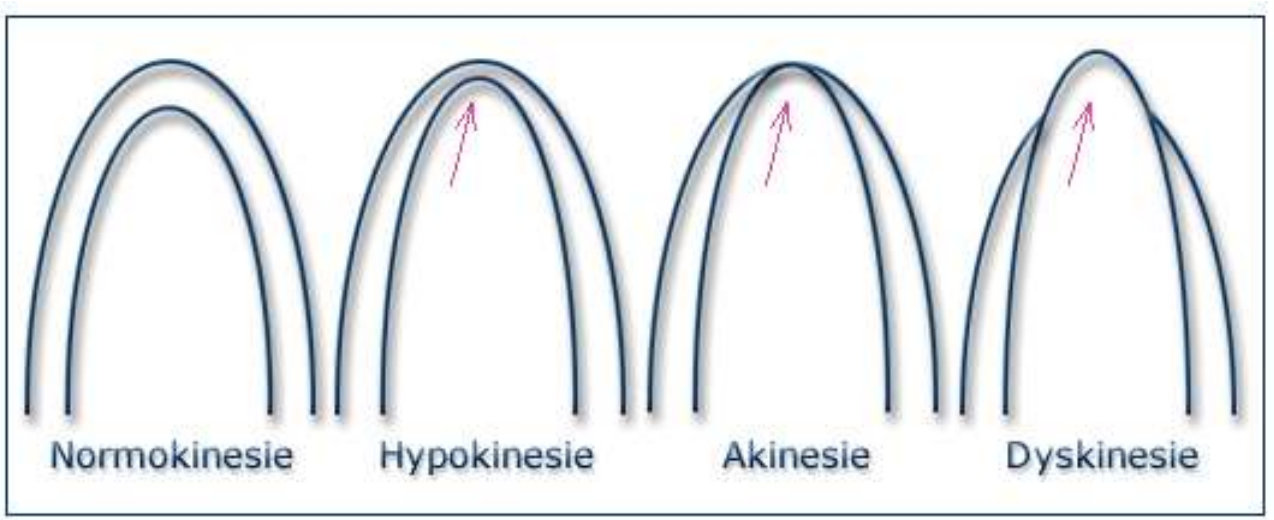
# ?? Geht – Steht –Klatsch ??



# Beurteilung der regionalen Wandbewegung




| | | | | |
|---|---|---|---|---|
| Wandbewegung | nach innen | nach innen aber weniger | keine | nach aussen |
| Wanddickenzunahme | 30- 50% | 10- 30% | < 10% | Paradoxe Bewegung |

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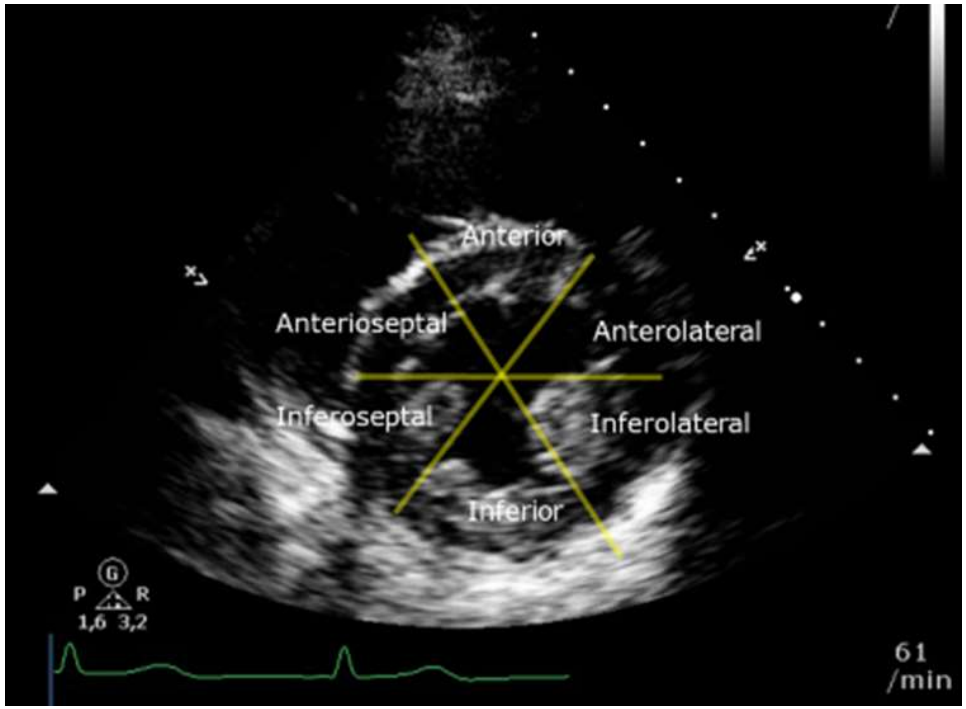
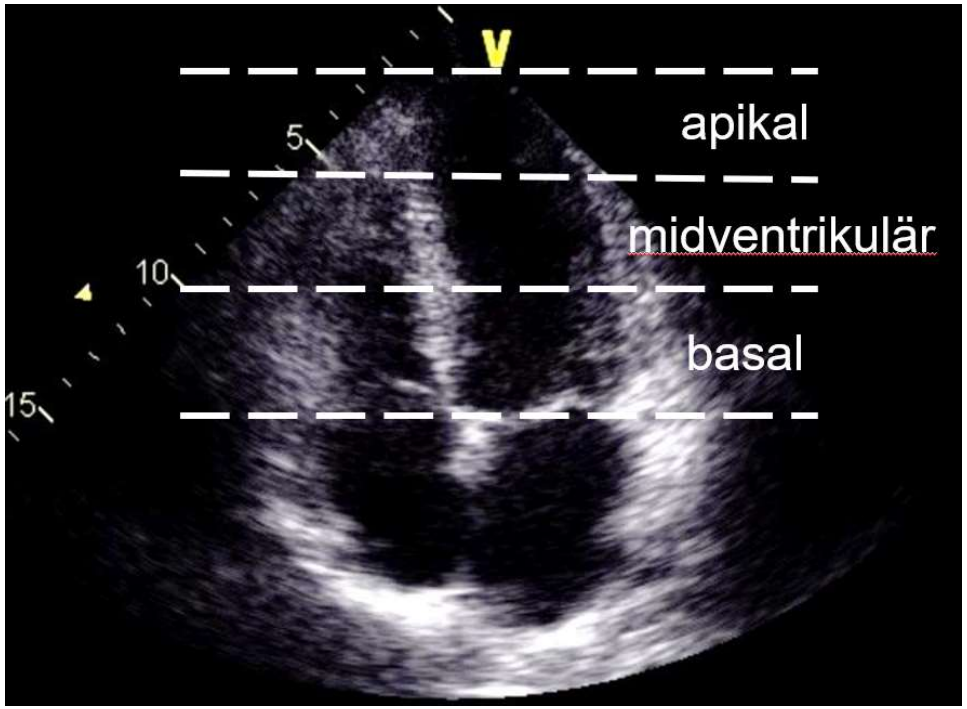
# LV Wandsegmente zur Beschreibung von RWBS



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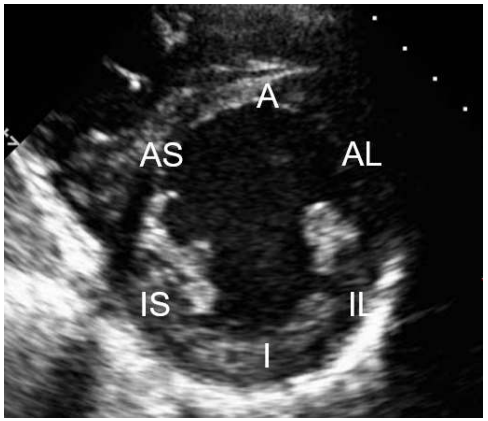
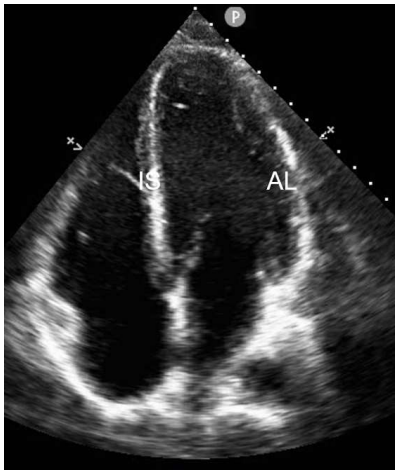
# Welche Anlotung zur genauen Beurteilung von RWBS?

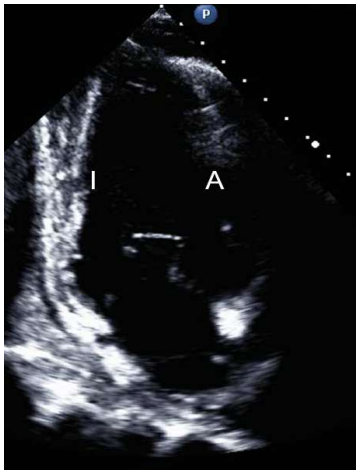
PSAX



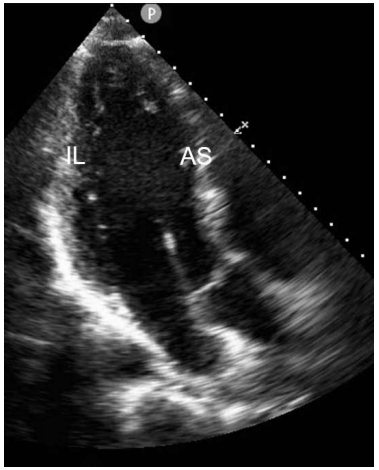

A4Ch

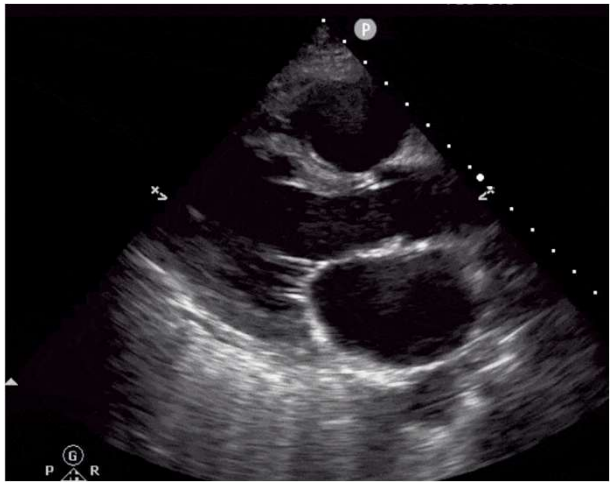



A2Ch

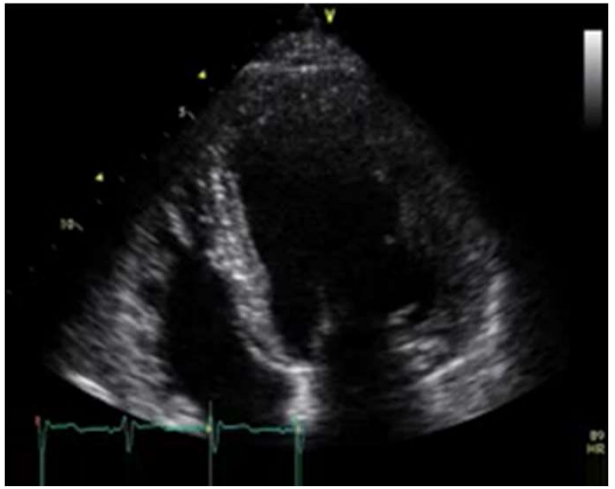


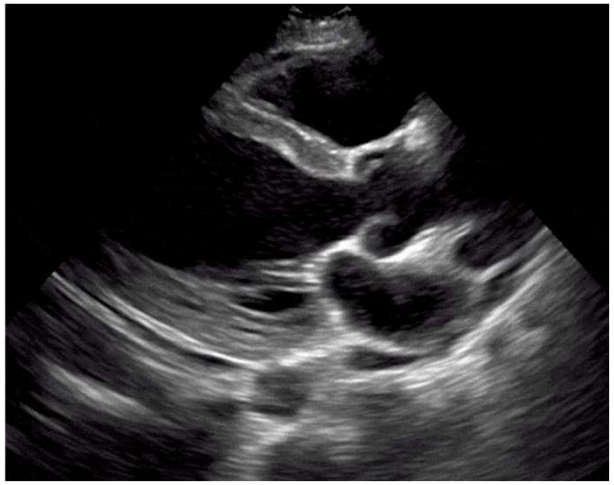

A3Ch (PLAX)



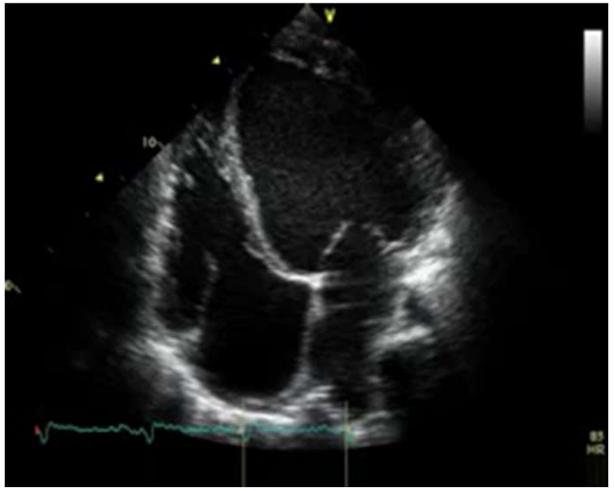


Mässig reduzierte LV EF
30- 40%





Stark reduzierte LV EF
< 30%



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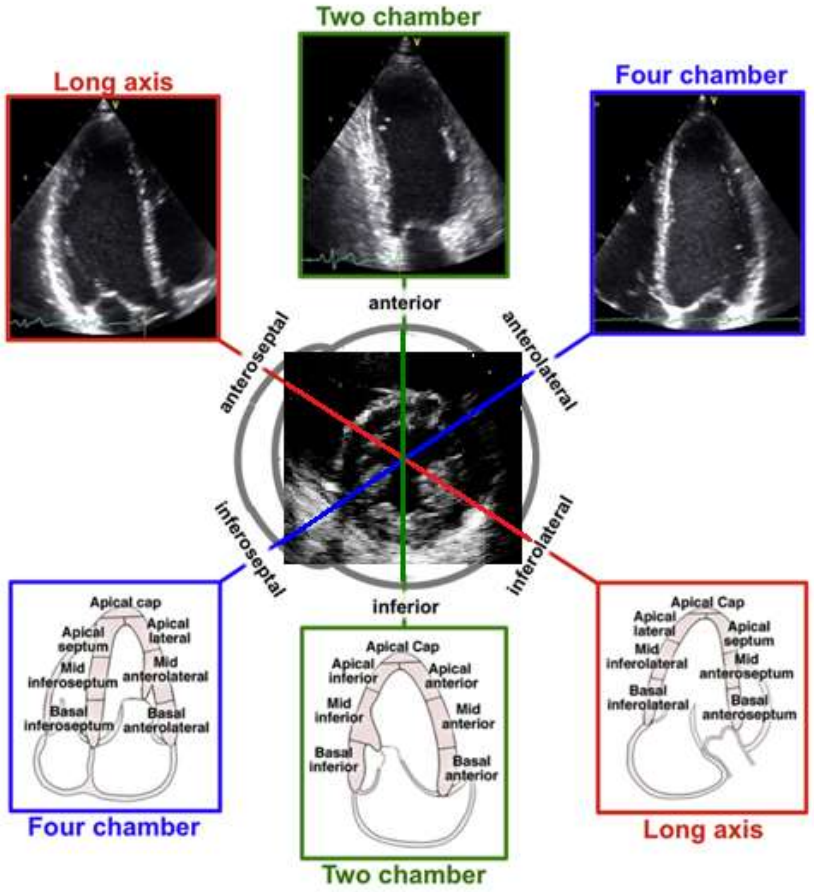
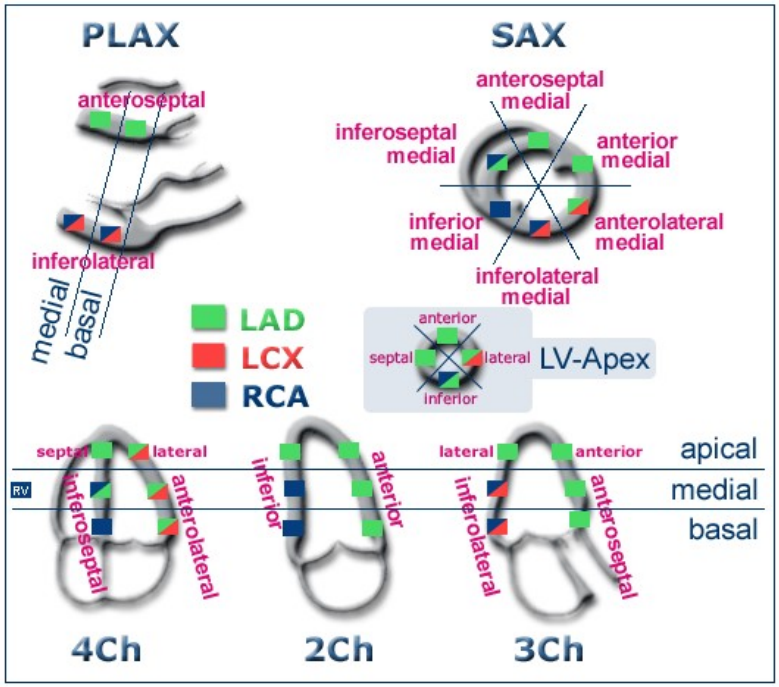
# Linksventrikuläre Wandsegmente und Koronarversorgung



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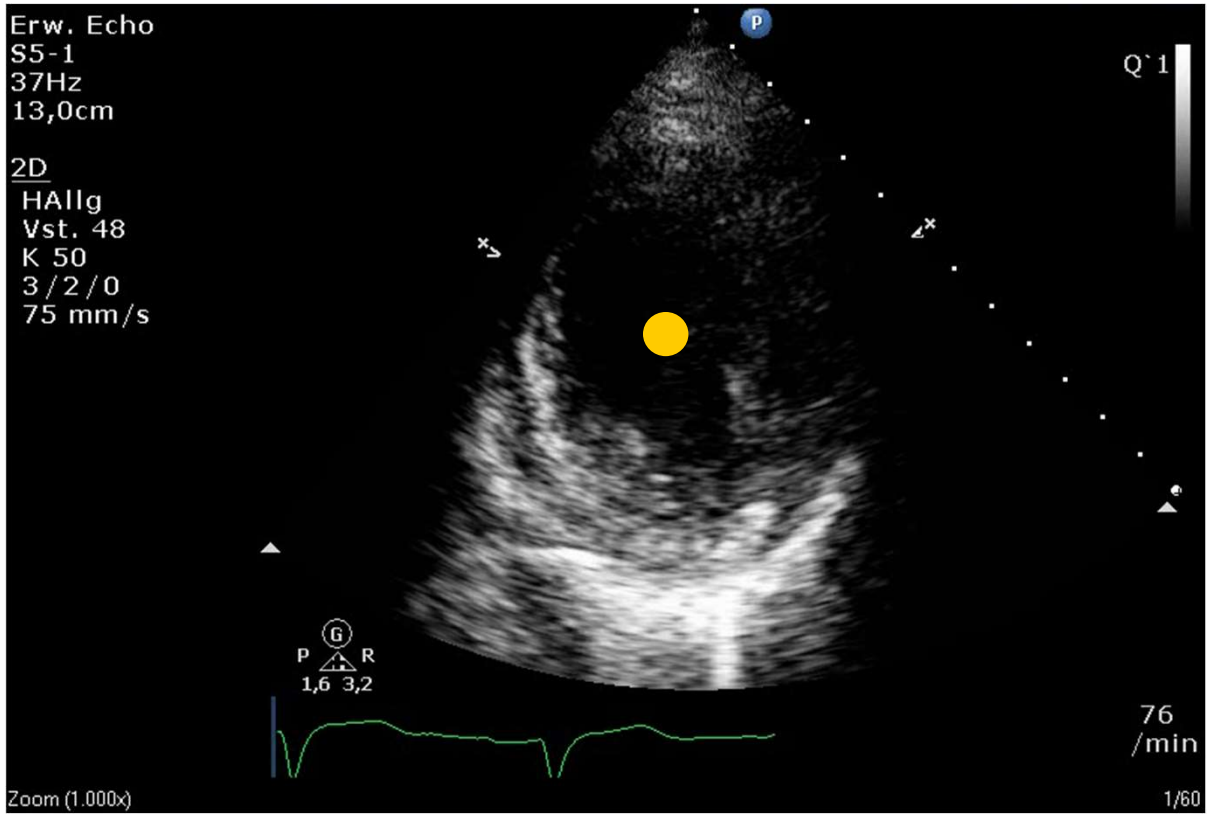
# RWBS – wo??



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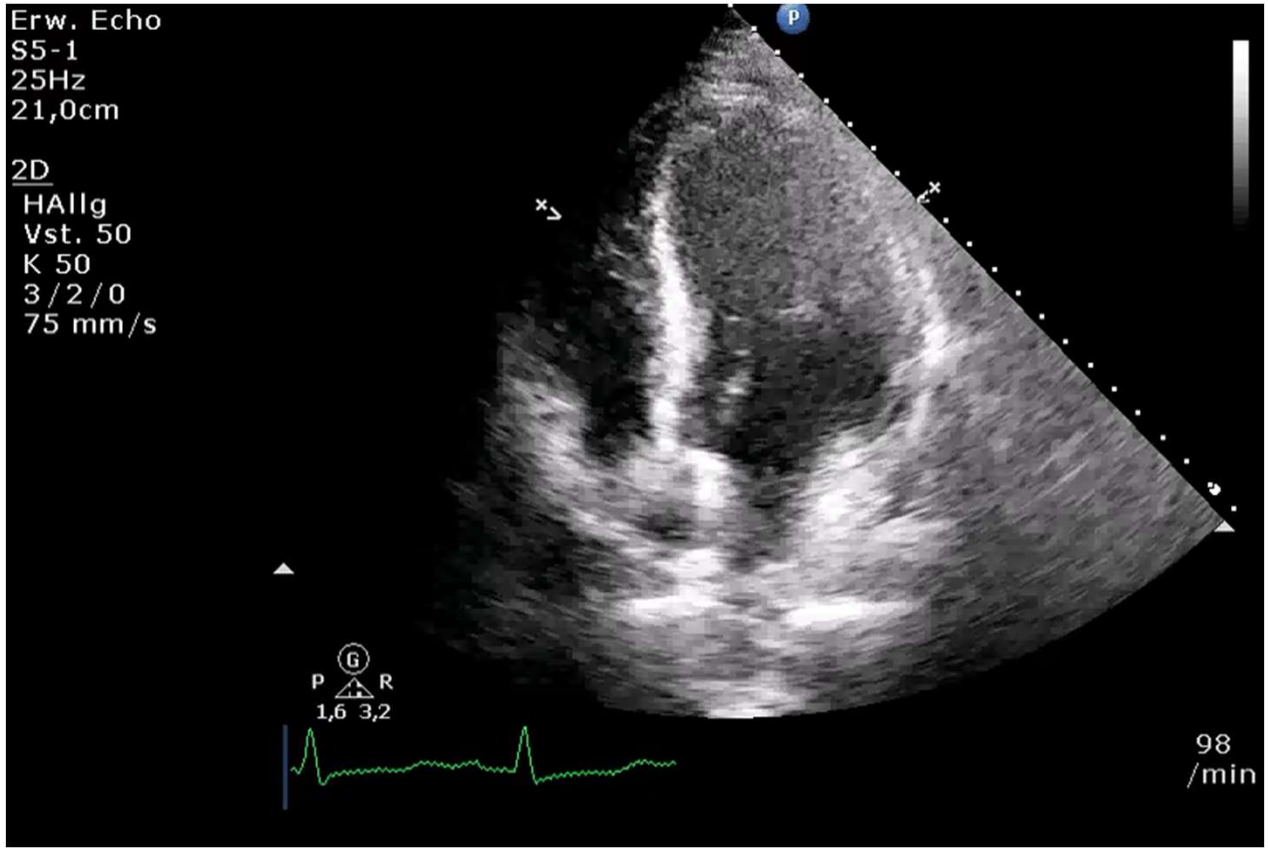
# RWBS – wo??



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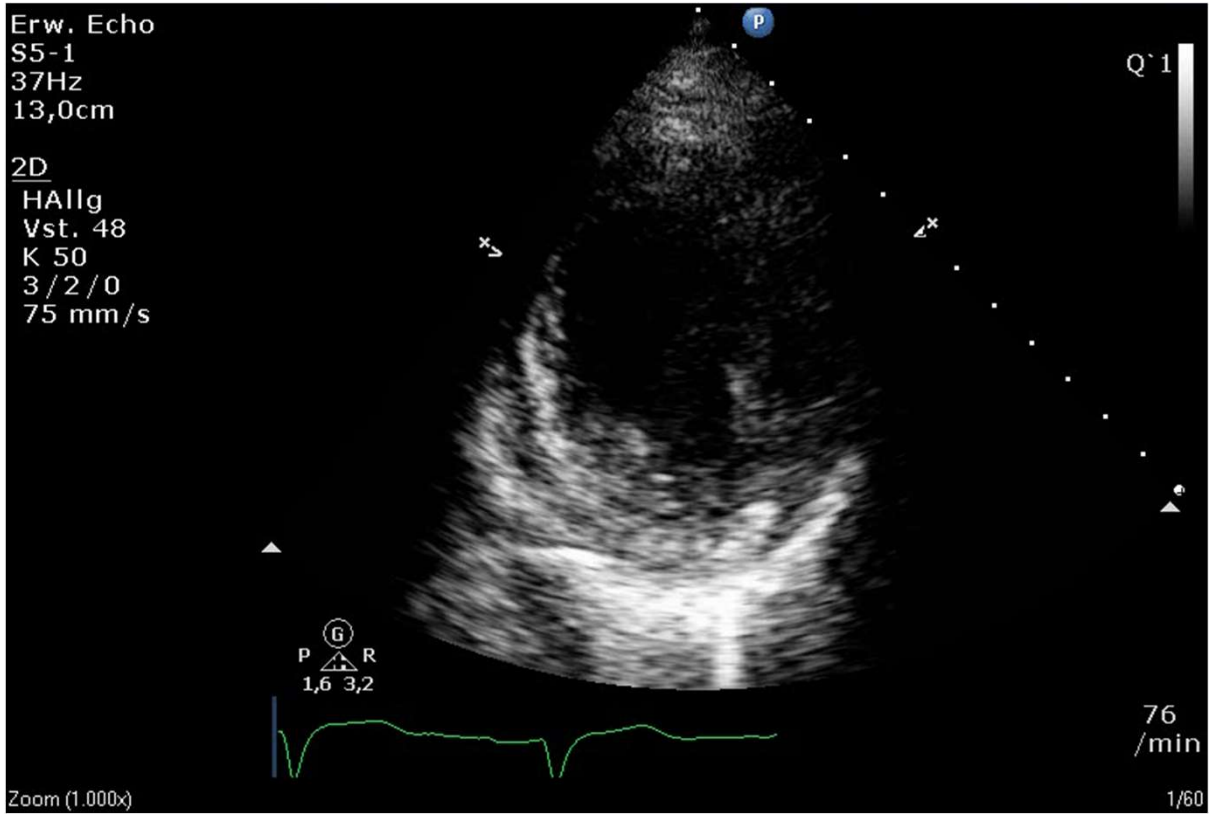
# RWBS – wo??



# Messungen

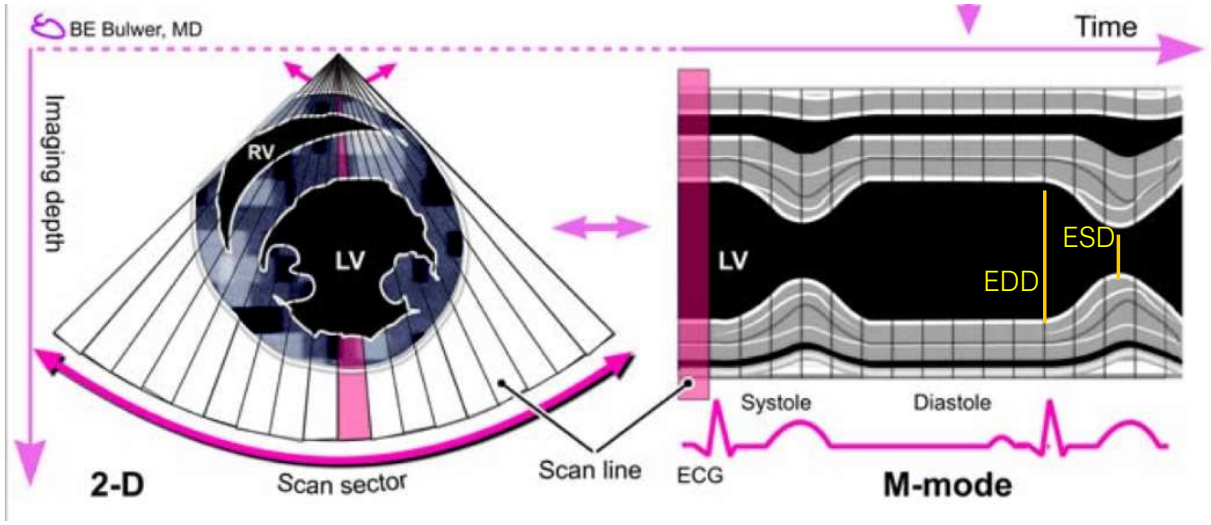
## …um das Gesehene zu bestätigen

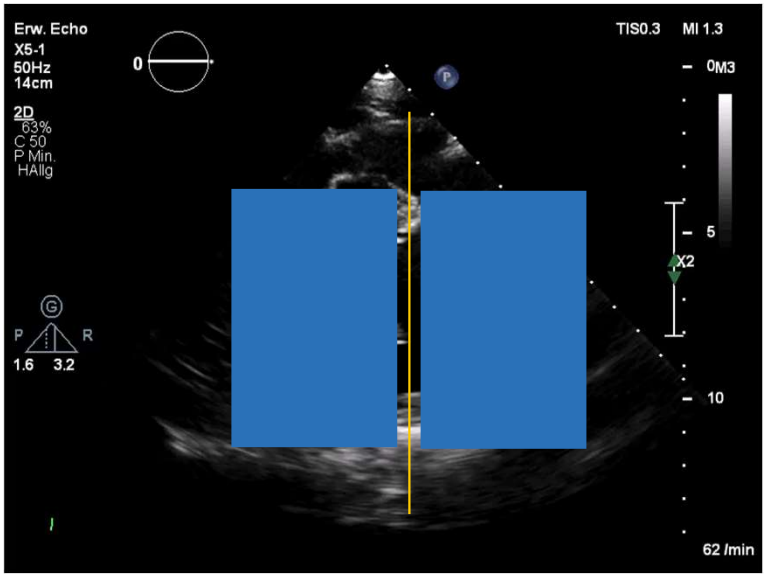
- Fractional Shortening FS
- Fractional Area Change FAC
- Mitral Annular Plane Systolic Excursion MAPSE

- EF nach Simpson

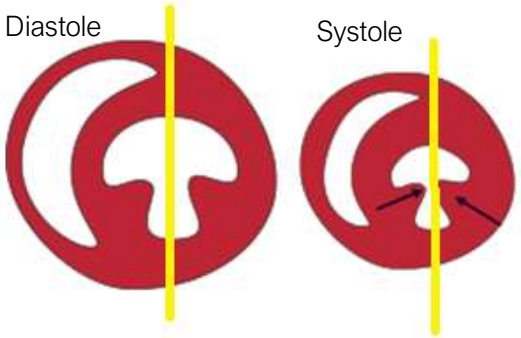
- LV Grösse und LV Dicke

# M(otion)- Mode



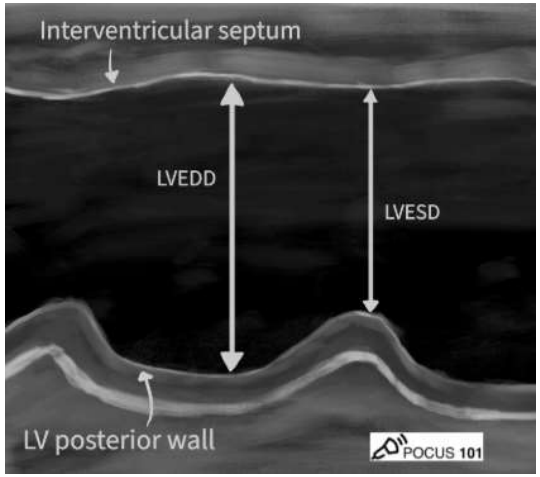



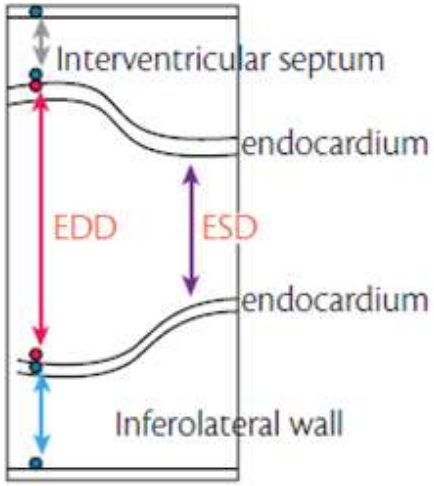

- hohe zeitliche Auflösung aber **eindimensionale** Messung



# FS - Fractional Shortening

- 1-D Messung über M- Mode (in PSAX oder PSLAX)
- Prozentuale linksventrikuläre Querschnittsverkürzung (ohne Volumenberechnung)
- Abschätzung der LV Funktion durch Messung des LIVDd und LVIDs
- Cave: begrenzte Aussage bei RWBS



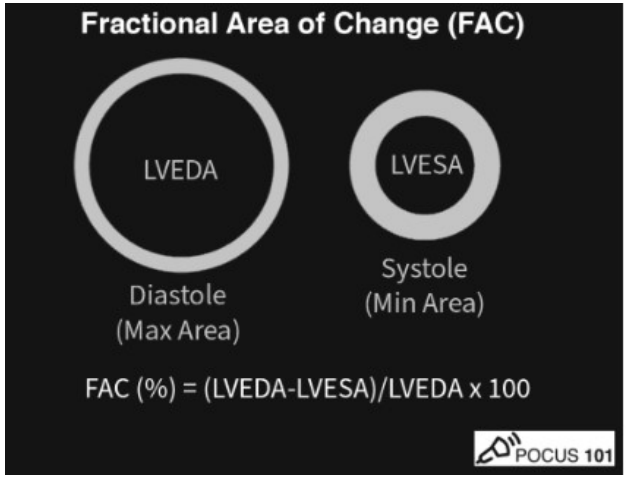



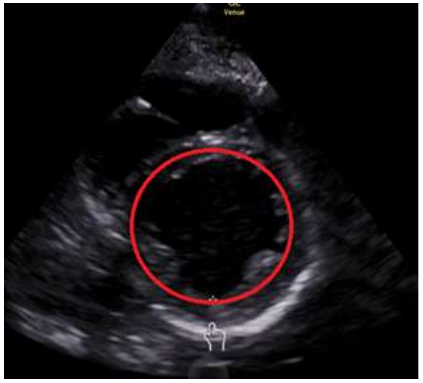

**FS (%) = (LVEDD-LVESD)/LVEDD x 100**

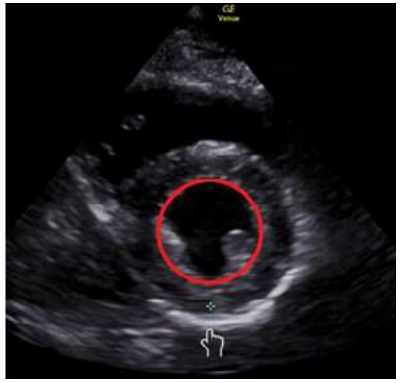
| Normal | Eingeschränkt |
|---|---|
| > 25 – 45% | < 25% |

# FAC - Fractional Area Change

- 2- D Messung (in PSAX)
- Prozentuale linksventrikuläre Flächenänderung des LV Cavums (ohne Volumenberechung)
- cave: begrenzte Aussage bei RWBS



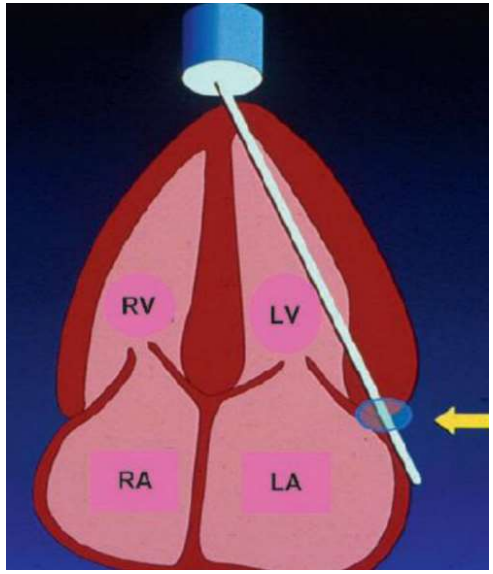



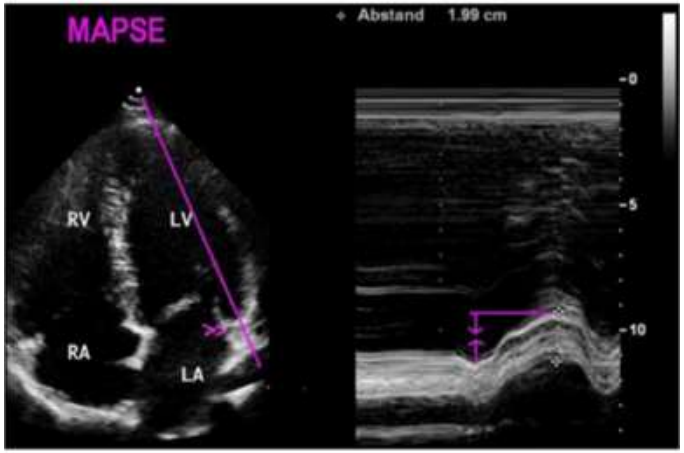


| Normal | Eingeschränkt |
|---|---|
| > 40% | < 35% |

# MAPSE - Mitral Annular Plane Systolic Excursion

- Quantitative Beurteilung der **longitudinalen** LV Funktion
- M- Mode Messung der Bewegung des lateralen Mitralklappenanulus




| Normal | Eingeschränkt |
|---|---|
| > 10mm | < **7mm** (schwer) |

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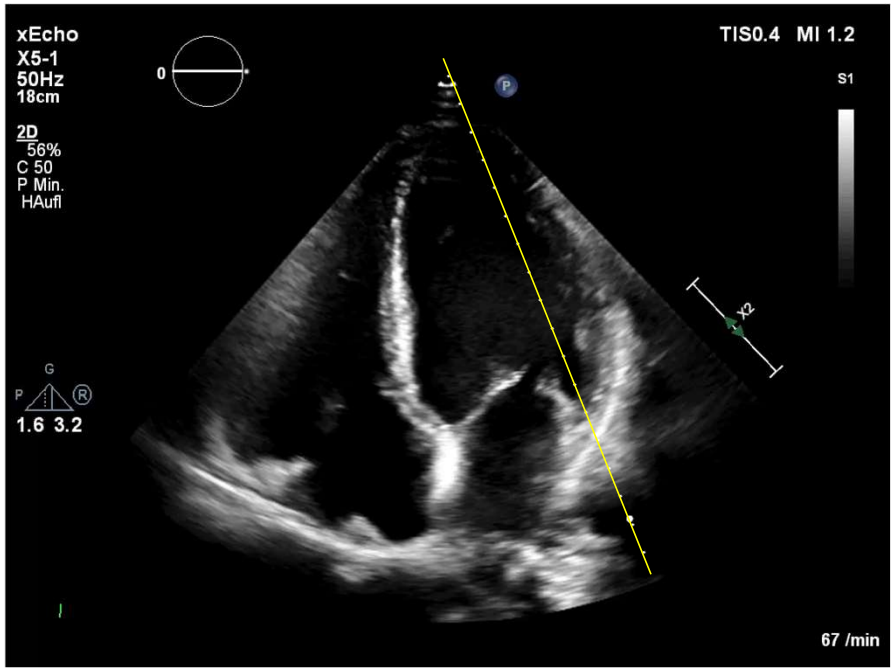
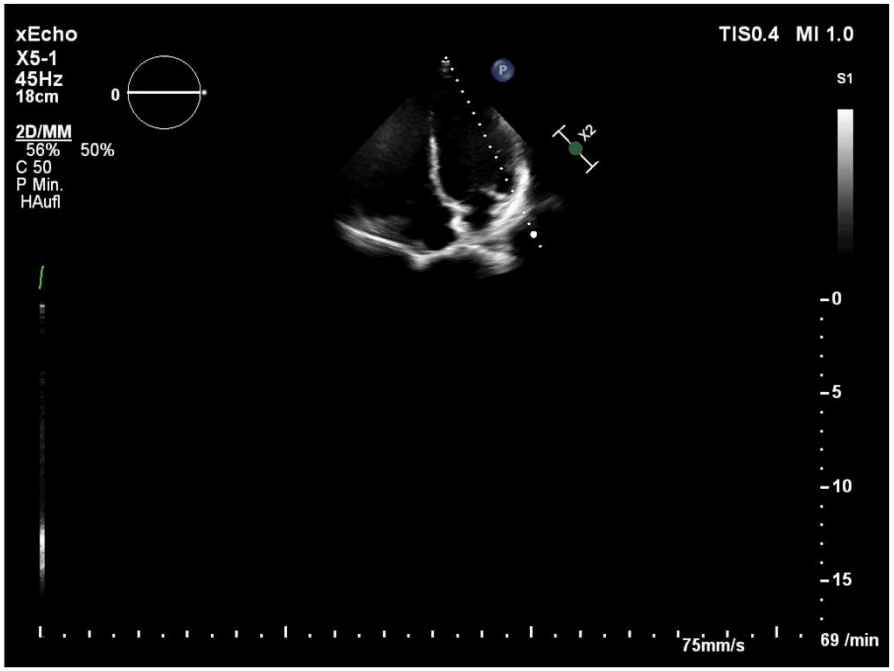
# MAPSE



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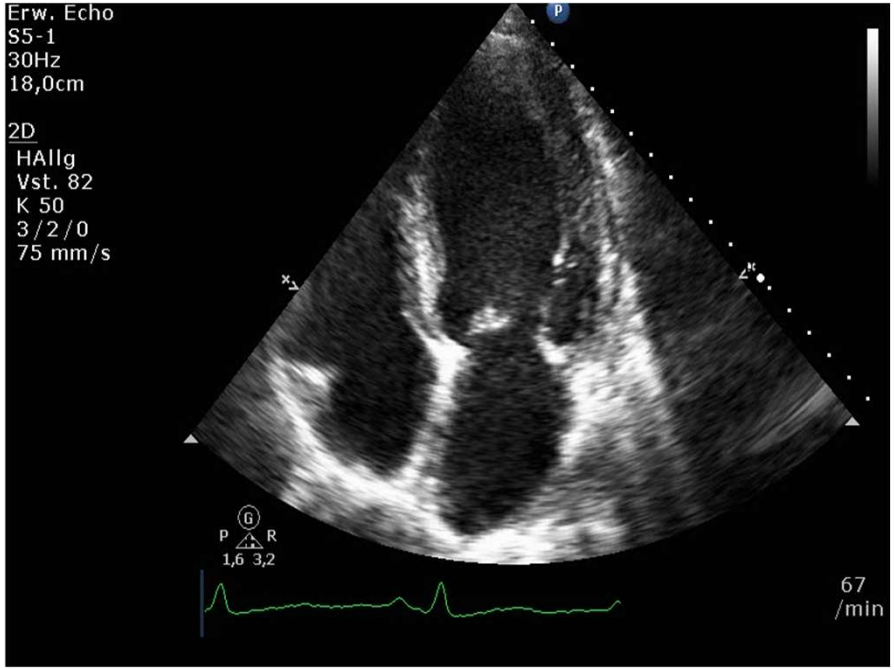
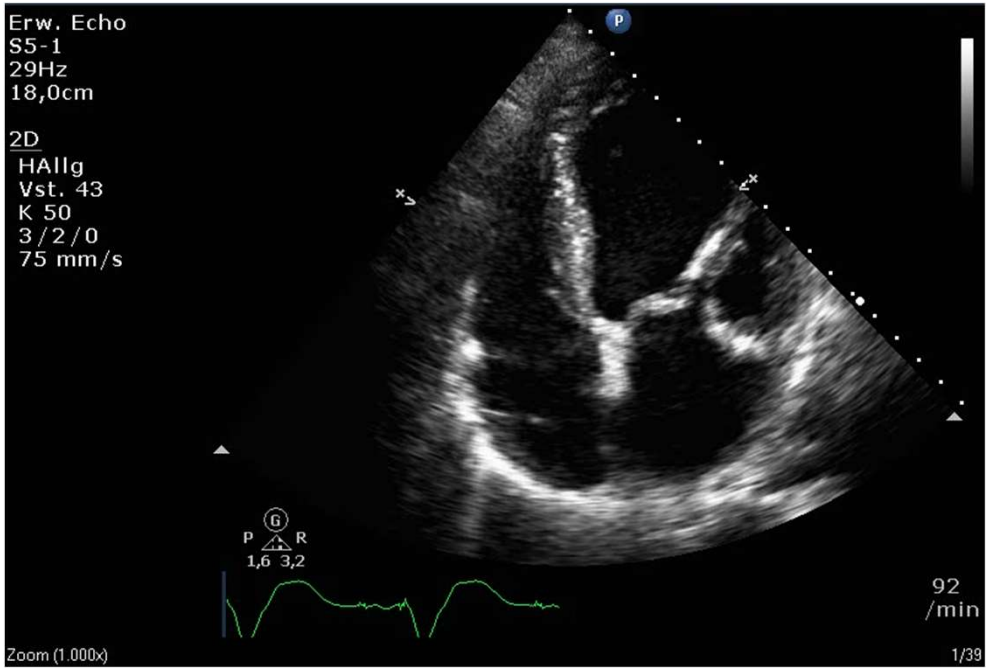
# MAPSE

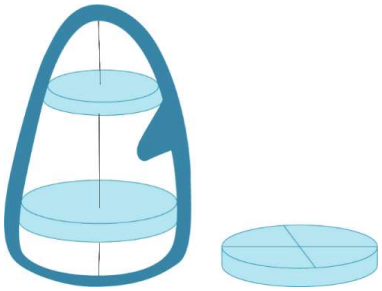


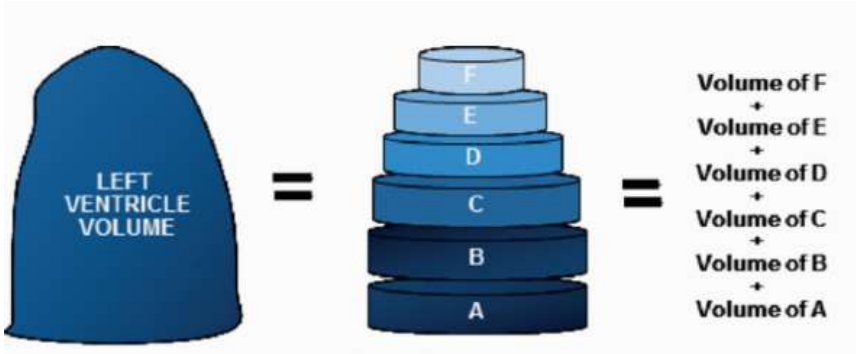



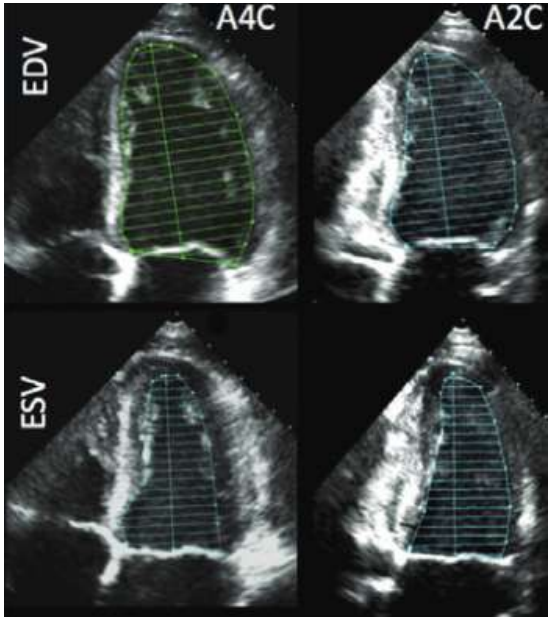
# EF nach Simpson

Scheibchensummationsmethode

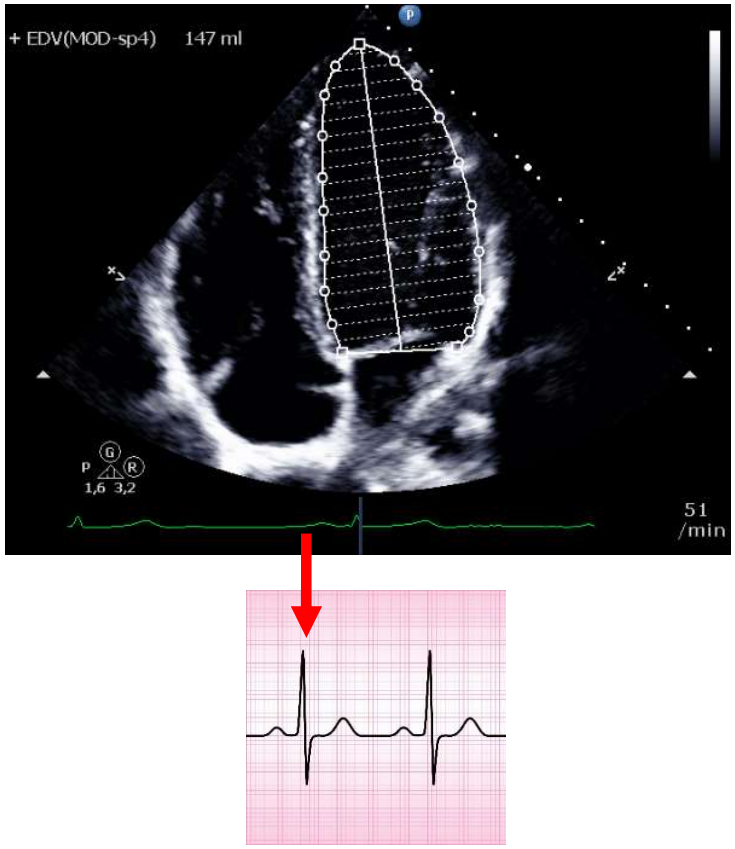
- 20 Scheiben → Messung und Summierung des Volumens jedes Scheibchens enddiastolsich und endsystolisch
- mono- oder biplane Messung: A4Ch und A2Ch



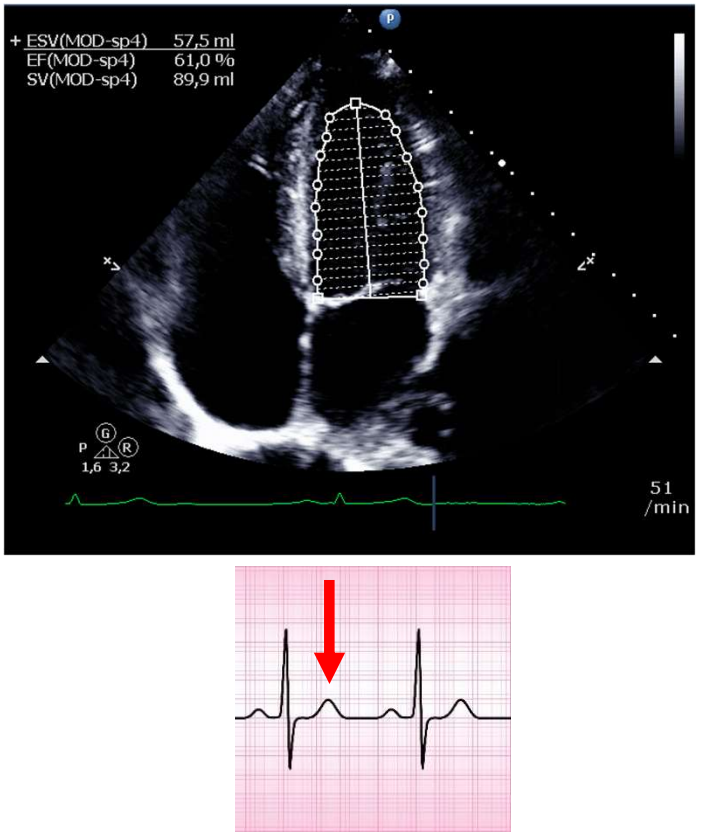


# EF nach Simpson




End- diastolisch




End- systolisch

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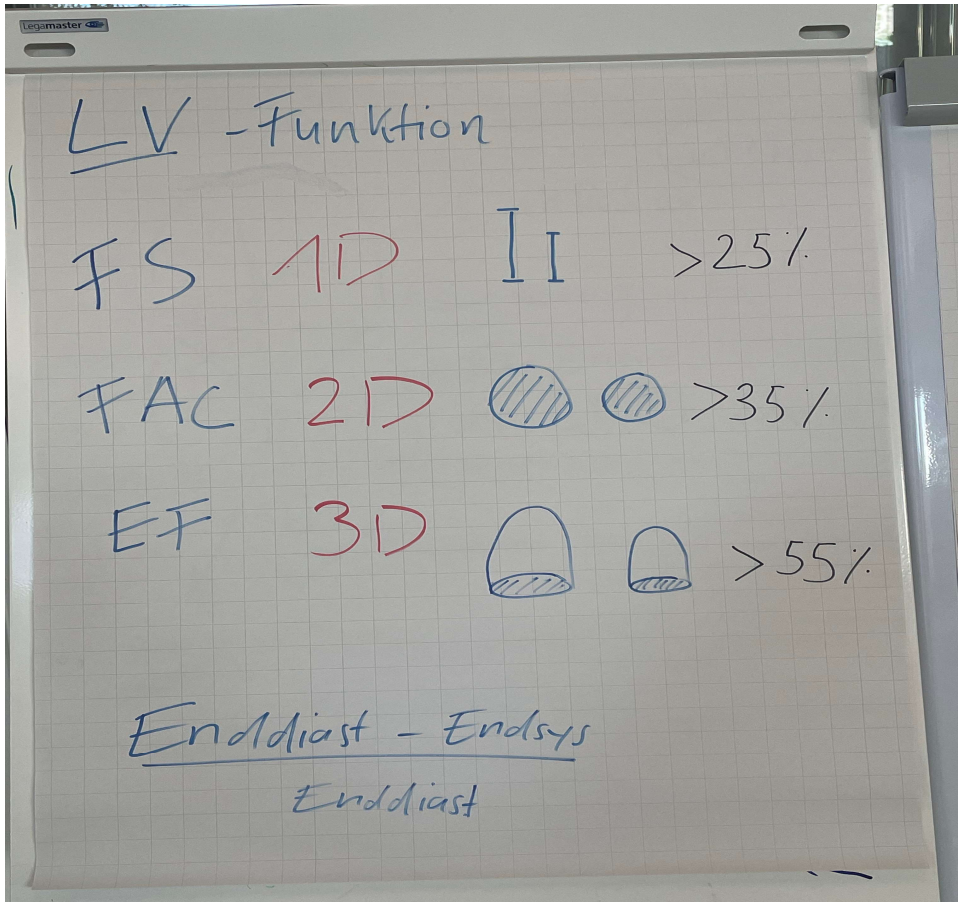
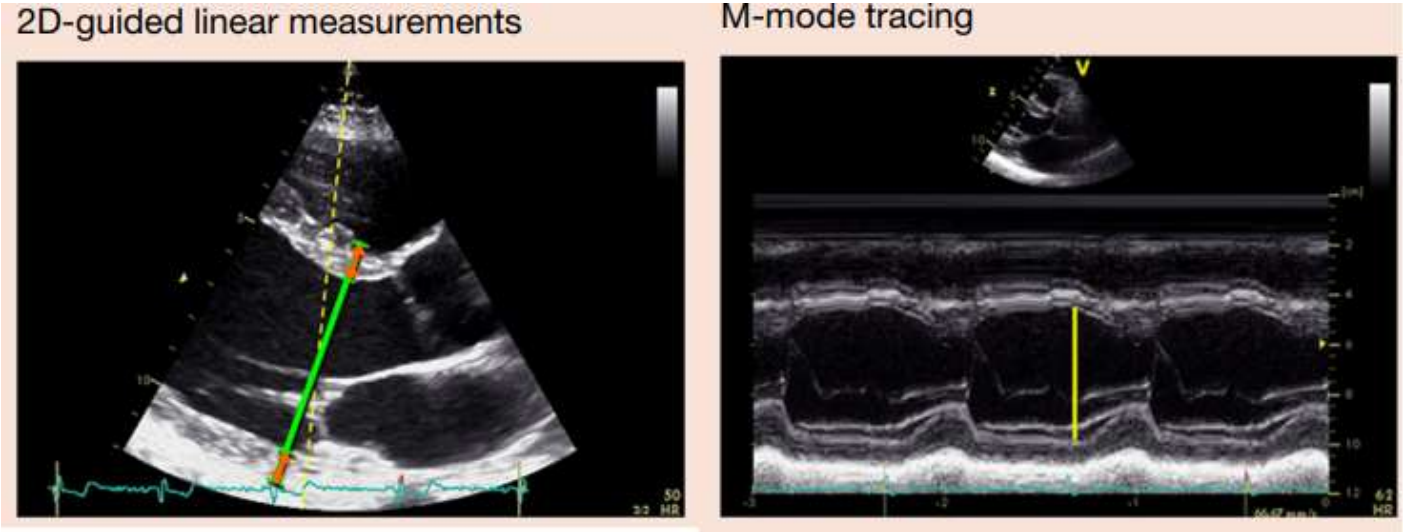
# Zusammenfassung Messungen



# Linksventrikulärer Innendurchmesser

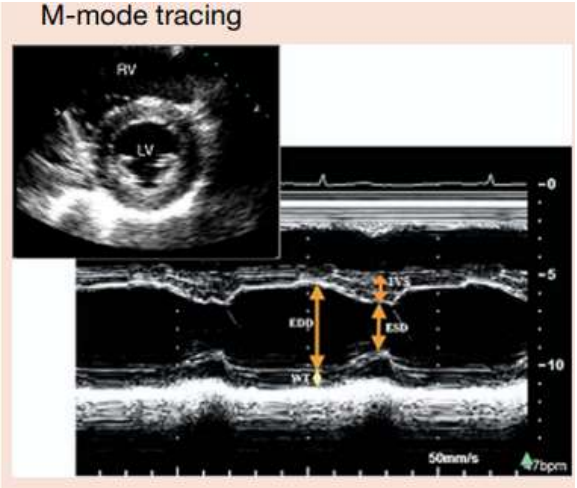
- Messung in PLAX unterhalb MK Spitze (2D oder M Mode Messung) am Ende der Diastole

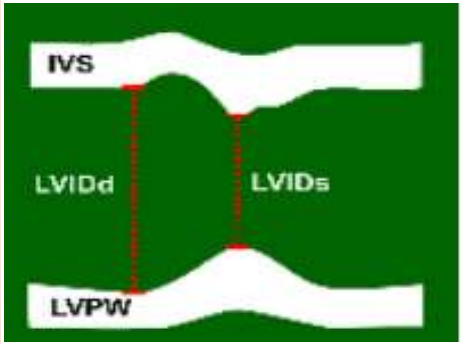



| | pathologisch |
|---|---|
| LV enddiastolischer Innendurchmesser LVIDd | > 55 mm |

# Linksventrikulärer Wanddicke

- Messung in PLAX oder PSAX (2D oder M Mode Messung) am Ende der Diastole


| | pathologisch |
|---|---|
| LV Wanddicke<br>(septal und posterior) | >12 mm |

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# Fragen?