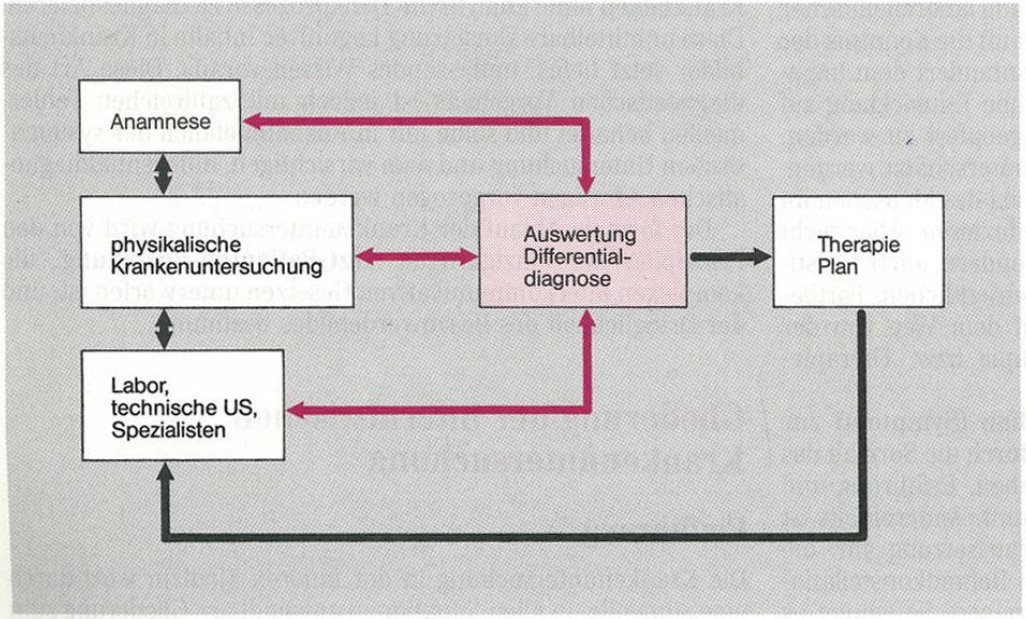
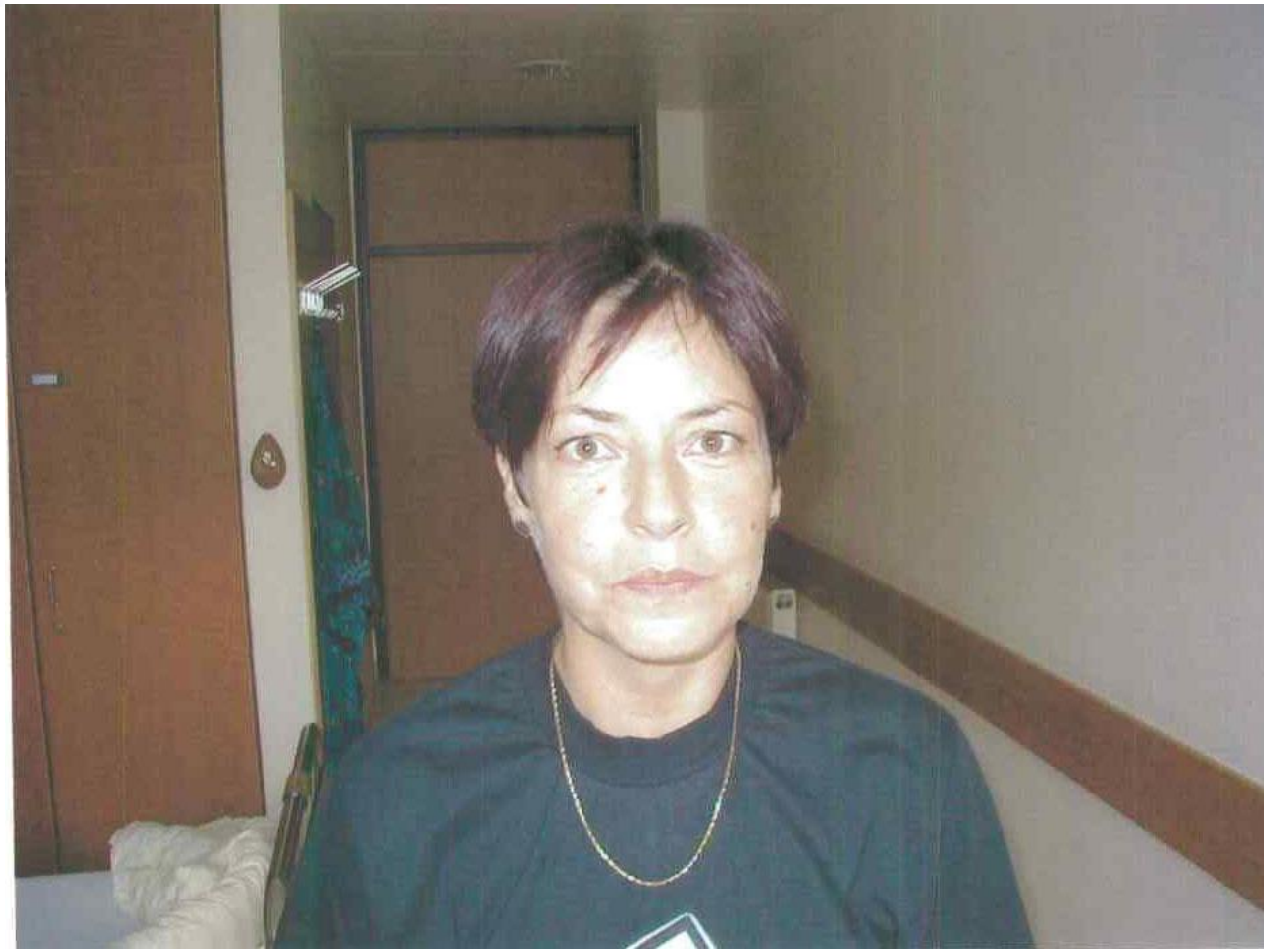
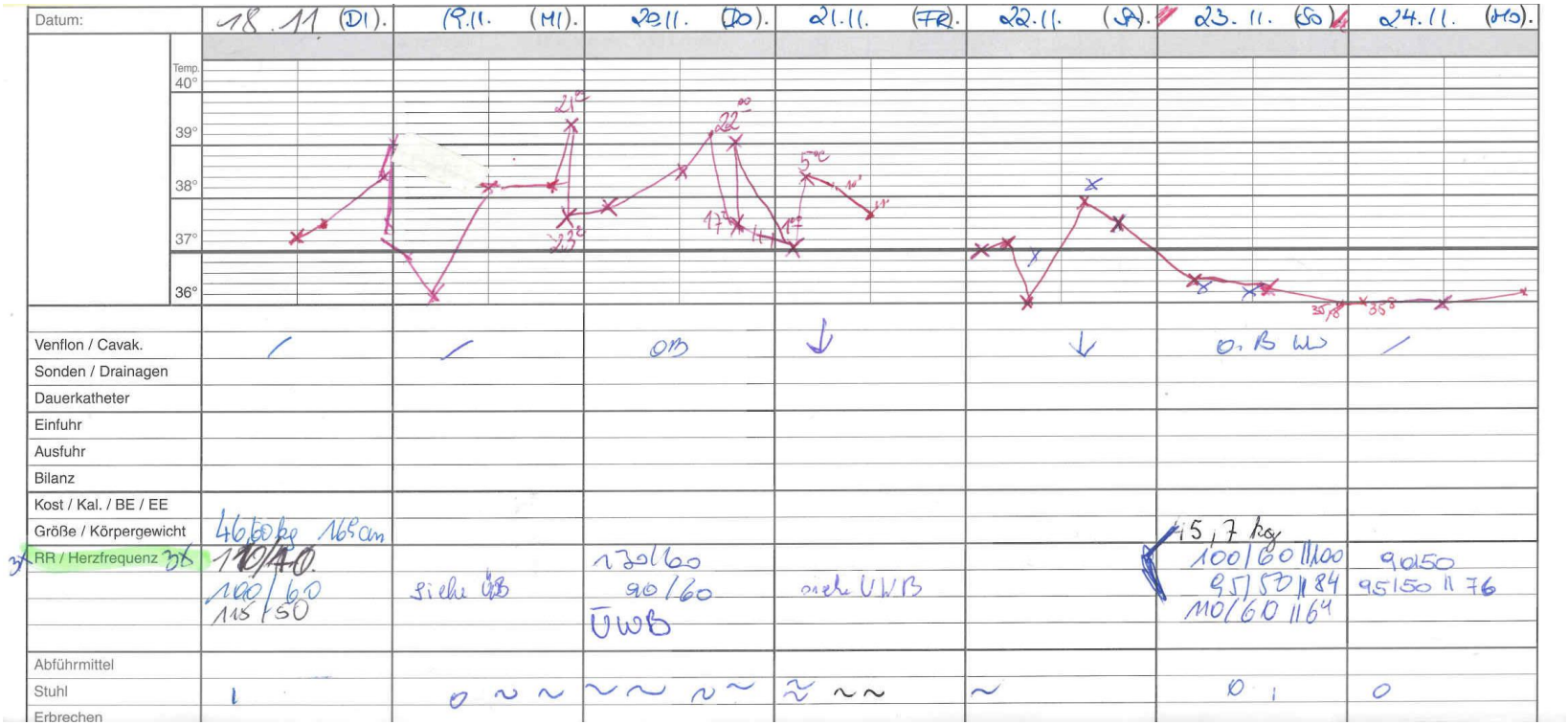
Clinical Decision-Making

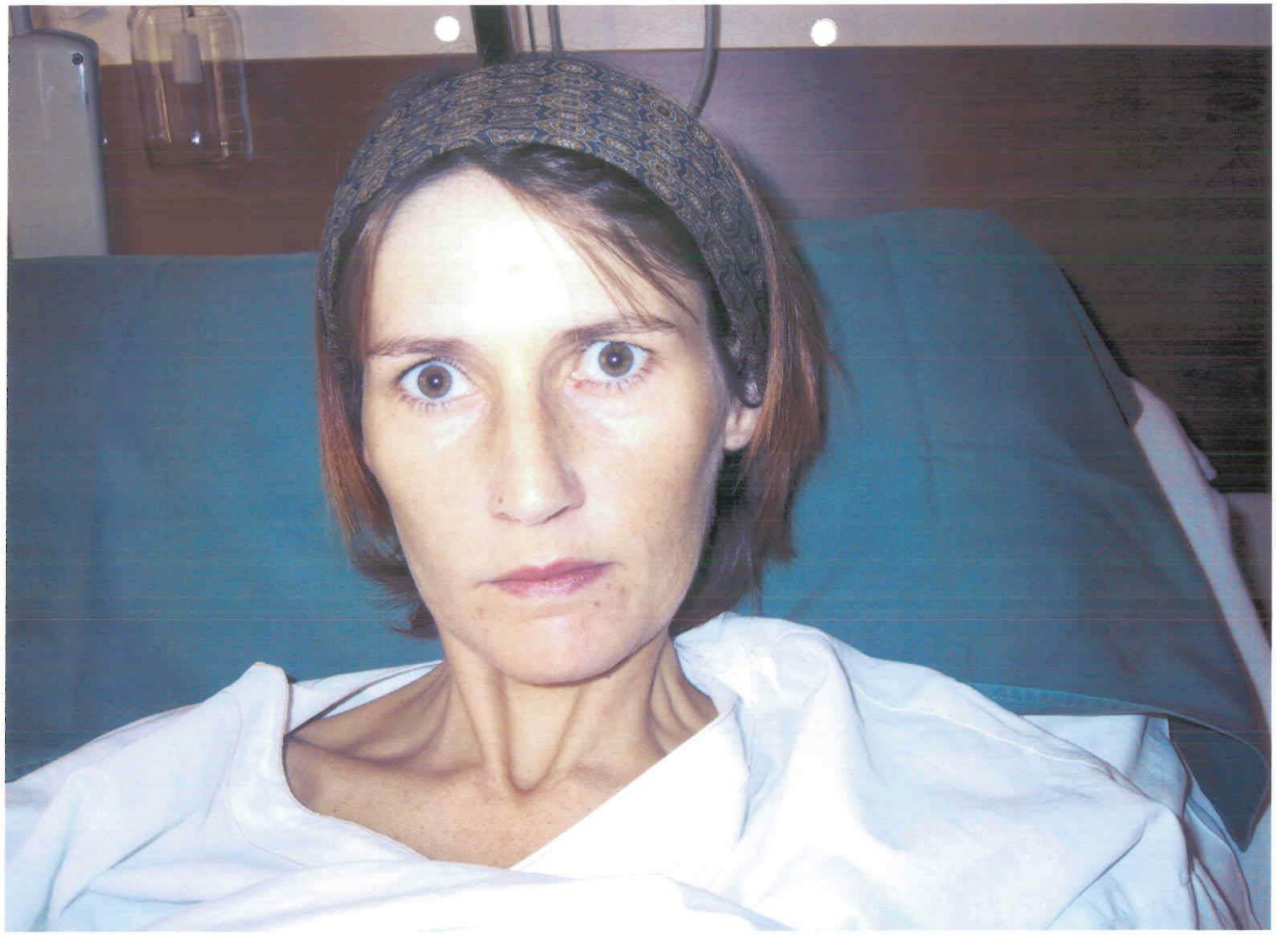


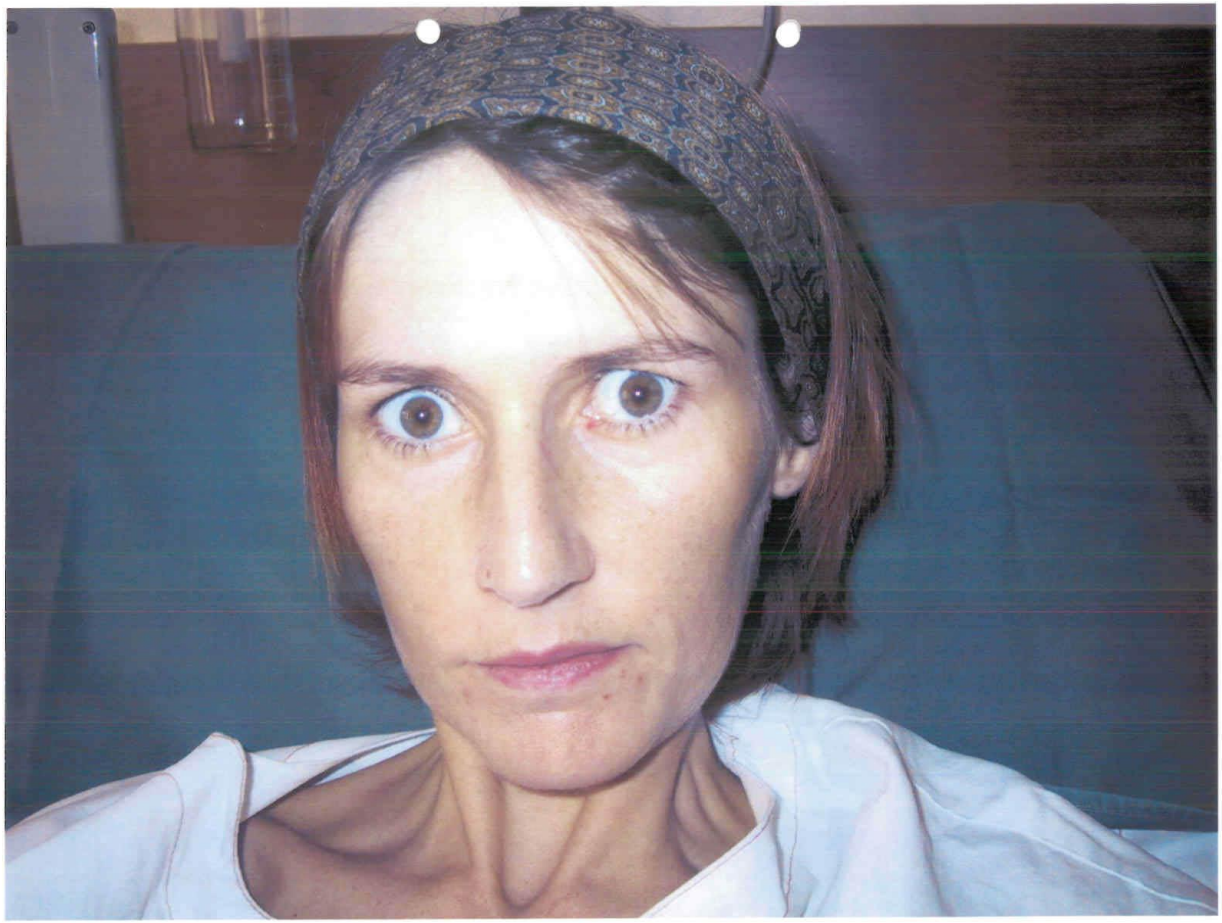
1. Untersuchungsgang bei inneren Erkrankungen



Symptomatologie







Evidence – Based Medicine

1. Formulating the management question to be answered
2. Searching the literature and on-line databases for applicable research data
3. Appraising the evidence gathered with regard to its validity and relevance
4. Integrating this appraisal with knowledge about the unique aspects of the patient (including preferences)

Clinical Decision-Making

Einteilung der Evidenzgrade (nach ÄZQ 1999; SIGN 1999)

Grad	Art der Evidenz
I-a	Evidenz aufgrund von Metaanalysen randomisierter, kontrollierter Studien
I-b	Evidenz aufgrund mindestens einer randomisierten, kontrollierten Studie
II-a	Evidenz aufgrund mindestens einer gut angelegten, kontrollierten Studie ohne Randomisierung
II-b	Evidenz aufgrund mindestens einer gut angelegten, quasi-experimentellen Studie
III	Evidenz aufgrund gut angelegter, nicht experimenteller deskriptiver Studien (z. B. Vergleichsstudien, Korrelationsstudien, Fall-Kontroll-Studien)
IV	Evidenz aufgrund von Berichten/Meinungen von Expertenkreisen, Konsensuskonferenzen und/oder klinischer Erfahrung anerkannter Autoritäten

Einstufung von Leitlinienempfehlungen in Empfehlungsklassen (nach AHCPR 1993; SIGN 1999)

Empfehlungsstärke	Beschreibung
A Evidenzgrade Ia, Ib	Belegt durch schlüssige Literatur guter Qualität, die mindestens eine randomisierte, kontrollierte Studie enthält
B Evidenzgrade IIa, IIb, III	Belegt durch gut durchgeführte, nichtrandomisierte, klinische Studien
C Evidenzgrad IV	Belegt durch Berichte/Meinungen von Expertenkreisen, Konsensuskonferenzen und/oder klinische Erfahrung anerkannter Autoritäten. Weist auf das Fehlen direkt anwendbarer klinischer Studien guter Qualität hin

Evidence – Based Medicine

TABLE 3-3 SELECTED TOOLS FOR FINDING THE EVIDENCE IN EVIDENCE-BASED MEDICINE

Name	Description	Web Address
Evidence-Based Medicine Reviews	Comprehensive electronic database that combines and integrates: 1. The Cochrane Database of Systematic Reviews 2. ACP Journal Club 3. The Database of Abstracts of Reviews of Effectiveness	*http://www.ovid.com*
Cochrane Library	Collection of EBM databases including The Cochrane Database of Systematic Reviews—full text articles reviewing specific health care topics	*http://www.cochrane.org*
ACP Journal Club	Collection of summaries of original studies and systematic reviews; published bimonthly; all data since 1991 available on Web site, updated yearly	*http://www.acpjc.org*
Clinical Evidence	Monthly updated directory of concise overviews of common clinical interventions	*http://www.clinicalevidence.com*
MEDLINE	National Library of Medicine database with citations back to 1966	*http://www.nlm.nih.gov*

Note: ACP, American College of Physicians; EBM, evidence-based medicine.

Clinical Decision-Making

		Persons tested: Diseased	Persons tested: Healthy	Total
Test Results	positive (P)	a 480 true positives (TP)	b 50 false positives (FP)	a + b = 530
	negative (N)	c 20 false negatives (FN)	d 450 true negatives (TN)	c + d = 470
	Total	a + c = 500	b + d = 500	a + b + c + d = 1000
		Sensitivity $= \frac{a}{a+c} = 96\%$	**Specificity** $= \frac{d}{b+d} = 90\%$	

Four-Fields-Table

Example of a four-fields-table for 1000 anticipated measurement values from a collective of 500 diseased persons and 500 healthy persons. The fields a - d are arranged as given by convention. The measurement values have been categorized irrespectively of their quantity as positive or negative according to an anticipated cut off. It is assumed that in diseased persons a true positive (TP) and in healthy persons a true negative (TN) measurement value will be obtained. Diseased persons with negative measurement values are categorized as false negative (FN), healthy persons with positive measurement values as false positive (FP). From the proportions of the correct and incorrect measure-ment values the quality parameters of a test (sensitivity and specificity) can be calculated as shown in the table.

Number needed to treat

Maß für absolute Risikoreduktion (ARR), die von einer Therapie erwartet werden kann.

„Wieviele Patienten müssen behandelt werden, um ein negatives Ereignis (z.B. Tod, Schlaganfall) zu verhindern."

NNT = 1/ARR

Number needed to treat

Beispiel:

eine Therapie führt zu einer Reduktion der Mortalität von 12 % (Kontrollarm) auf 8 % (Therapiearm).

⟶ relative Risikoreduktion = 4/12x100 = 33 % Reduktion der Mortalität

⟶ absolute Risikoreduktion = 12 % - 8 % = 4 %

⟶ NNT = ¼ . 100 = 25

d.h. es müssen 25 Patienten 5 Jahre lang behandelt werden, um einen Todesfall zu verhindern.

Number needed to treat

Beispiel:

Thrombolysis with Alteplase 3 to 4,5 Hours after Acute Ischemic Stroke

Hacke W, et al. NEJM 2008;359:1317-1329

alteplase: n = 418

placebo: n = 403

Patients with favorable outcome (modified Rankin scale = 0-1)

nach 90 Tagen:

alteplase: 52,4 %

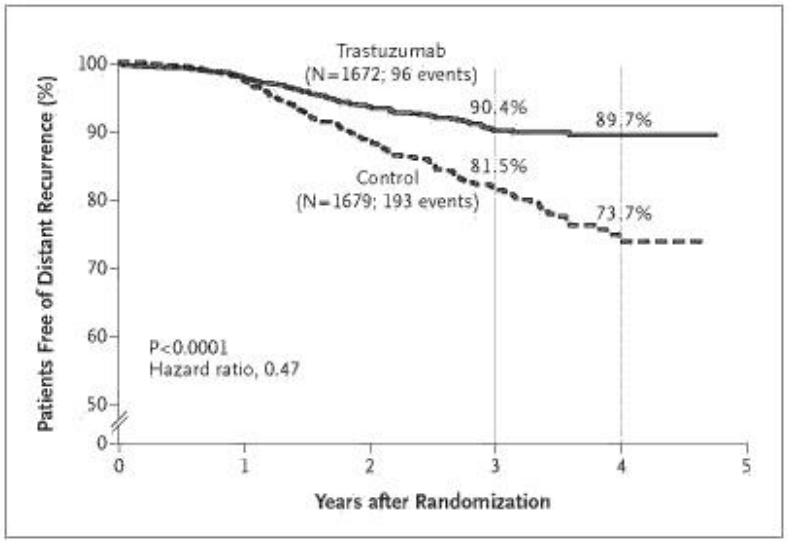
placebo: 45,2 %

odds ratio: 1,32

NNT = 100/(52,4 – 45,2) = 100/7,2 = 13,9 Patienten

Number needed to treat

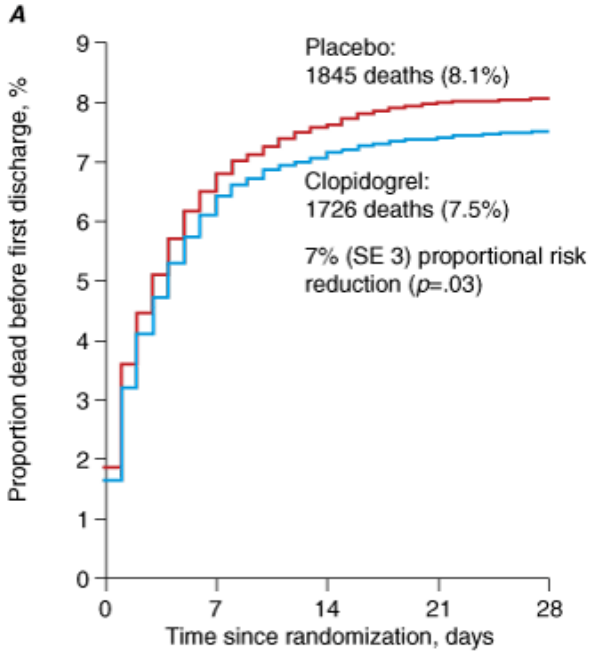
Trastuzumab in der Behandlung des nicht metastasierten Mamma-Carcinom



$$NNT_3 = \frac{100}{ARR} = \frac{100}{90{,}4 - 81{,}5} = \frac{100}{8{,}9} = 11{,}2$$ Patienten/3 Jahre

$$NNT_4 = \frac{100}{ARR} = \frac{100}{89{,}7 - 73{,}7} = \frac{100}{16{,}0} = 6{,}25$$ Patienten/4 Jahre

Kardiologie



Days	0–6	7–13	14–20	21–28
Number of events				
Clopidogrel	1403	223	69	31
Placebo	1487	246	89	23

Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine*, 17th Edition: http://www.accessmedicine.com

Clinical Decision-Making

likelihood ratio: ratio of the probability of a given test result („positive" or „negative") in a patient with disease to the probability of the result in a patient without disease

for a positiv test: = true-positive rate/false positive rate

= sensitivity/(1 – specificity)

Clinical Decision-Making

TABLE 3-2 MEASURES OF DISEASE PROBABILITY

Pretest probability of disease = probability of disease before test is done. May use population prevalence of disease or more patient-specific data to generate this probability estimate.

Posttest probability of disease = probability of disease accounting for both pretest probability and test results. Also called predictive value of the test.

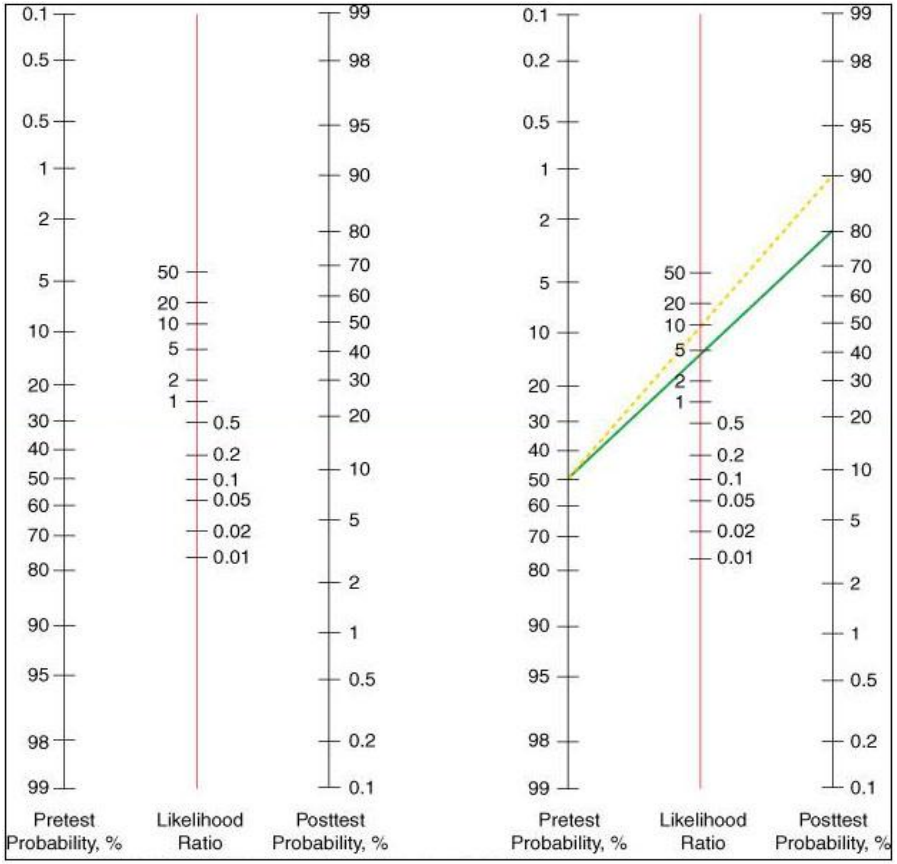
Bayes' theorem: Computational version:

$$\text{Posttest probability} = \frac{\text{Pretest probability} \times \text{test sensitivity}}{\text{Pretest probability} \times \text{test sensitivity} + (1 - \text{pretest probability}) \times \text{test false-positive rate}}$$

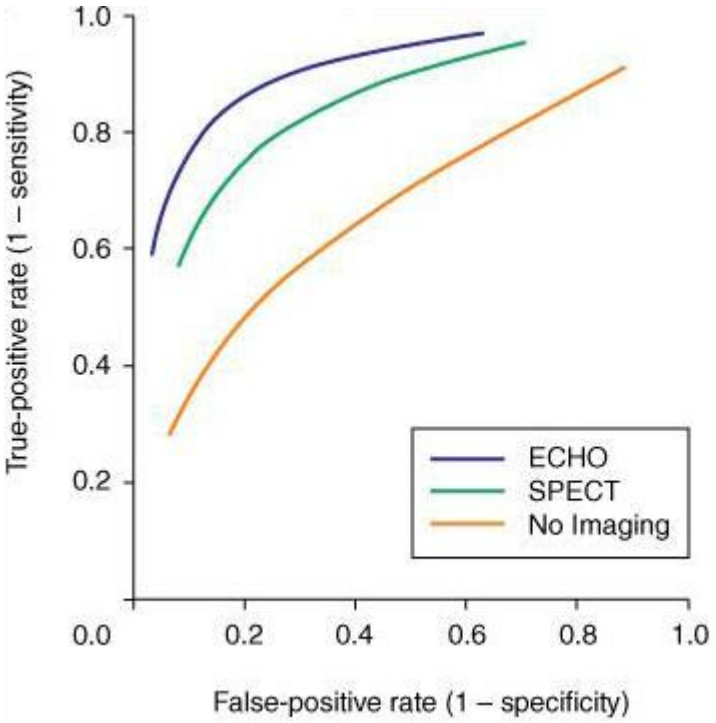
Example [with a pretest probability of 0.50 and a "positive" diagnostic test result (test sensitivity = 0.90, test specificity = 0.90)]:

$$\text{Posttest probability} = \frac{(0.50)(0.90)}{(0.50)(0.90) + (0.50)(0.10)} = 0.90$$

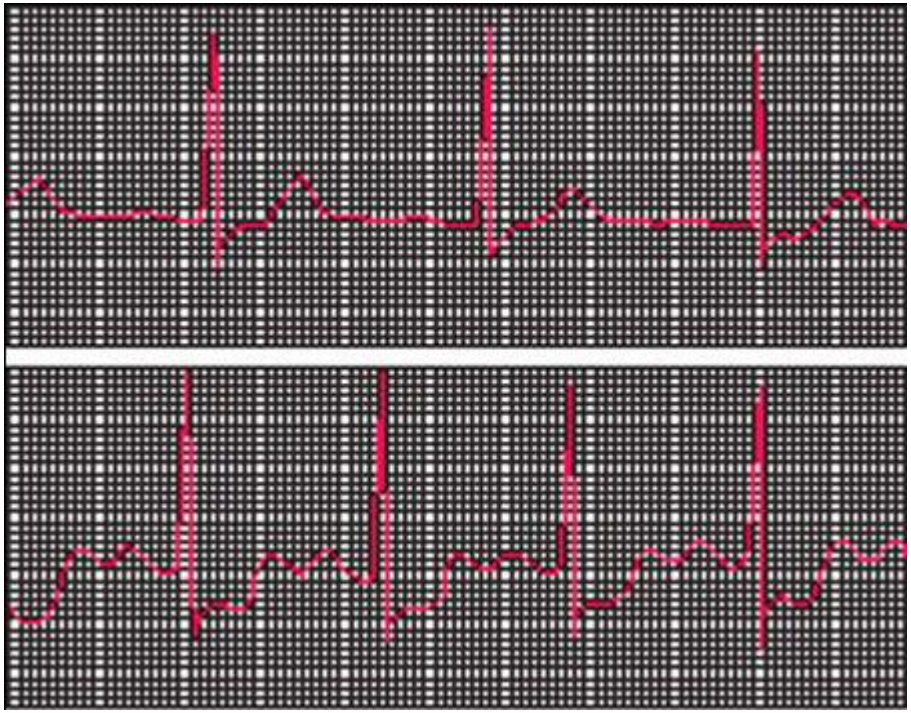
Clinical Decision-Making



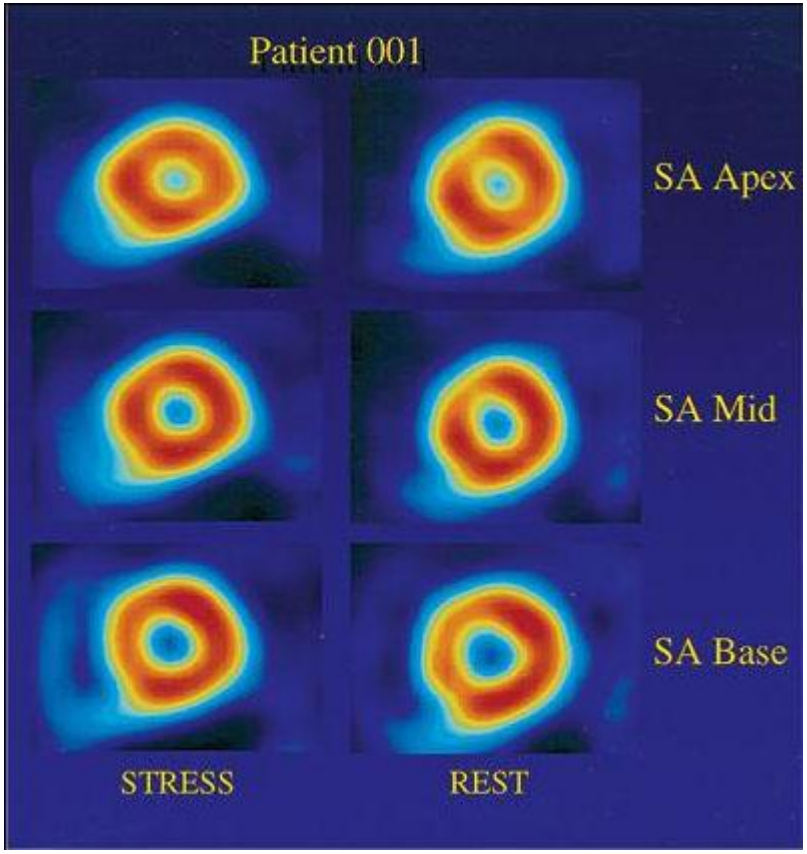
Clinical Decision-Making



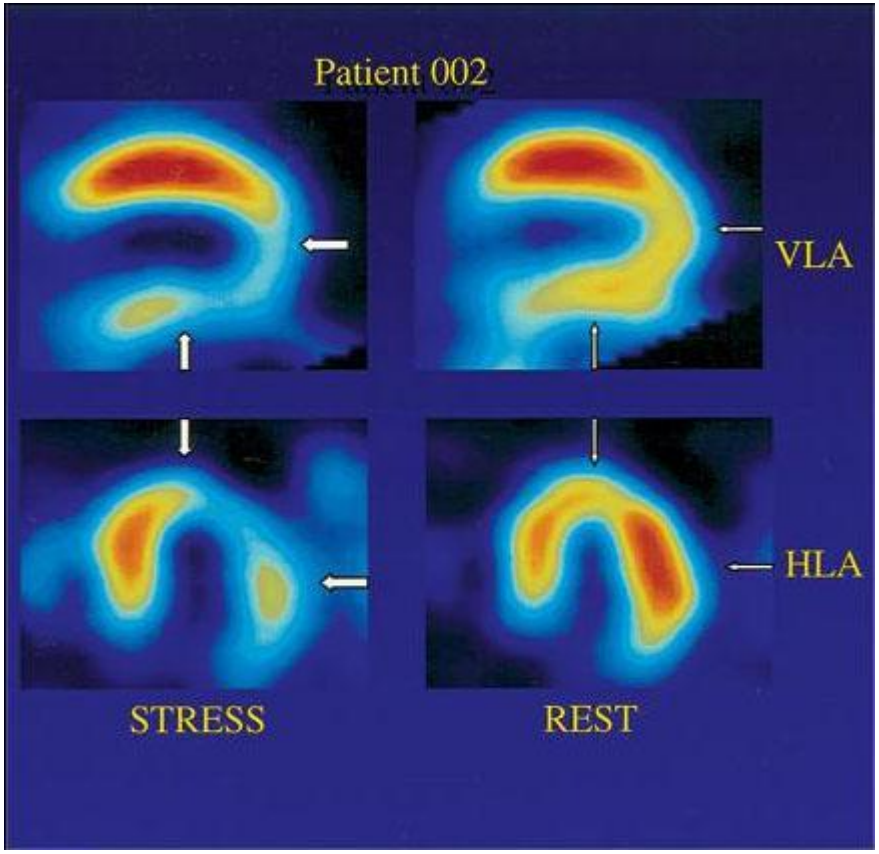
Clinical Decision Making



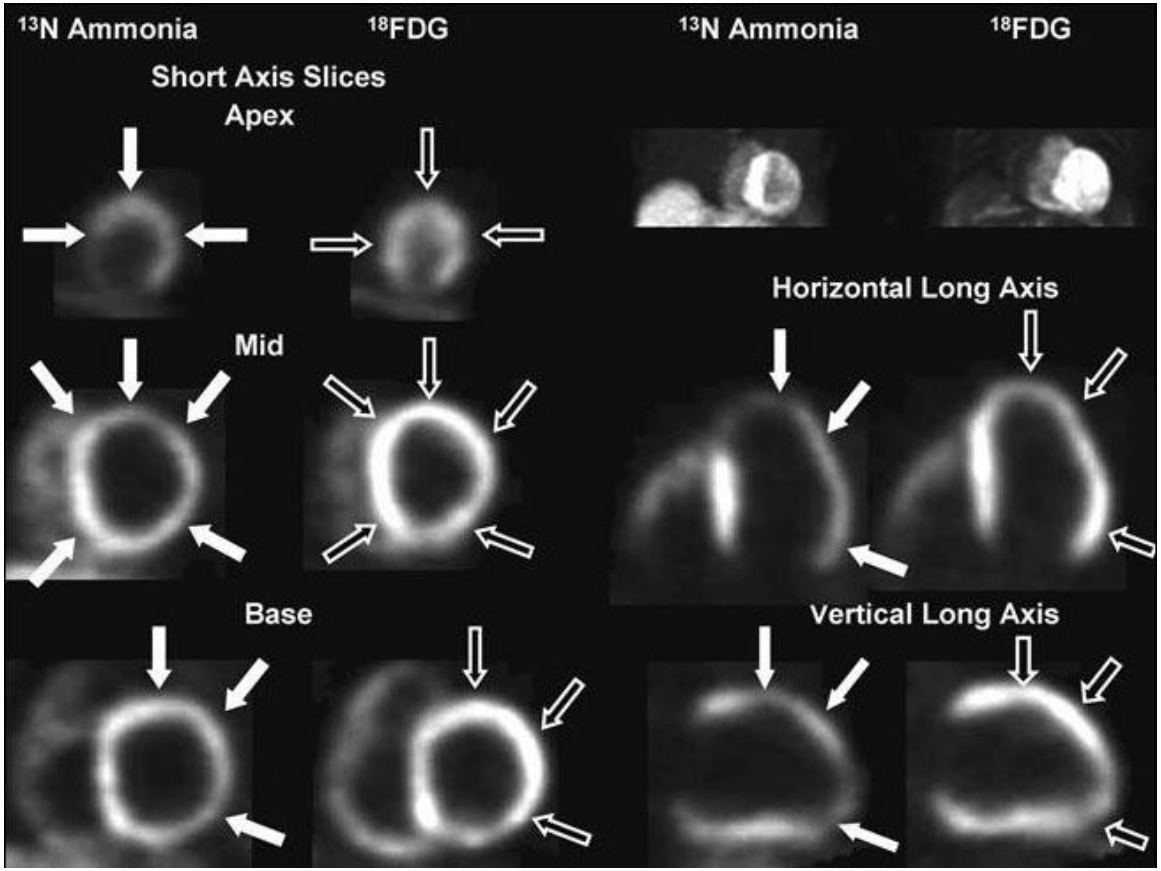
Clinical Decision-Making



Clinical Decision-Making



Clinical Decision-Making



Clinical Decision-Making

Beispiel: Diagnostik der coronaren Herzkrankheit

Ergometrie: sensitivity 66 %

specificity 84 %

⟶ likelihood ratio = 0,66/(1-0,84) = 4,1

SPECT myocardial perfusion test:

sensitivity 90 %

specificity 90 %

⟶ likelihood ratio = 0,9/(1-0,9) = 9

Clinical Decision-Making

Beispiel: Diagnostik der coronaren Herzkrankheit

Patient mit einem pretest probability für coronare Herzkrankheit von 10 %

Ergometrie: → posttest probability nach positiver Ergometrie: 30 %

SPECT-myocardial perfusion test:

→ posttest probability mit positivem SPECT: 50 %

Clinical Decision-Making

TABLE 13-4 PREVALENCE OF MYOCARDIAL INFARCTION AND UNSTABLE ANGINA AMONG SUBSETS OF PATIENTS WITH ACUTE CHEST DISCOMFORT IN THE EMERGENCY DEPARTMENT

Finding	Prevalence	
	Myocardial Infarction, %	Unstable Angina, %
ST elevation (≥1 mm) or Q waves on ECG not known to be old	79	12
Ischemia or strain on ECG not known to be old (ST depression ≥1 mm or ischemic T waves)	20	41
None of the preceding ECG changes but a prior history of angina or myocardial infarction (history of heart attack or nitroglycerin use)	4	51
None of the preceding ECG changes and no prior history of angina or myocardial infarction (history of heart attack or nitroglycerin use)	2	14

Note: ECG, electrocardiogram.

Unpublished data from Brigham and Women's Hospital Chest Pain Study, 1997–1999.

Symptomatologie

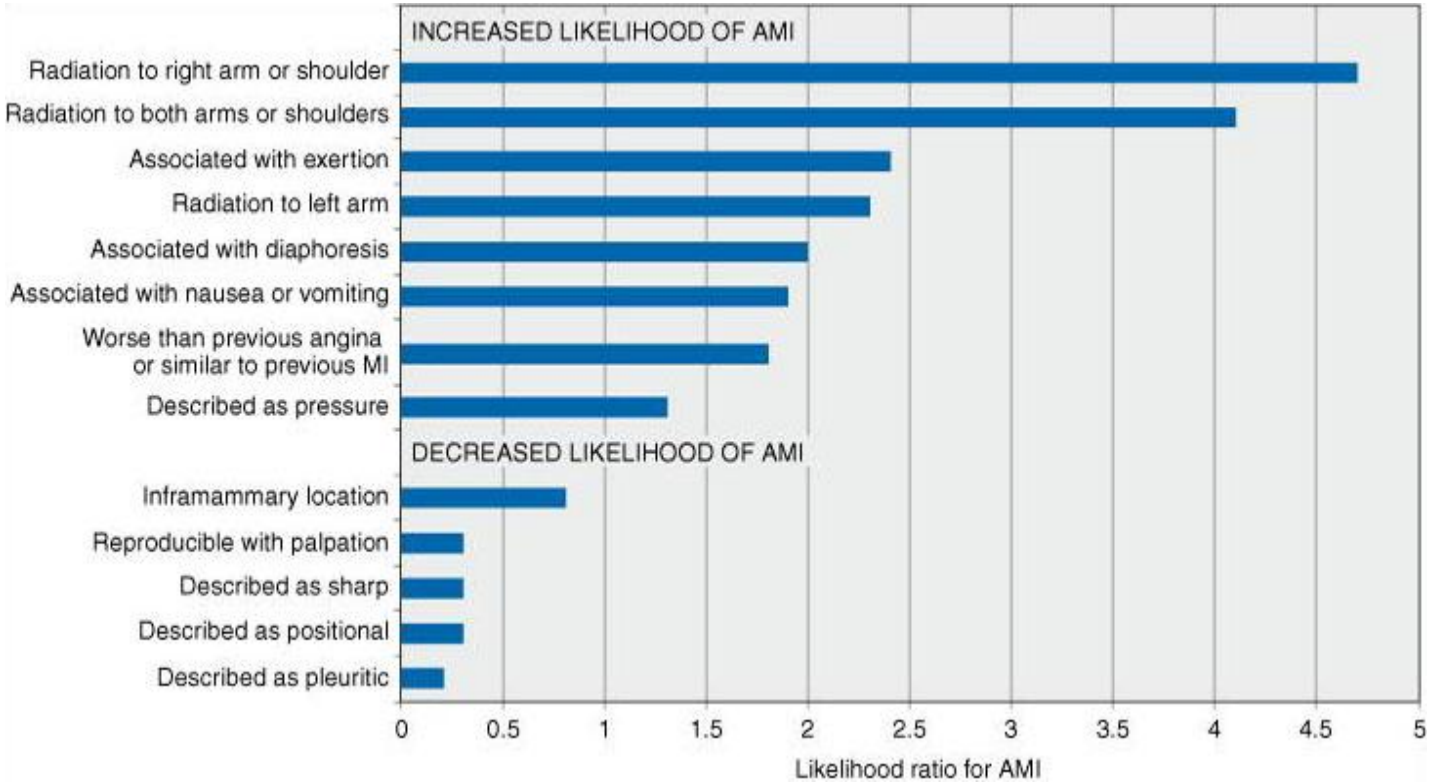
TABLE 13-1 DIFFERENTIAL DIAGNOSES OF PATIENTS ADMITTED TO HOSPITAL WITH ACUTE CHEST DISCOMFORT RULED NOT MYOCARDIAL INFARCTION

Diagnosis	Percent
Gastroesophageal disease[a]	42
Gastroesophageal reflux	
Esophageal motility disorders	
Peptic ulcer	
Gallstones	
Ischemic heart disease	31
Chest wall syndromes	28
Pericarditis	4
Pleuritis/pneumonia	2
Pulmonary embolism	2
Lung cancer	1.5
Aortic aneurysm	1
Aortic stenosis	1
Herpes zoster	1

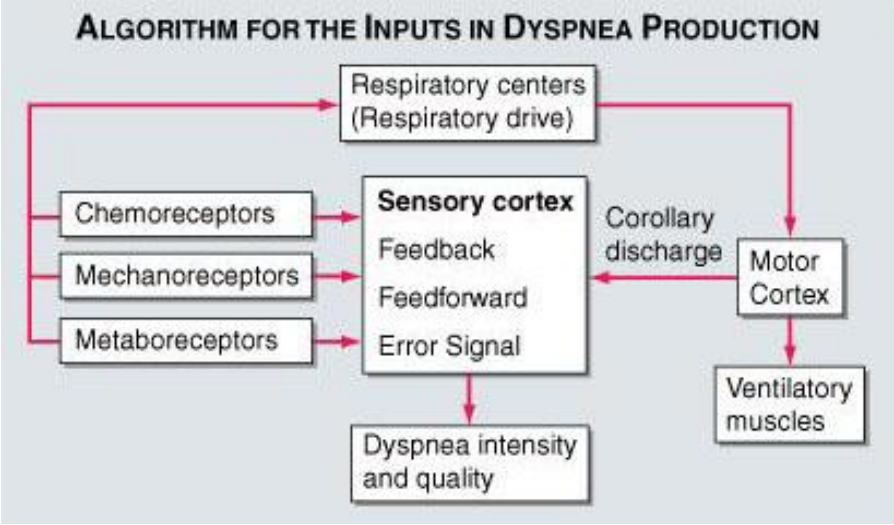
[a]In order of frequency.

Source: P Fruergaard et al: Eur Heart J 17:1028, 1996.

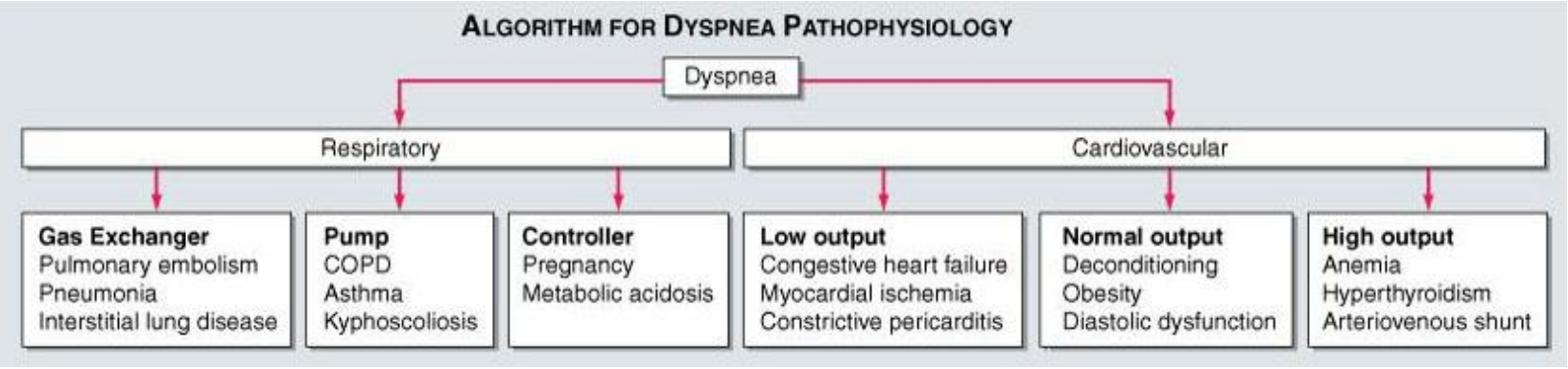
Symptomatologie



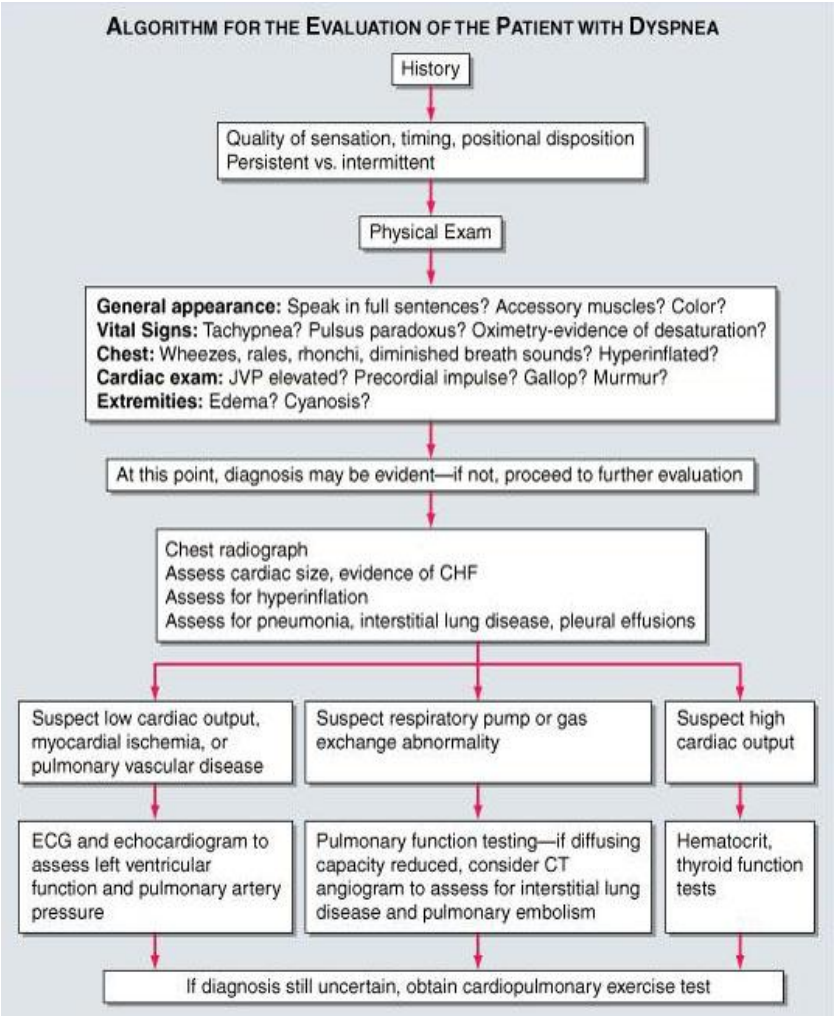
Symptomatologie



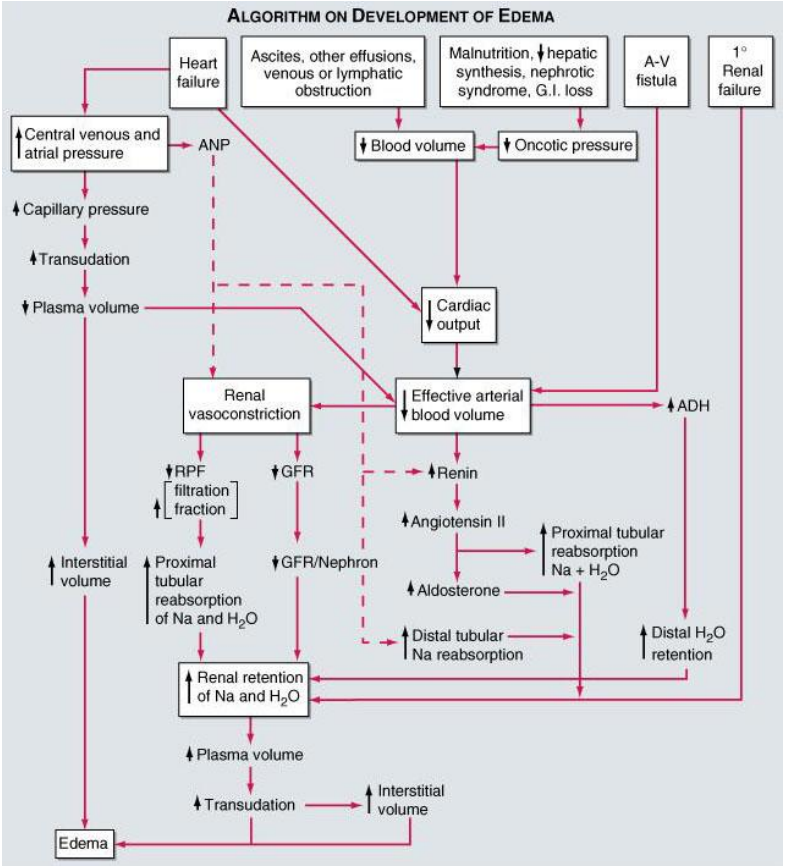
Symptomatologie



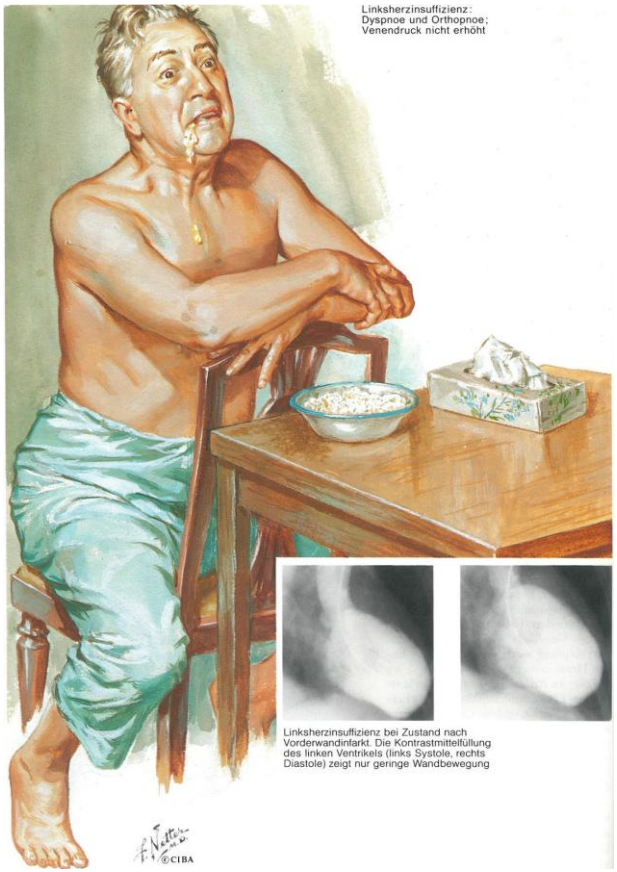
Symptomatologie



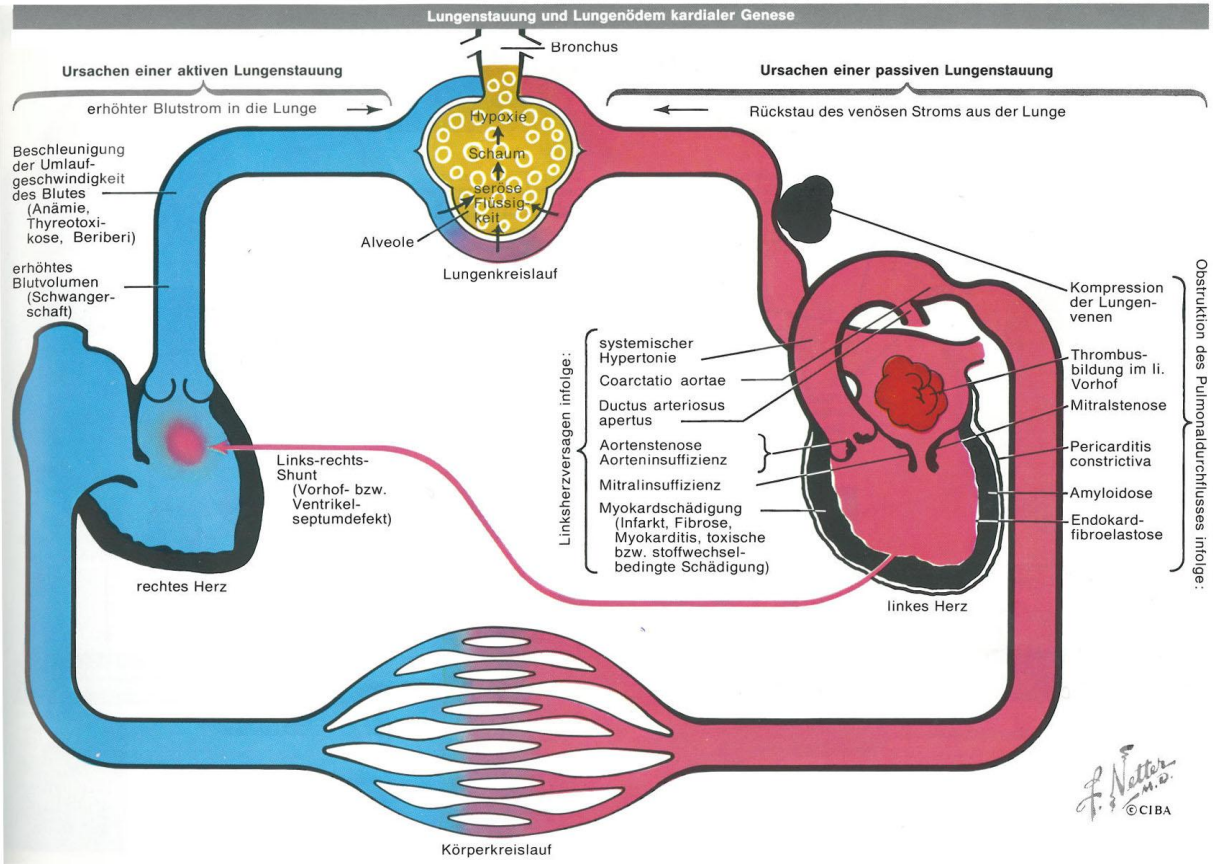
Symptomatologie



Herzinsuffizienz

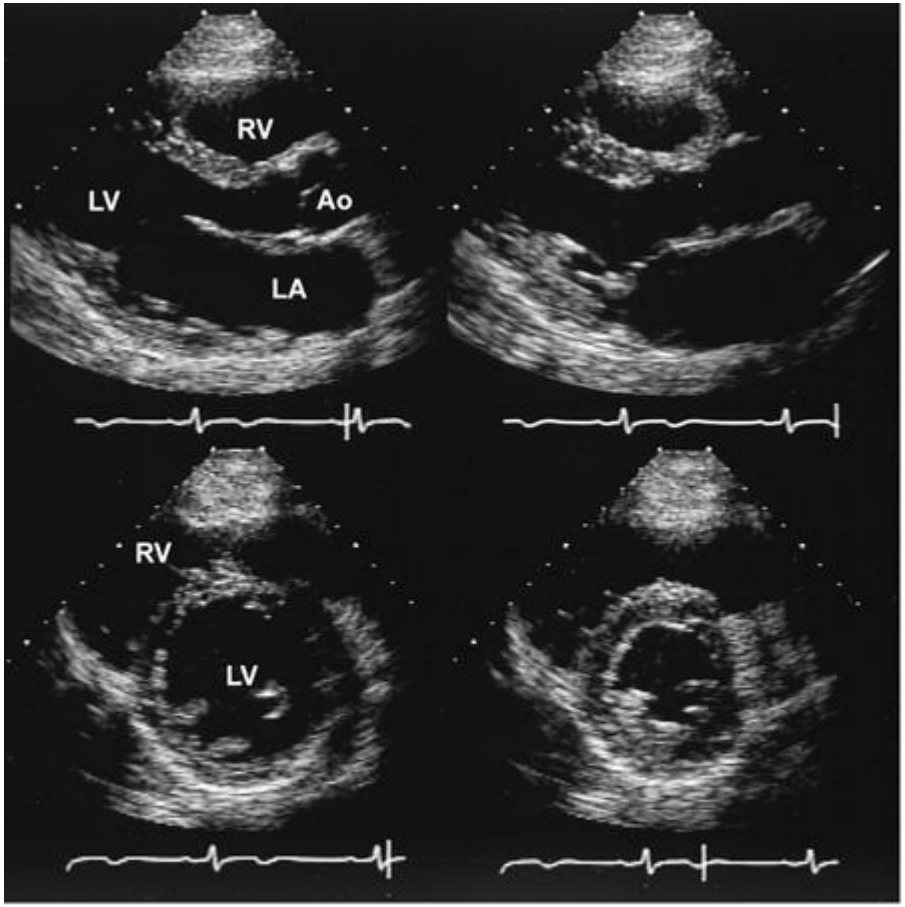


Herzinsuffizienz



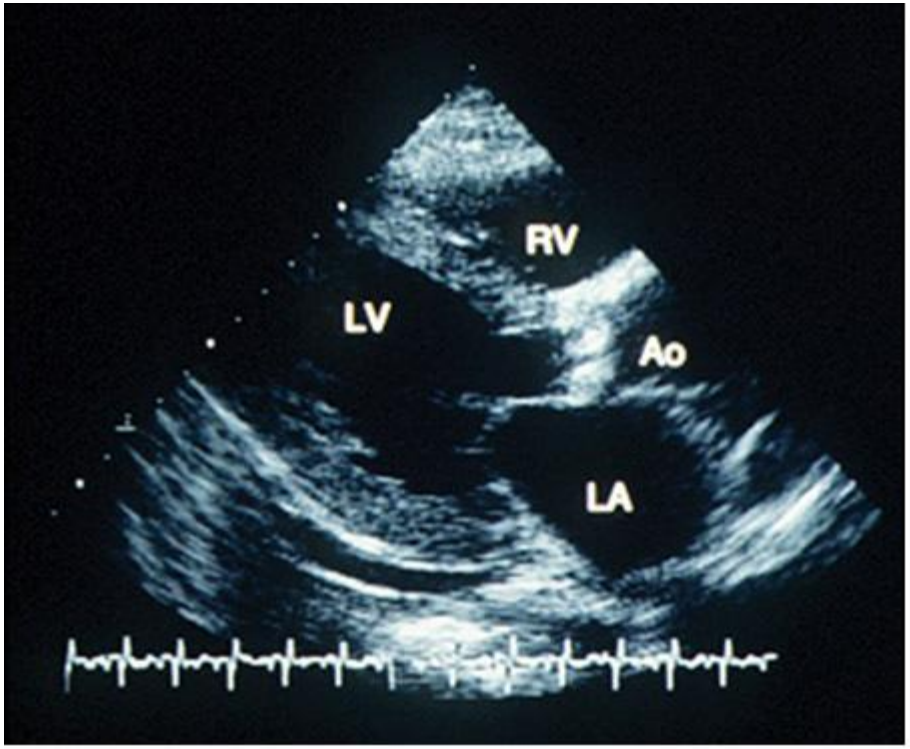
Echokardiographie

zur Bestimmung der Linksventrikelfunktion



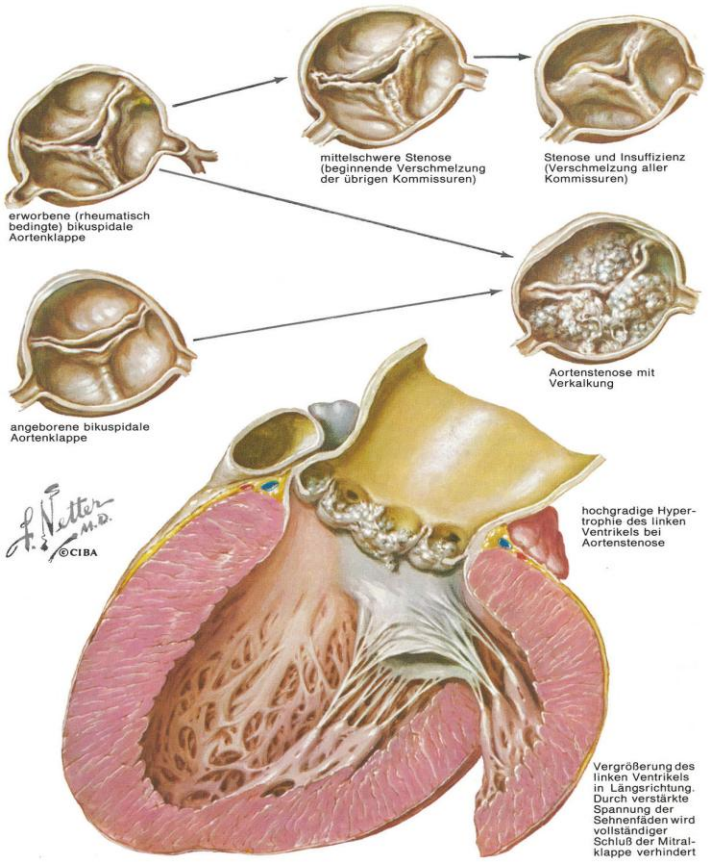
Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J:
Harrison's Principles of Internal Medicine, 17th Edition: http://www.accessmedicine.com

Echokardiographie
zur Bestimmung der Linksventrikelfunktion

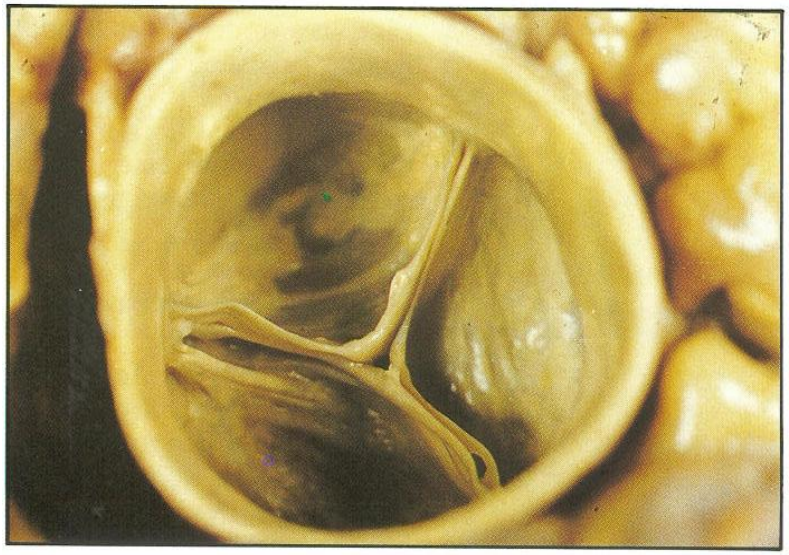


Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J:
Harrison's Principles of Internal Medicine, 17th Edition: http://www.accessmedicine.com

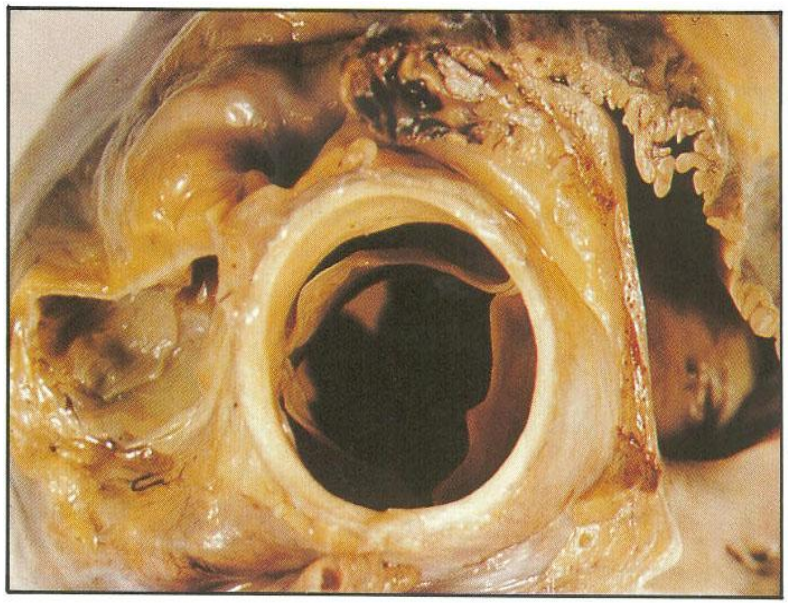
Aortenklappenstenose



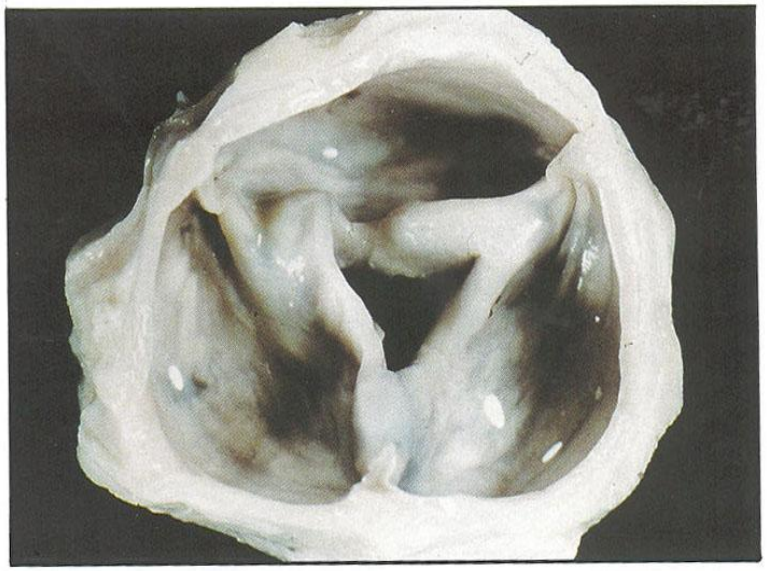
normale Aortenklappe



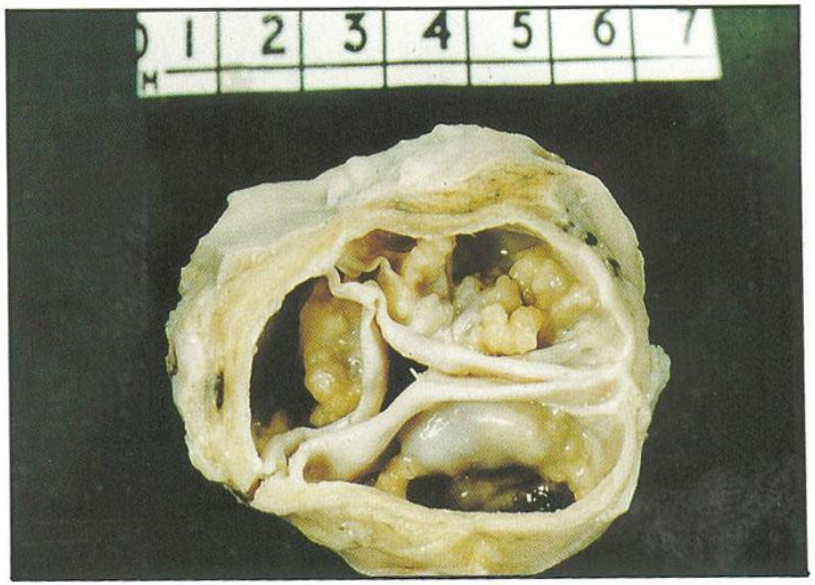
normale Aortenklappe



Aortenklappenstenose (rheumatisch)



Aortenklappensklerose (sklerotisch)



Prinzipien der Dopplersonographie

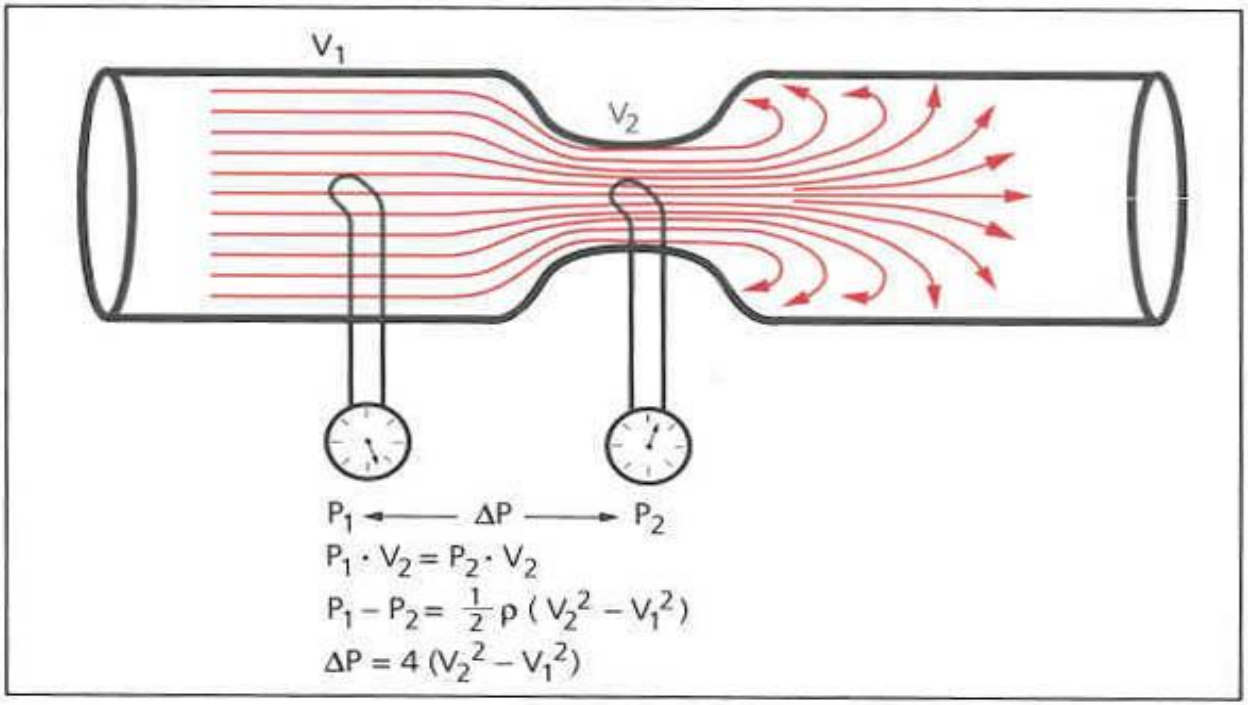


Abb. 34

V_1 = V_{max} vor der Stenose (m/s)
V_2 = V_{max} in der Stenose (m/s)
ρ = Dichte des Blutes = 1,06 · 10 kg/m (konstant)
P_1 = Druck vor der Stenose (mmHg)
P_2 = Druck nach der Stenose (mmHg)

Prinzipien der Dopplersonographie

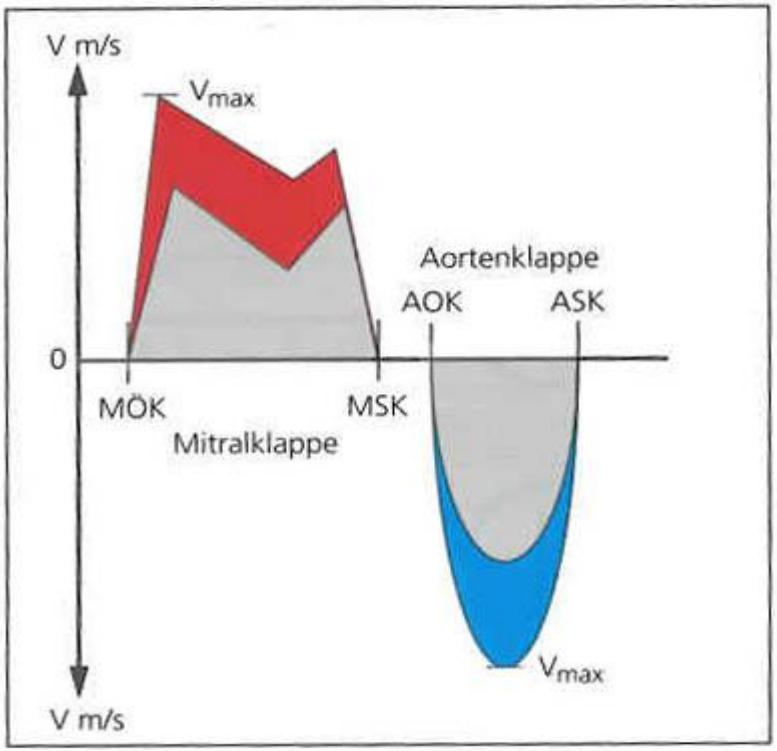


Abb. 35 Flußprofile an der Mitral- und Aortenklappe: normal (grau), Mitralstenose (rot), Aortenstenose (blau), achte auf $\mathbf{V_{max}}$!).
MÖK: Mitralklappenöffnungsklick,
MSK: Mitralklappenschließungsklick,
AÖK: Aortenklappenöffnungsklick,
ASK: Aortenklappenschließungsklick.

Kontinuitätsgleichung

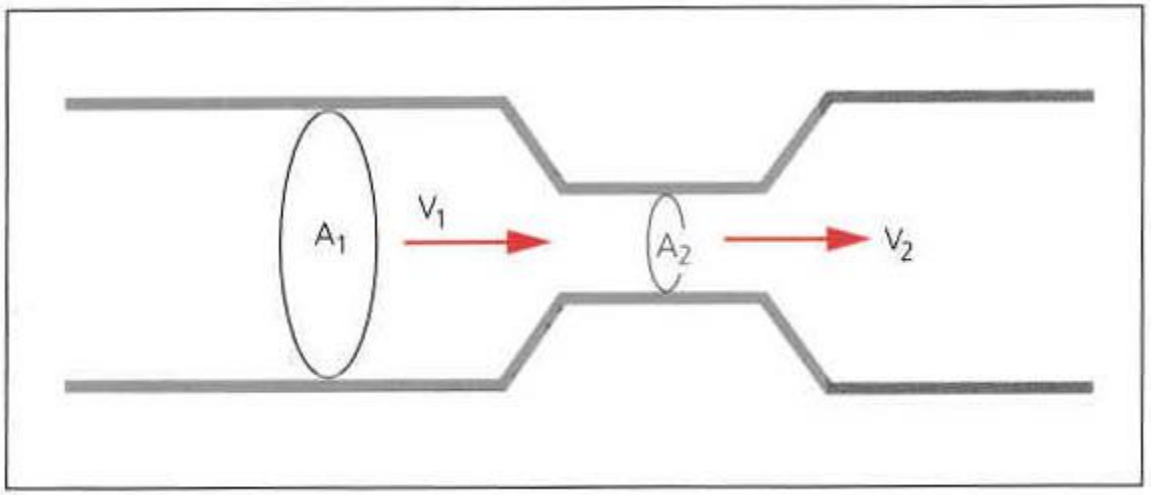


Abb. 37 Kontinuitätsgleichung $A_1 \cdot V_1 = A_2 \cdot V_2$.

Mitralklappenstenose

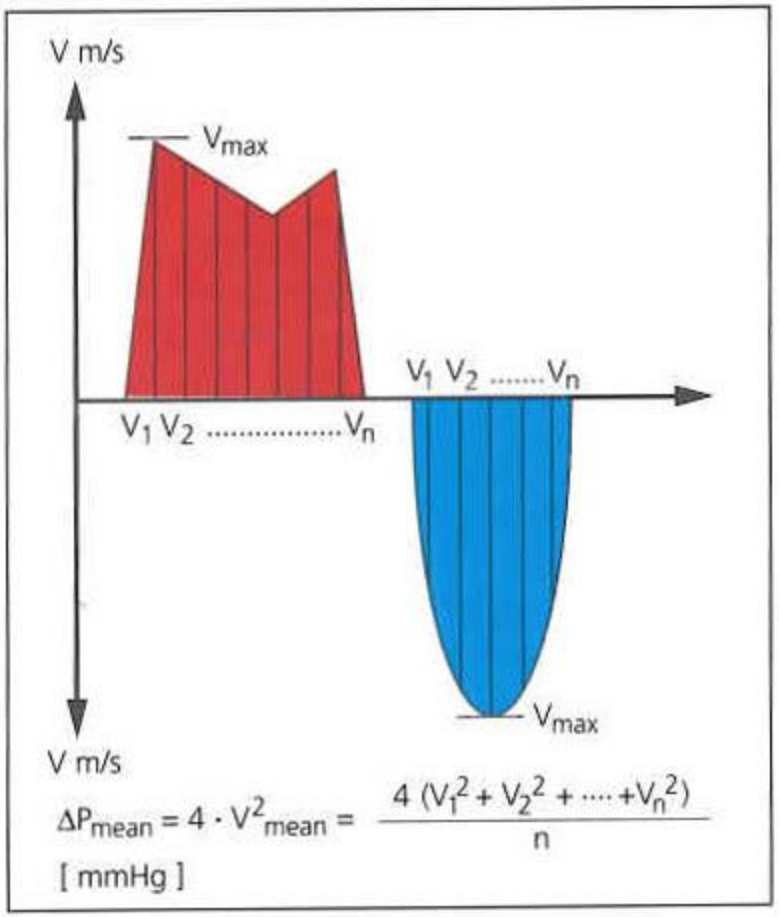


Abb. 36 Der mittlere Druckgradient zeigt als *Flußzeitintegral* das Gesamtverhalten der Blutströmung während der *ganzen Systole* (blau) oder Diastole (rot).

Aortenklappenstenose

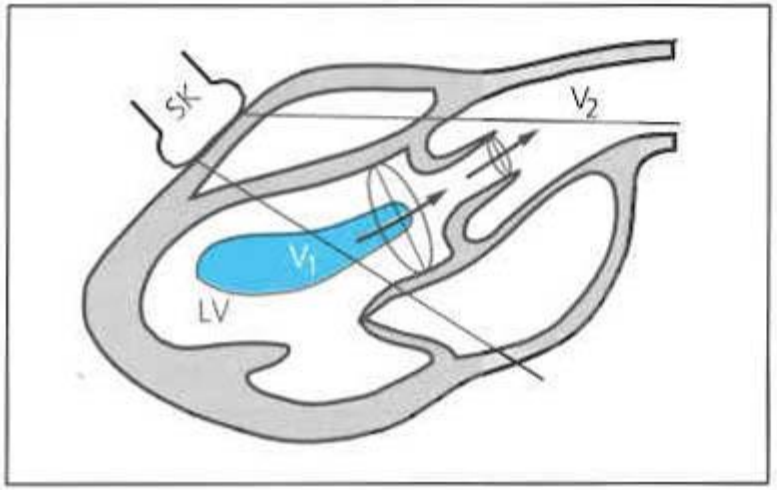


Abb. 38 Anwendung der Kontinuitäts-gleichung bei der Aortenstenose.

Aortenklappenstenose

$A_1 \cdot V_1 = A_2 \cdot V_2$

A_1 = Querschnittsfläche vor der Stenose, wird in der parasternalen Längsachse (2D) oder 5-K-B gemessen. Errechnung von A_1 im LVOT (linksventrikulärer Ausflußtrakt) durch Bestimmung des *Durchmessers* ca. 1 cm vor der Aortenklappe

$A_1 = \pi \cdot r^2$, d. h. $A_1 = 3{,}14 \cdot \left(\frac{d}{2}\right)^2 = cm^2$

V_1 = Geschwindigkeit vor der Stenose mit dem PW gemessen (m/s)

A_2 = Querschnitt in der Stenose (cm^2)

V_2 = Geschwindigkeit in der Stenose mit dem CW gemessen (m/s)

AÖF = $A_2 = A_1 \cdot \frac{V_1}{V_2}$ (cm^2)

AÖF = $A_2 = cm^2$

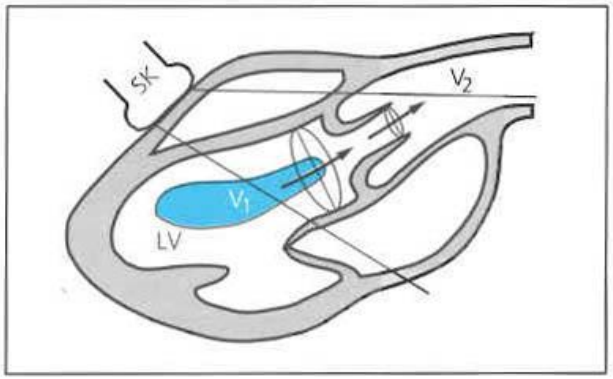


Abb. 38 Anwendung der Kontinuitätsgleichung bei der Aortenstenose.

Aortenklappenstenose

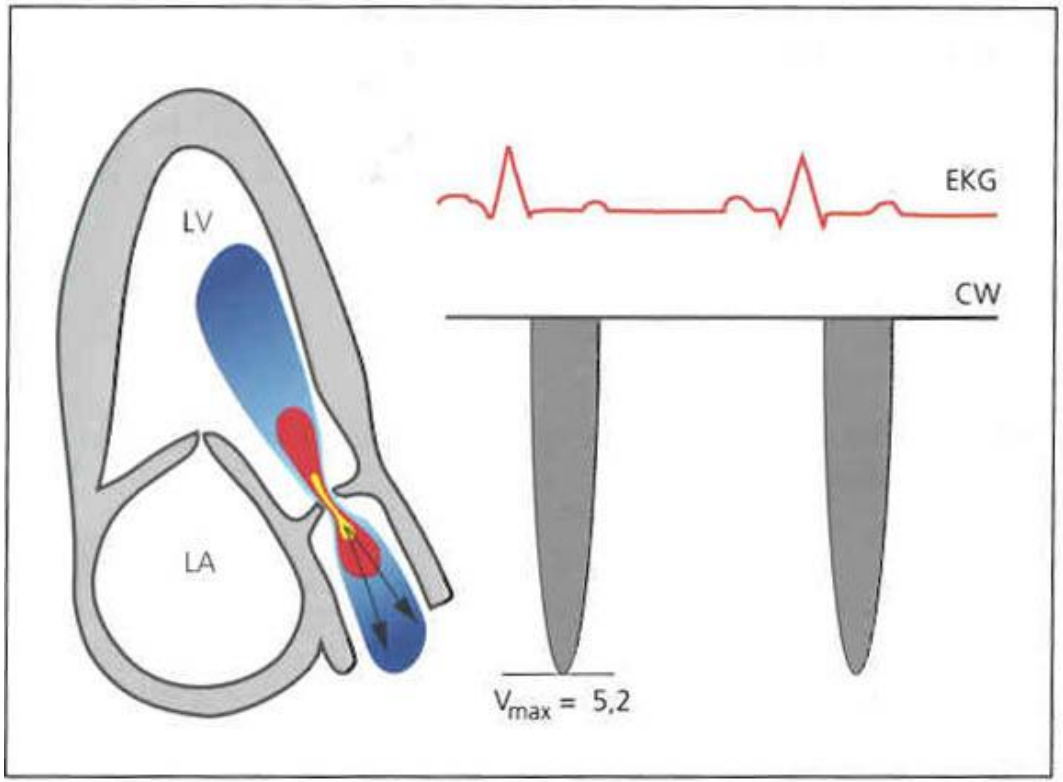
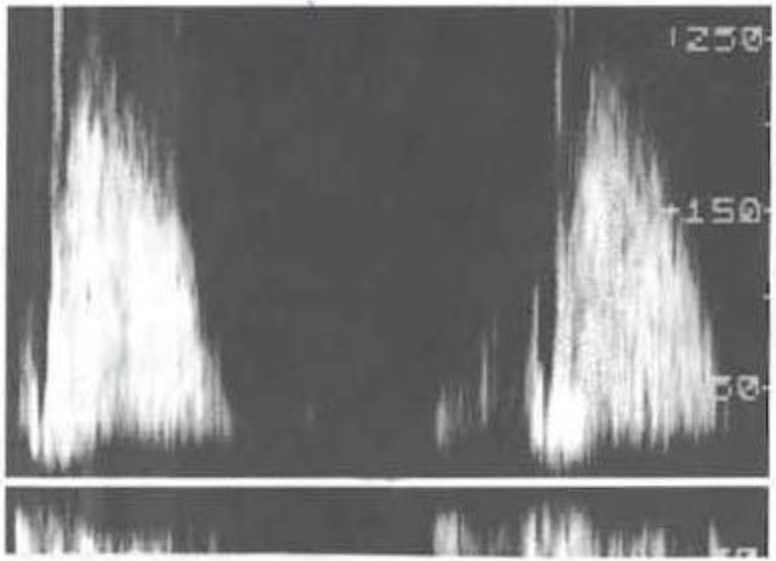


Abb. 41 DE-Nachweis einer Aortenstenose.

V_{max} = 5,2 m/s
V_{mean} = 4,1 m/s
$\Delta P_{max} = 4 \cdot V^2_{max} = 108$ mmHg
$\Delta P_{mean} = 4 \cdot V^2_{mean} = 67$ mmHg

Aortenklappenstenose



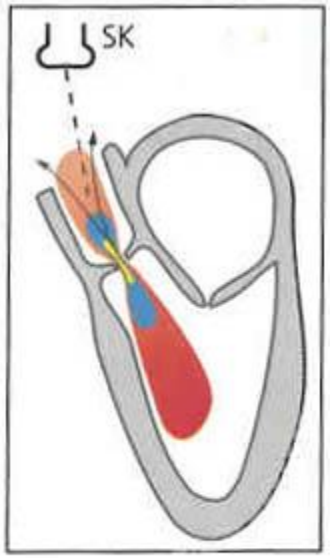


Abb. 42 CW-DW-Nachweis einer leichten Aortenstenose rechts parasternal. Daher antegrader Blutfluß.
$V_{max} = 2{,}5$ m
ΔP_{max} $4 \cdot (2{,}5) = 25$ mmHg

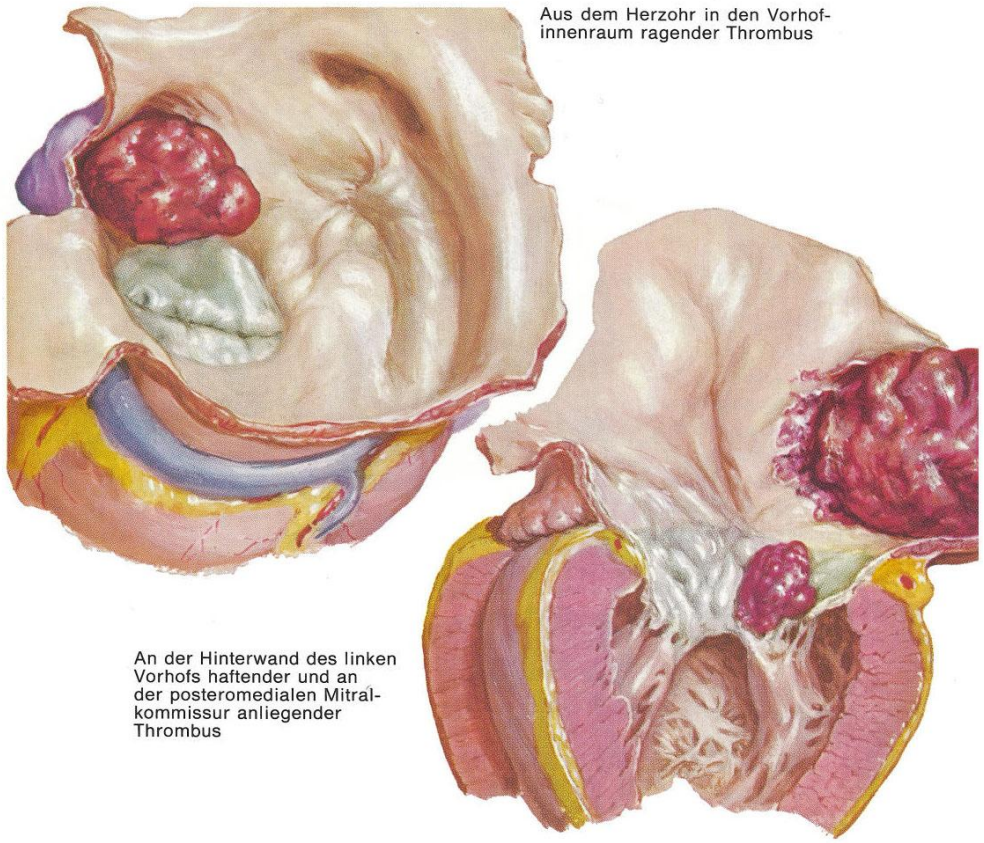
Aortenklappenstenose

Dopplersonographische Graduierung bei Aortenstenose
(s. a. Abb. **43** u. **44**).

	maximaler Druckgradient ΔP_{max} (mmHg)	mittlerer Druckgradient ΔP_{mean} (mmHg)	Aortenklappen-Öffnungsfläche AÖF (cm^2)
Schweregrad I	< 67	< 41	2,3 – 1,4
Schweregrad II	67 – 89	41 – 54	1,3 – 0,7
Schweregrad III	> 89	> 54	< 0,7

Merke:
1. Stenose muß kurzstreckig (2–4 mm) sein
2. AÖF ~ 0,7 cm^2
3. V_1 (LVOT) ~ 1 m/s

Mitralklappenstenose (rheumatisch)



Mitralklappenstenose

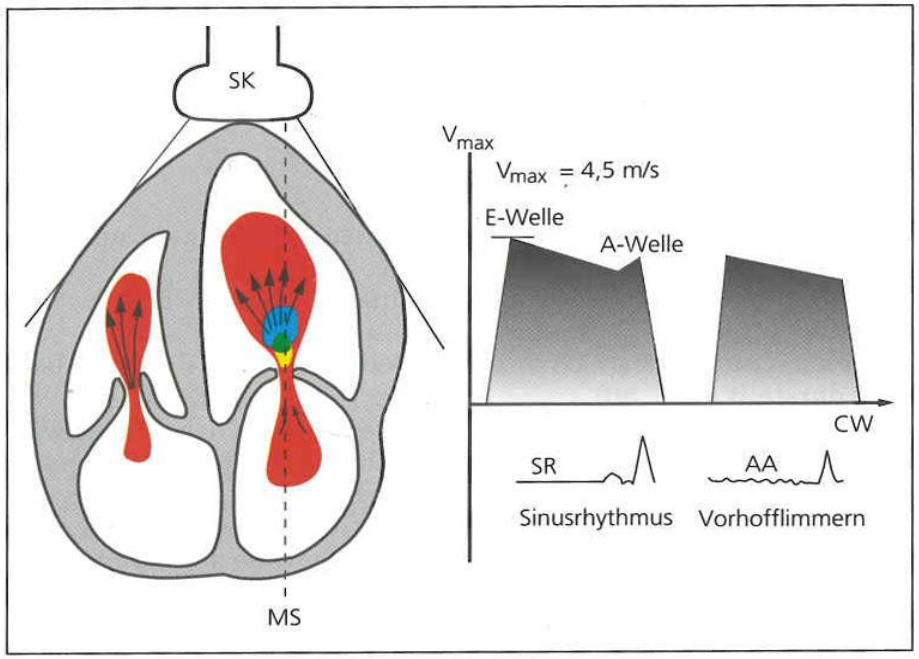


Abb. 50 Farb- und CW-dopplerechokardiographischer Nachweis einer Mitralstenose bei Sinusrhythmus und VH-Flimmern.
Beispiel: V_{max} = 4,5 m/s
$\Delta P_{max} = 4 \cdot (4,5)^2 = 81$ mmHg
V_{mean} = 3,21 (wird planimetrisch bestimmt).

Mitralklappenstenose

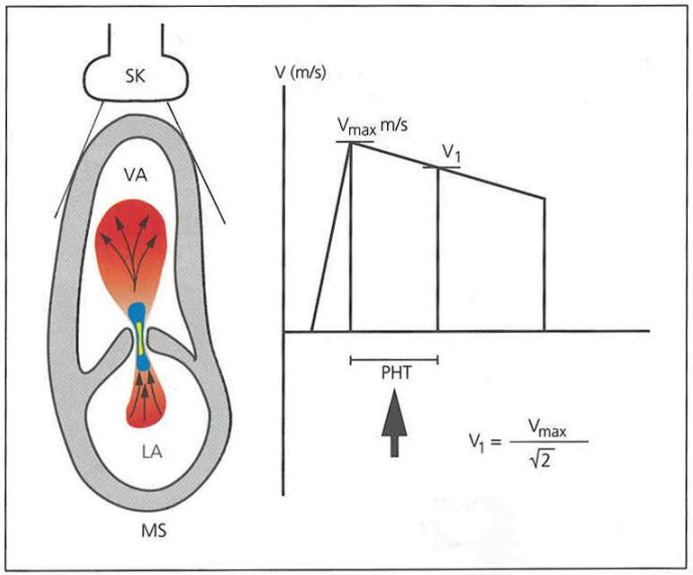


Abb. 51 Mitralöffnungsfläche und PHT.

Bei der Pressure-Half-Time handelt es sich um die Zeit, in der der Spitzengradient (ΔP_{max})während der Diastole auf die Hälfte des Ausgangswertes abfällt.

$$\Delta P_{max} = 4 \cdot V^2_{max} \qquad 4 \cdot V_1^2 = \frac{4 \cdot V^2_{max}}{2}$$

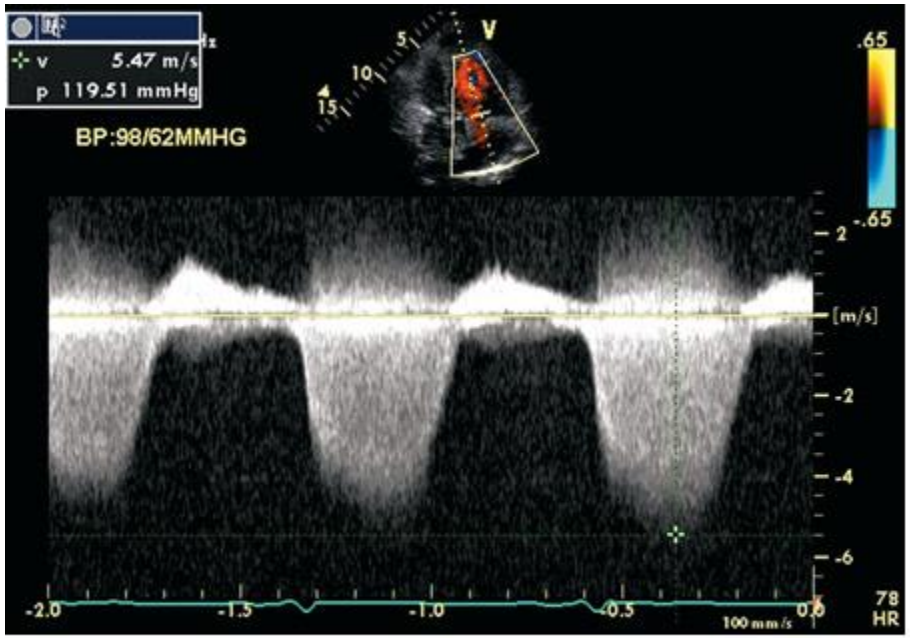
$$\frac{\Delta P_{max}}{2} = 4 \cdot V_1^2 \qquad V_1 = \frac{V_{max}}{\sqrt{2}}$$

Mitralklappenstenose

Graduierung bei Mitralstenose

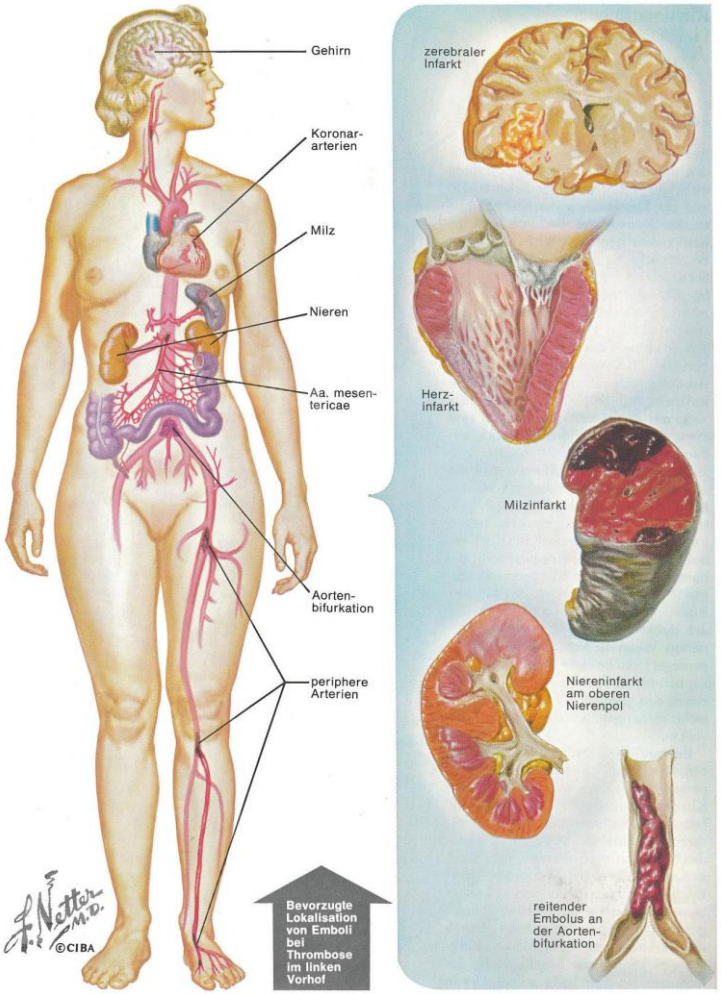
Grad I	*subklinische Mitralstenose,* NYHA I Klappenöffnungsfläche > 2,5 cm^2
Grad II	*leichtgradige Mitralstenose,* NYHA II Klappenöffnungsfläche 1,5–2,5 cm^2 ΔP_{mean} um ca. 5 mmHg
Grad III	*mittelgradige Mitralstenose,* NYHA III Klappenöffnungsfläche 1,5–1 cm^2 ΔP_{mean} um ca. 10 mmHg **– OP-Indikation – !**
Grad IV	Klappenöffnungsfläche < 1 cm^2, meist < 0,7 cm^2 **– OP-Indikation – !**

Tricuspidalklappeninsuffizienz

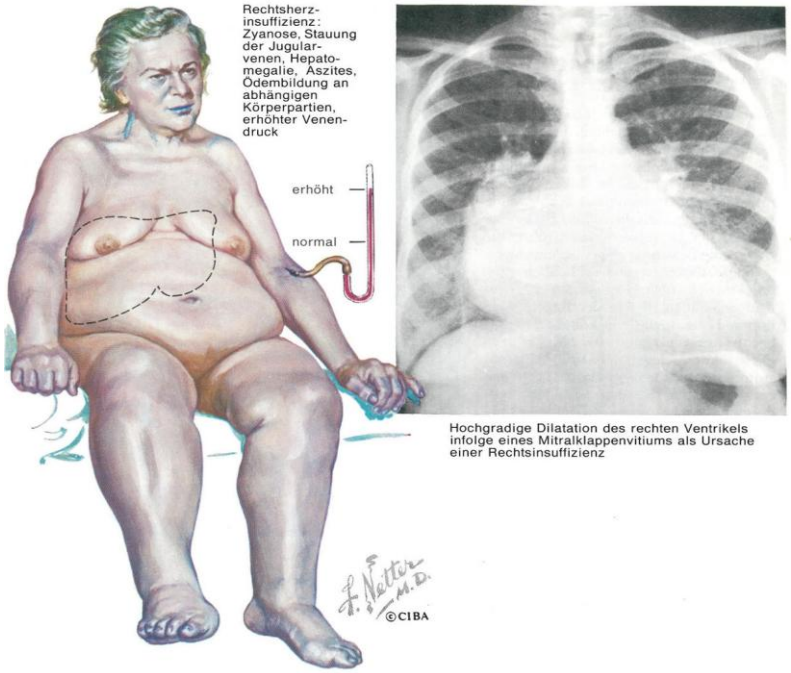


Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine*, 17th Edition: http://www.accessmedicine.com

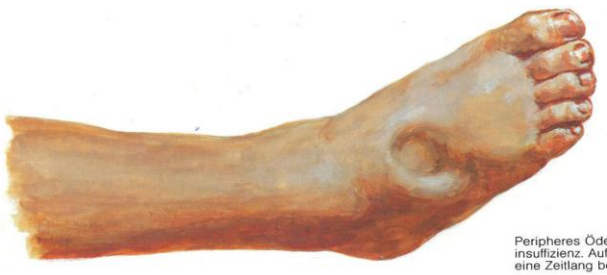
Morbus embolicus



Herzinsuffizienz

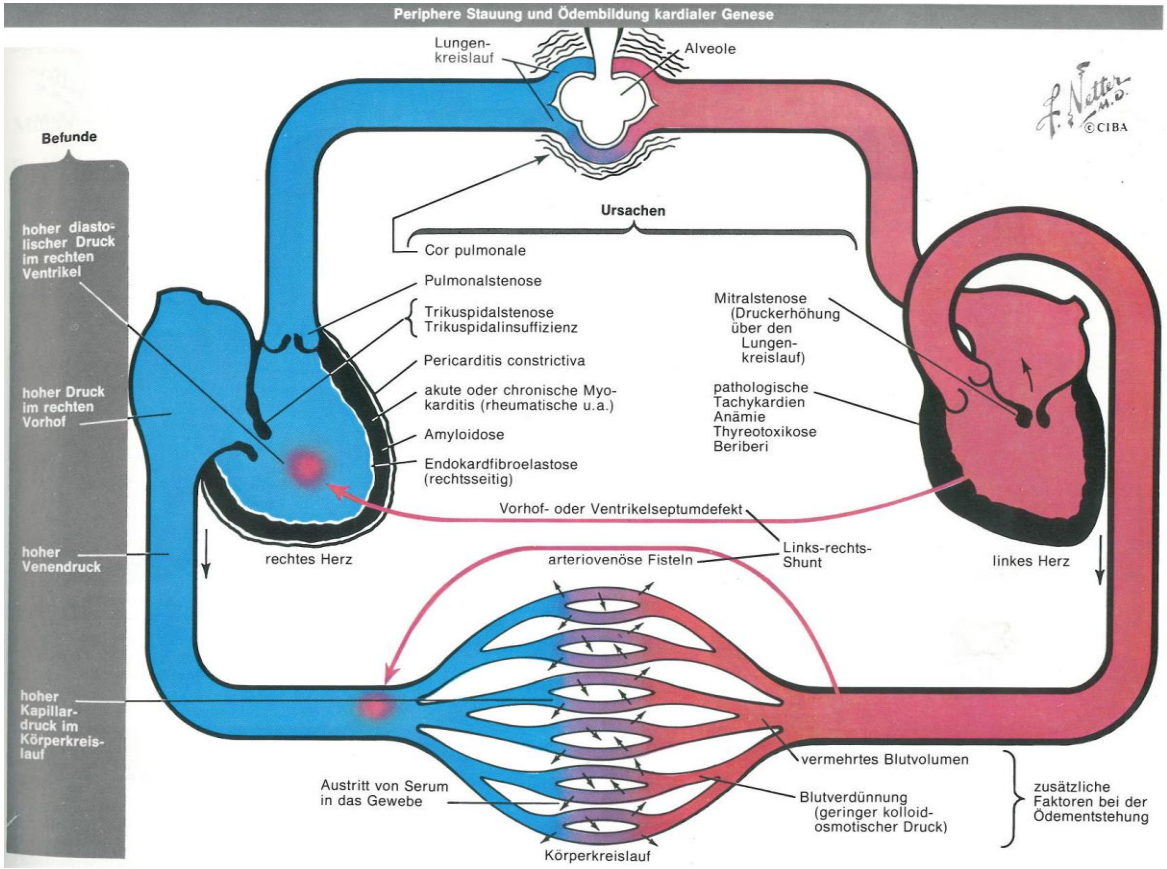


Hochgradige Dilatation des rechten Ventrikels infolge eines Mitralklappenvitiums als Ursache einer Rechtsinsuffizienz



Peripheres Ödem bei Rechtsherz-insuffizienz. Auf Druck bleibt eine Delle eine Zeitlang bestehen

Herzinsuffizienz



Symptomatologie