# Aortenaneurysma: Diagnostik und Verlaufsuntersuchungen

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# Guidelines

Clinical Practice Guidelines

Eur J Vasc Endovasc Surg (2024) 67, 192–331

EJVES Open Access

CLINICAL PRACTICE GUIDELINE DOCUMENT

## Editor's Choice – European Society for Vascular Surgery (ESVS) 2024 Clinical Practice Guidelines on the Management of Abdominal Aorto-Iliac Artery Aneurysms ☆

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ESC European Society of Cardiology

European Heart Journal (2024) 45, 3538–3700
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ESC GUIDELINES

## 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases

**Developed by the task force on the management of peripheral arterial and aortic diseases of the European Society of Cardiology (ESC)**

***Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS), the European Reference Network on Rare Multisystemic Vascular Diseases (VASCERN), and the European Society of Vascular Medicine (ESVM)***

SOCIETY FOR VASCULAR SURGERY® DOCUMENT

## The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm

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ACC/AHA CLINICAL PRACTICE GUIDELINE

## 2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines

*Developed in collaboration with and endorsed by the American Association for Thoracic Surgery, American College of Radiology, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, and Society for Vascular Surgery*

*Endorsed by the Society of Interventional Radiology and Society for Vascular Medicine*

## Abdominal aortic aneurysm: diagnosis and management

NICE guideline

Published: 19 March 2020

www.nice.org.uk/guidance/ng156

*EJVES* 2024 (140 pages), *Eur Heart J* 2024 (163 pages), *J Vasc Surg* 2018 (78 pages), *Circulation* 2022 (149 pages)
https://www.nice.org.uk/guidance (49 pages)

# Aneurysma der Aorta abdominalis AAA

## Definition

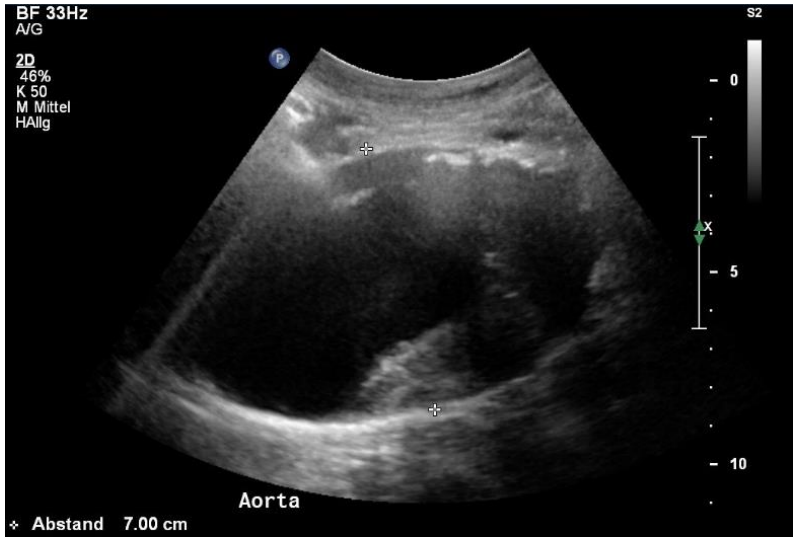
- Durchmesser **≥ 3 cm** (antero-posterior, transversal oder maximum) (>2 SD des mittleren äusseren Durchmessers bei Männern)
- Ev. niedriger Grenzwert bei Frauen und Asiaten
- Fokale Aufweitung um mehr als das 1.5fache der normalen infrarenalen oder suprarenalen Aorta
- Subaneurysmale Aortendilatation (max. Durchmesser 2.5-2.9cm)

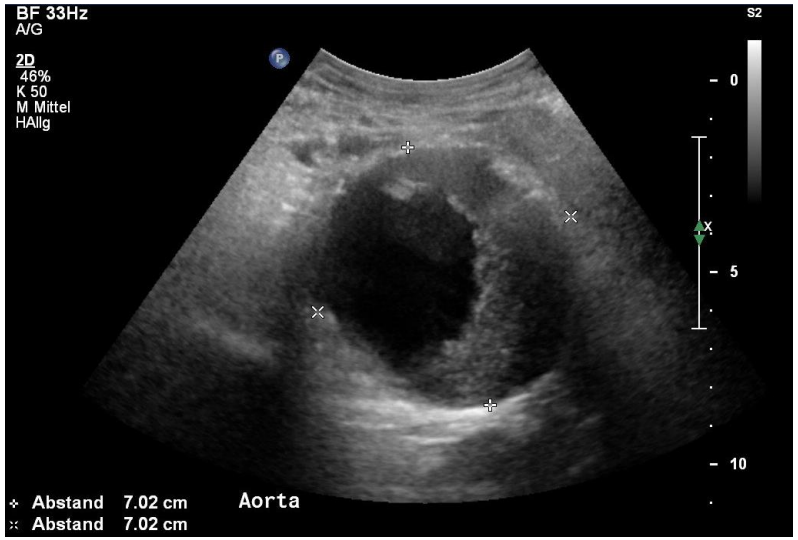
# Bildgebung

- **Ultraschall** gilt als «first line» Methode für Screening und Verlaufsuntersuchung

| Recommendation 7 | | | Unchanged |
|---|---|---|---|
| Ultrasonography is recommended for the first line diagnosis and surveillance of small abdominal aortic aneurysms. | | | |
| Class | Level | References | ToE |
| I | B | Concannon *et al.* (2014),[110] Rubano *et al.* (2013),[111] Long *et al.* (2012)[112] | |

| Recommendation 8 | | | Changed |
|---|---|---|---|
| The anteroposterior plane with consistent calliper placement should be considered the preferred method for ultrasound abdominal aortic diameter measurement. | | | |
| Class | Level | References | ToE |
| IIa | B | Bissacco *et al.* (2023),[8] Long *et al.* (2012 ),[112] Grondal *et al.* (2012)[114] | |




Anterior-posteriorer Durchmesser

Wanhainen A et al. *EJVES* 2024

# Bildgebung

| Systematic reviews | Question/comparison | Findings (quality of evidence) |
|---|---|---|
| Alamoudi, 2015[7]<br>Concannon, 2014[8] | Diagnostic accuracy of imaging for AAA compared with digital subtraction angiography | • The mean reported sensitivities and specificities were as follows:<br>  • DUS: 81% and 91.1%<br>  • CTA: 84.3% and 98.4%<br>  • MRA: 95.8% and 95.8%<br>• Non-radiologist-performed ultrasound achieved acceptable sensitivity and specificity for both detection and measurement of AAA |

Diagnostische Genauigkeit
- Gute Sensitivität und Spezifität

**Recommendation 9** — **Changed**

Computed tomography angiography is recommended for treatment planning once the anteroposterior diameter threshold for elective abdominal aortic aneurysm repair has been met on ultrasound, and for the diagnosis of rupture.

| Class | Level | References | ToE |
|---|---|---|---|
| I | C | Long *et al.* (2012),[112] Oliver-Williams *et al* (2019),[117] Biancari *et al.* (2013)[122] | |

**Recommendation 10** — **Changed**

Aortic diameter measurement with computed tomography angiography is recommended using dedicated post-processing software analysis; with consistent calliper placement in an orthogonal plane perpendicular to the aorta.

| Class | Level | References | ToE |
|---|---|---|---|
| I | C | Mora *et al.* (2014)[123] | |

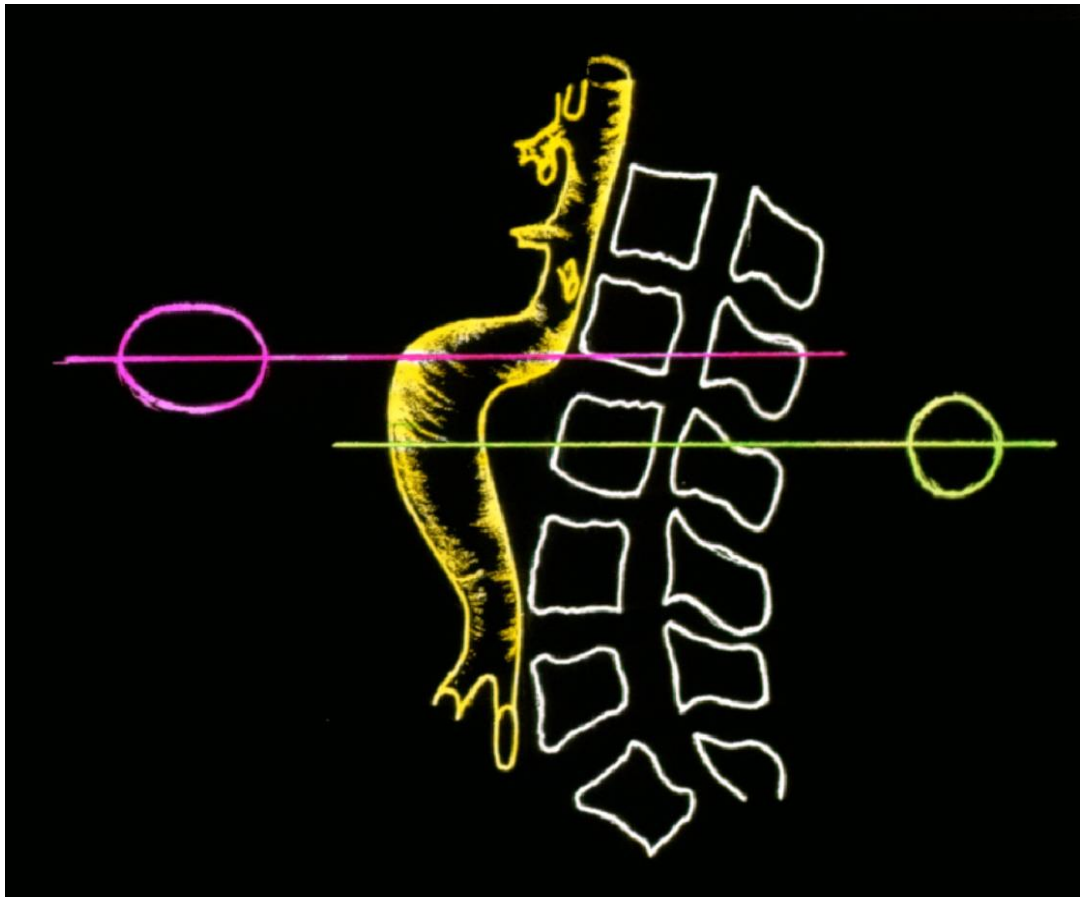
CTA:
- Entscheidung der Therapie
- Planung der Behandlung
- Diagnose einer Ruptur

**Table 4.1. Cross sectional imaging criteria for planning of infrarenal abdominal aortic aneurysm repair.**

| |
|---|
| Proximal neck to be cross clamped or used as landing zone, including; diameter and length, angulation, shape, presence and extent of calcification and athero-thrombosis. |
| Iliac arteries to be cross clamped or used for access and landing zone, including: patency; diameter and length; angulation/tortuosity; extent of calcification and athero-thrombosis; patency of internal iliac arteries and pelvic circulation; presence of iliac artery aneurysms. |
| Access vessel and lower limb "runoff" vessels/circulation. |
| Anatomy and patency of visceral arteries and presence of accessory renal arteries. |
| Concomitant aneurysms in visceral arteries or thoracic aorta. |
| Other: Venous anomalies, including position and patency of inferior vena cava and left renal vein; organ position, including pelvic or horseshoe kidney; signs of concomitant disease potentially altering prognosis and, thereby, indication for repair. |

CTA für Behandlungsplan:
- Proximale Landungszone
- Iliacalarterien
- Zugangsgefässe
- Viszeralgefässe und Nierenarterien
- Thorakale Aorta

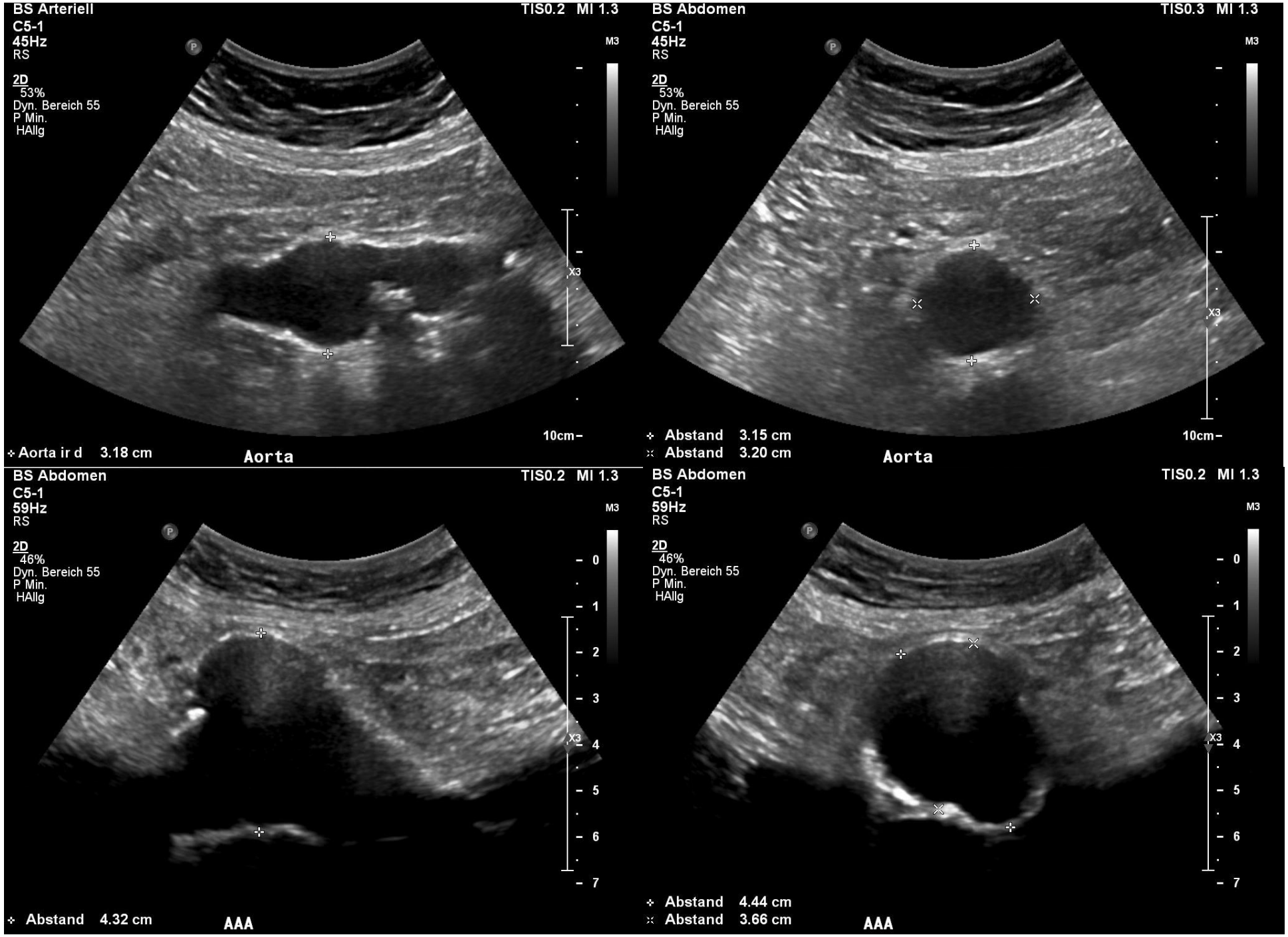
# AAA: Schnittebene



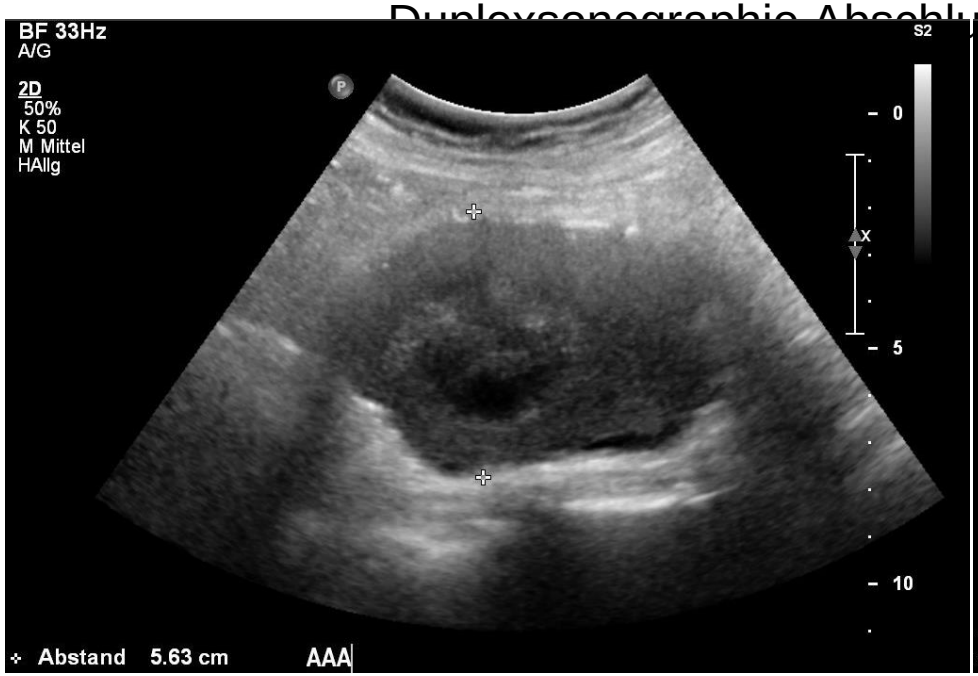
Senkrecht zur Gefässachse
(nicht zur Körperachse)

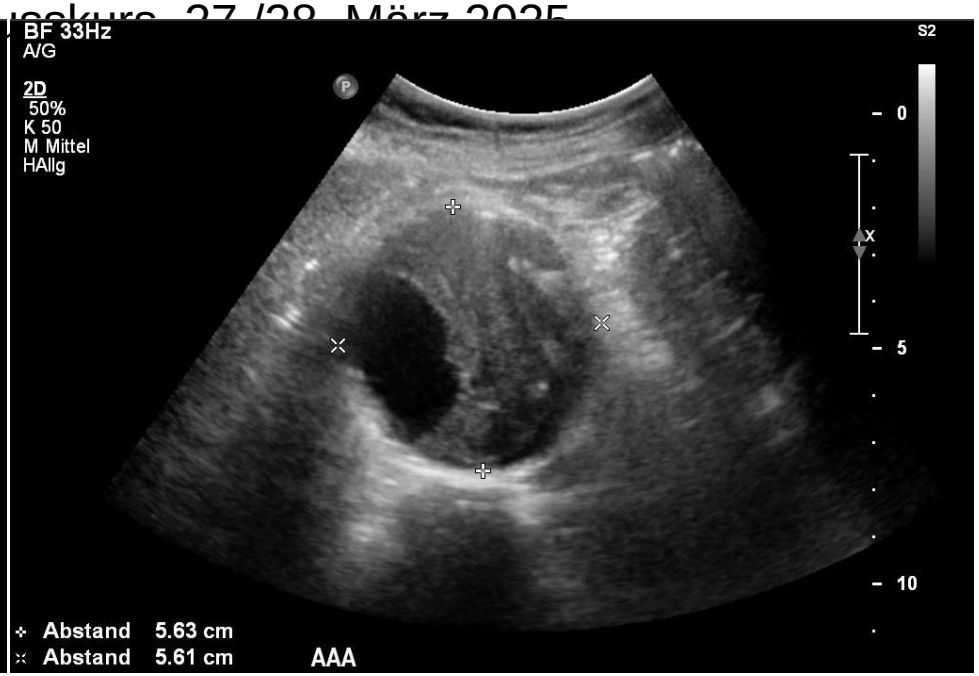
Querschnitt: Gefahr der Ueberschätzung des Durchmessers
(üblicherweise wird a.p. gemessen)

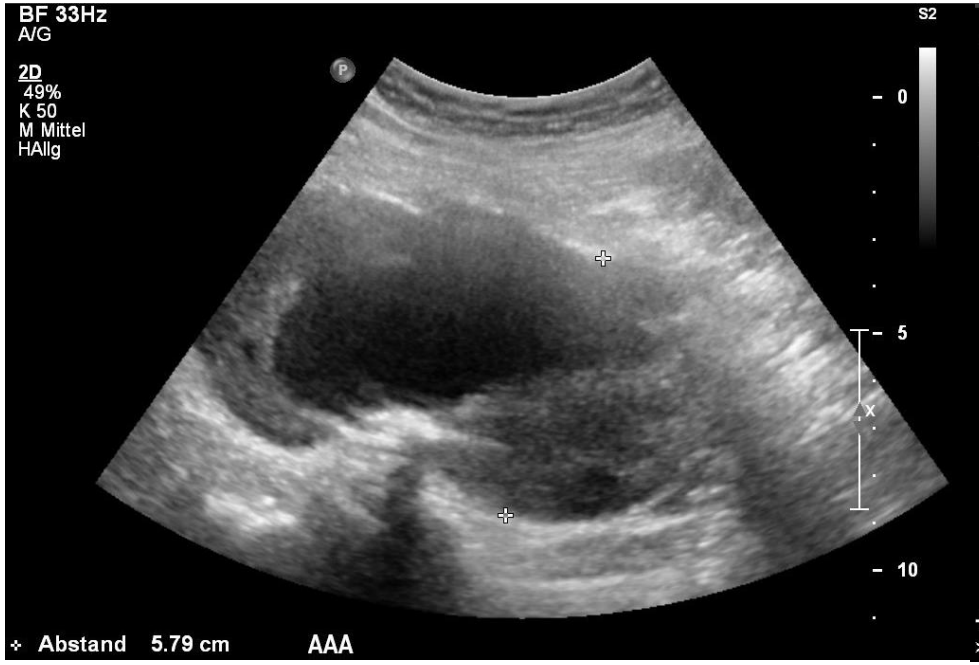
Längsschnitt: keine Ueberschätzung (Cave: Unterschätzung)

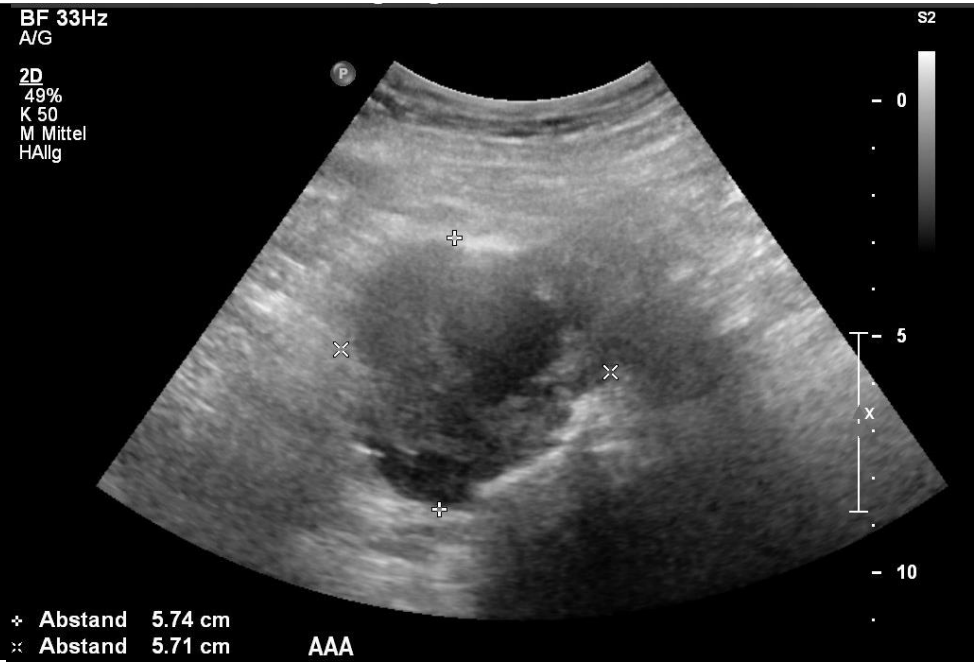

BS Arteriell
C5-1
45Hz
RS
2D
53%
Dyn. Bereich 55
P Min.
HAllg
TIS0.2 MI 1.3
M3
10cm
Aorta ir d 3.18 cm
Aorta
BS Abdomen
C5-1
45Hz
RS
2D
53%
Dyn. Bereich 55
P Min.
HAllg
TIS0.3 MI 1.3
M3
10cm
Abstand 3.15 cm
Abstand 3.20 cm
Aorta
BS Abdomen
C5-1
59Hz
RS
2D
46%
Dyn. Bereich 55
P Min.
HAllg
TIS0.2 MI 1.3
M3
Abstand 4.32 cm
AAA
BS Abdomen
C5-1
59Hz
RS
2D
46%
Dyn. Bereich 55
P Min.
HAllg
TIS0.2 MI 1.3
M3
Abstand 4.44 cm
Abstand 3.66 cm
AAA

# Duplexsonographie Abschlusskurs, 27./28. März 2025

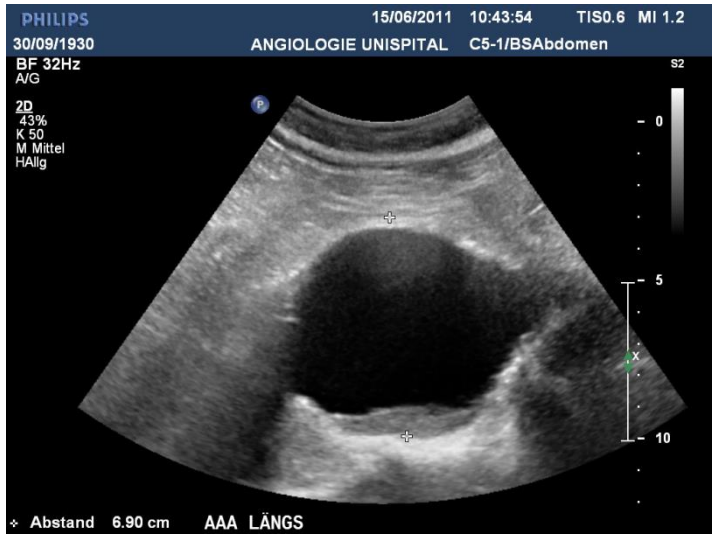


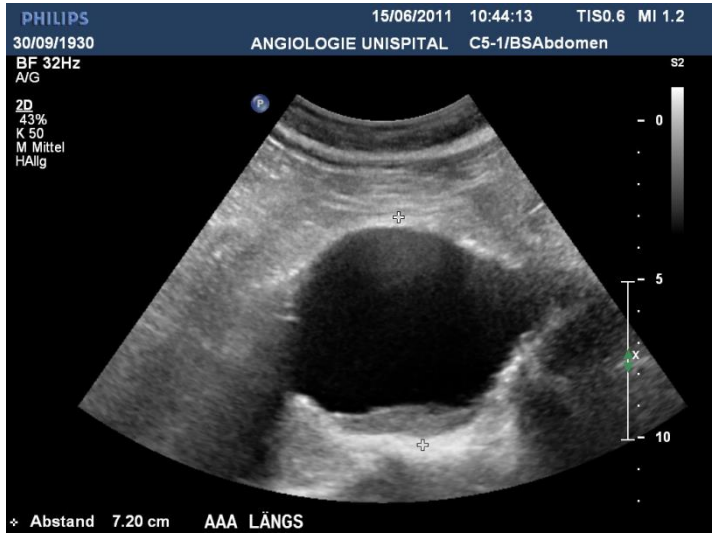



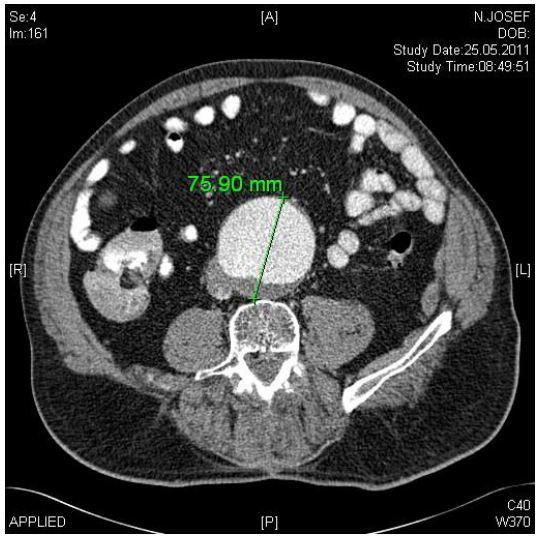
Inner-to-inner (Differenz 2-5mm)




Leading-edge-to-leading-edge




Outer-to-outer (± 2mm)




CT axial (nicht achsenkorrigiert)

Moll FL et al. *Eur J Vasc Endovasc Surg* 2011

# Messmethode

- Interobserver Variabilität tiefer für OTO als ITI und LELE
- ITI 0.3 – 0.6 cm kleiner als OTO (Empfehlung ITI in NICE guideline)
- Diastole versus Systole: 2mm Differenz
- Standard mit Reproduzierbarkeit ±5mm

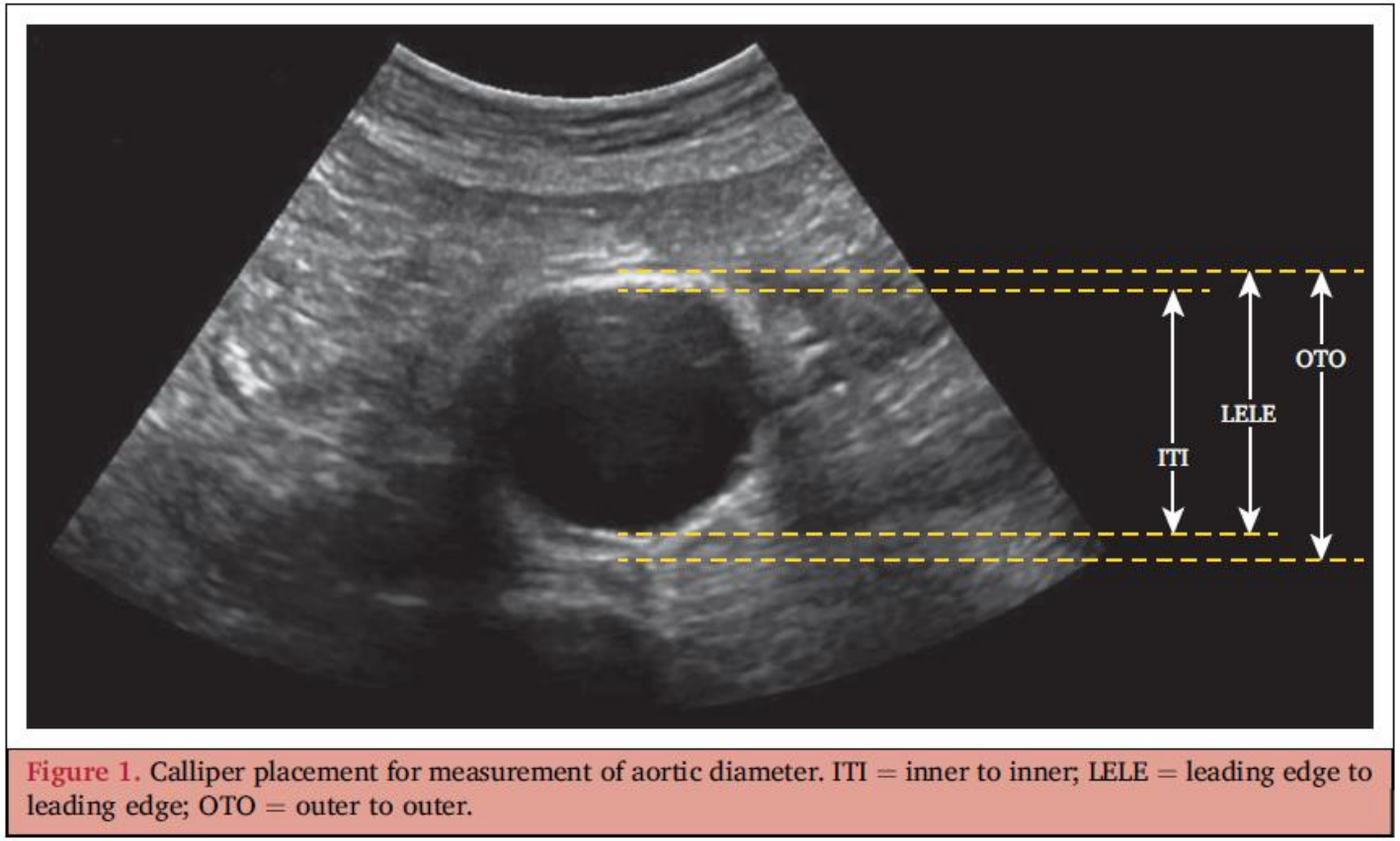



Figure 1. Calliper placement for measurement of aortic diameter. ITI = inner to inner; LELE = leading edge to leading edge; OTO = outer to outer.

## NICE Guidelines:

When measuring aortic size with ultrasound, report the inner-to-inner maximum anterior-posterior aortic diameter, in accordance with the NHS AAA screening programme. Clearly document any additional measurements taken.

**Empfehlung**

Die Leading-edge-Methode in senkrechter Messung rechtwinklig zur Längsachse des Gefäßes soll für das Ultraschallscreening angewandt werden.

Evidenzgrad 3b / Empfehlungsgrad A, starker Konsens

Wanhainen A et al. *EJVES* 2019, https://www.nice.org.uk/guidance
S3-Leitlinie zu Screening, Diagnostik, Therapie und Nachsorge des Baucharotenaneurysmas: https://www.awmf.org/leitlinien/detail/ll/004-014.html

# Epidemiologie AAA

- Prävalenz ist abhängig von Alter, Geschlecht, und Population
- Lifetime Risiko für AAA ist 8.2% bei Männern und 10.5% bei aktiven Rauchern.

**Table 2.1.** Summary of randomised trials of population based screening for abdominal aortic aneurysm in men.

| Trial characteristics | Chichester UK,[135] | Viborg Denmark,[132] | MASS UK,[133] | Western Australia,[134] |
|---|---|---|---|---|
| Number randomised | 15,775 | 12,628 | 67,800 | 41,000 |
| Gender | Men and women | Men | Men | Men |
| Age (year) | 65–80 | 65–73 | 65–74 | 65–79 |
| Period recruited | 1988–1990 | 1994–1998 | 1997–1999 | 1996–1998 |
| Year published | 1995 | 2002 | 2002 | 2004 |
| Attendance rate | 68% | 76% | 80% | 70%[a] |
| AAA detection rate | 4% (7.6% in men) | 4% | 4.9% | 7.2% |
| Place of screening | Hospital | Hospital | Community | Community |
| Intervention policy | At 6.0 cm | At 5.0 cm measured as external diameter | At 5.5 cm measured as internal diameter | none |
| Mean follow up (year) | 4.1 | 13.0 | 13.1 | 12.8 |
| AAA mortality, odds ratio (95% CI) Screened vs. not | 0.59 men only (0.27–1.29) | 0.31 (0.13–0.79) | 0.58 (0.42–0.78 | 0.91 (0.68–1.21) |
| All cause mortality, odds ratio (95% CI) Screened vs. not | 1.07 (men only) (0.93–1.22) | 0.98 (0.95–1.02) | 0.97 (0.93–1.02) | 0.98 (0.96–1.01) |

- Inzidenz **asymptomatisches** AAA: 3 bis 117 pro 100‘000 Personen-Jahre
- Inzidenz **rupturiertes** AAA: 1 bis 21 pro 100‘000 Personen-Jahre
- 50% sterben bevor sie den Spital erreichen, Gesamtmortalität 85%

Isselbacher EM et al. JACC 2022, Wanhainen A et al. *EJVES* 2019, Moll FL et al. Eur J Vasc Endovasc Surg 2011, Weiss N et al. VASA 2014

# Epidemiologie AAA

- Neuere Screeningprogramme bei 65-jährigen Männern (tiefe Prävalenz: 1.7% Schweden, 1.3% UK, 3.3% Dänemark, 5% USA nur Raucher)
- Tiefe Prävalenz bei Frauen >60 Jahre 0.7%
- Signifikante Reduktion der AAA-spezifischen Mortalität (OR 0.5 - 0.6)

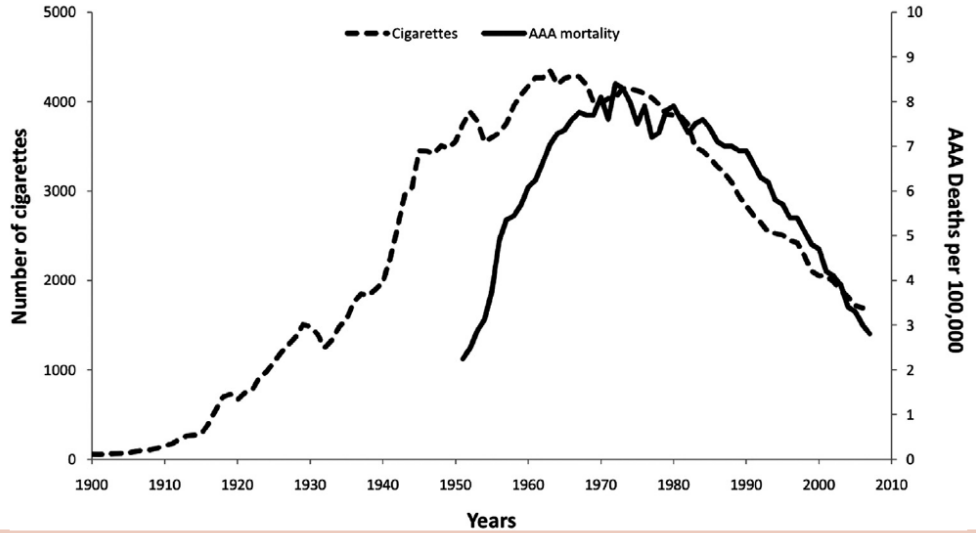



**Fig 1.** The annual adult per capita cigarette consumption and age-adjusted abdominal aortic aneurysm (*AAA*) deaths per 100,000 white men by year in the United States. (From Lederle FA. The rise and fall of abdominal aortic aneurysm. Circulation 2011;124:1097-9.).

- Abnahme des Zigarettenkonsums
- Verbesserung der Behandlung der Risikofaktoren: Statine, antihypertensive Medikation

| Systematic reviews | Question/comparison | Findings (quality of evidence) |
|---|---|---|
| Guirguis-Blake, 2014[4]<br>Cosford, 2011[5]<br>Takaji, 2010[6] | Effectiveness of screening for AAA | • Screening (primarily in men >65 years) was associated with reduction in AAA mortality (high); absolute reduction: 4 per 1000; number needed to screen: 238 |

- NNS: 238

Wanhainen A et al. *Circulation* 2016; Persson SE et al. *J Vasc Surg* 2017
Chaikof EL et al. *J Vasc Surg* 2018

# Risikofaktoren

Männer OR 5.7

Alter OR 2.8 - 28

Rauchen OR 2.6-12

Familienanamnese OR 3.8

Diabetes OR 0.75

Rauchstopp OR 0.4-0.9

Früchte. Gemüse OR 0.9

**TABLE 15** Risk Factors for Abdominal Aortic Aneurysm

| Strong Risk Factors | Additional Risk Factors |
|---|---|
| Smoking history | Hypertension |
| Older age | Hyperlipidemia |
| Male sex | White race |
| Family history of abdominal aortic aneurysm | Inherited vascular connective tissue disorder |
| | Atherosclerotic cardiovascular disease |

Isselbacher EM et al. JACC 2022, Chaikof EL et al. *J Vasc Surg* 2018

| Variable | Estimate | *P* | OR | 95% CI | Score |
|---|---|---|---|---|---|
| Male (vs female) | 1.74 | <.0001 | 5.71 | 5.57-5.85 | 18 |
| Age, years (vs <55 years) | | | | | |
| 55-59 | 1.01 | <.0001 | 2.76 | 2.55-3.00 | 11 |
| 60-64 | 1.68 | <.0001 | 5.35 | 4.97-5.76 | 17 |
| 65-69 | 2.24 | <.0001 | 9.41 | 8.76-10.12 | 23 |
| 70-74 | 2.67 | <.0001 | 14.46 | 13.45-15.55 | 28 |
| 75-79 | 3.02 | <.0001 | 20.43 | 18.99-21.99 | 31 |
| 80-84 | 3.35 | <.0001 | 28.37 | 26.31-30.59 | 35 |
| Race/ethnicity (vs white) | | | | | |
| Hispanic | −0.37 | <.0001 | 0.69 | 0.62-0.77 | −4 |
| African American | −0.33 | <.0001 | 0.72 | 0.66-0.78 | −3 |
| Asian | −0.41 | <.0001 | 0.72 | 0.59-0.75 | −4 |
| High blood pressure | 0.22 | <.0001 | 1.25 | 1.21-1.28 | 2 |
| Coronary artery disease | 0.54 | <.0001 | 1.72 | 1.69-1.76 | 6 |
| Family history of AAA | 1.34 | <.0001 | 3.80 | 3.66-3.95 | 14 |
| High cholesterol | 0.29 | <.0001 | 1.34 | 1.31-1.37 | 3 |
| Diabetes | −0.29 | <.0001 | 0.75 | 0.73-0.77 | −3 |
| Peripheral arterial disease | 0.47 | <.0001 | 1.59 | 1.54-1.65 | 5 |
| Smoking, packs/day | | | | | |
| ≤10 years | | | | | |
| <0.5 | 0.96 | <.0001 | 2.61 | 2.47-2.74 | 10 |
| 0.5-1 | 1.16 | <.0001 | 3.19 | 2.93-3.46 | 12 |
| >1 | 1.16 | <.0001 | 3.20 | 2.88-3.56 | 12 |
| 11-20 years | | | | | |
| <0.5 | 1.58 | <.0001 | 4.87 | 4.63-5.12 | 16 |
| 0.5-1 | 1.76 | <.0001 | 5.79 | 5.48-6.12 | 18 |
| >1 | 1.79 | <.0001 | 6.00 | 5.66-6.35 | 19 |
| 21-35 years | | | | | |
| <0.5 | 1.99 | <.0001 | 7.29 | 6.97-7.64 | 21 |
| 0.5-1 | 2.08 | <.0001 | 7.99 | 7.62-8.38 | 22 |
| >1 | 2.13 | <.0001 | 8.41 | 8.57-9.36 | 22 |
| >35 years | | | | | |
| <0.5 | 2.19 | <.0001 | 8.96 | 8.57-9.36 | 23 |
| 0.5-1 | 2.42 | <.0001 | 11.19 | 10.76-11.64 | 25 |
| >1 | 2.50 | <.0001 | 12.13 | 11.66-12.61 | 26 |
| Quit smoking | | | | | |
| <5 years ago | −0.14 | <.0001 | 0.87 | 0.84-0.912 | −1 |
| 5-10 years ago | −0.39 | <.0001 | 0.68 | 0.65-0.71 | −4 |
| > 10 years ago | −0.87 | <.0001 | 0.42 | 0.41-0.43 | −9 |
| Fruits and vegetables, >3 times/week | −0.10 | <.0001 | 0.91 | 0.88-0.92 | −1 |
| Nuts, >3 times/week | −0.11 | <.0001 | 0.90 | 0.89-0.93 | −1 |
| Exercise, ≥1 time/week | −0.15 | <0001 | 0.86 | 0.85-0.88 | −2 |
| BMI ≥25 kg/m$^2$ | 0.18 | <0001 | 1.20 | 1.17-1.22 | 2 |

# AAA-Screening

**Table 6. Potential for abdominal aortic aneurysm screening in different risk populations.**

| Risk group | Potential for screening | |
|---|---|---|
| | Men | Women |
| 65 year old | + | − |
| 65 year old former or current smoker | ++ | − |
| Non-white ethnicity | − | − |
| First degree relative with abdominal aortic aneurysm | +++ | +++ |
| Other peripheral aneurysms | +++ | +++ |
| Cardiovascular disease | − | − |
| Organ transplanted | ++ | ++ |

+ indicates different degrees of suitability for screening and − indicates not suitable for screening.

**Recommendation 11** — **Changed**

**Ultrasound screening for the early detection of abdominal aortic aneurysm is recommended in high risk populations* to reduce death from aneurysm rupture.**

| Class | Level | References | ToE |
|---|---|---|---|
| I | A | Lederle *et al.* (2000),[99] Wanhainen *et al.* (2016),[119] Scott *et al.* (1995),[127] Ashton *et al.* (2002),[128] Thompson *et al.* (2009),[129] Lindholt *et al.* (2005),[133] Norman *et al.* (2004),[134] Cosford and Lend (2007),[158] Guirguis-Blake *et al.* (2014)[159] | |

* What can be considered a high risk group varies based on local conditions, such as disease prevalence, life expectancy, and healthcare structure, see Table 6.

Wanhainen A et al. *EJVES* 2024

# AAA-Wachstum

- Durchschnitt 2.2 mm / Jahr (Männer und Frauen)
- 1.3mm / Jahr bei 3cm, bis 3.6mm / Jahr bei 5cm
- Raucher +0.35mm / Jahr (+16%)
- Diabetes -0.51 mm / Jahr (-25%) (Metformin?)
- **Rauchstopp**: -20% Wachstumsrate, halbiert Ruptur-Rate
- Doxycycline, Beta-Blocker, ACE-Hemmer, Statine, Aspirin, Ticagrelor: **kein Effekt**
- Metformin reduziert möglicherweise das AAA-Wachstum (Meta-Analyse, ongoing trial)
- Statine erwägen um AAA-Wachstum zu reduzieren, Rupturrate und peri-operative Mortalität senken
- Bewegung: kein Effekt

| Recommendation 17 | | | Unchanged |
|---|---|---|---|
| Patients with a small abdominal aortic aneurysm are recommended to stop smoking and should receive help to do this, to reduce the abdominal aortic aneurysm growth rate and risk of rupture. | | | |
| Class | Level | References | ToE |
| I | B | Sweeting *et al.* (2012),[210] Hartmann-Boyce *et al.* (2022)[211] | |

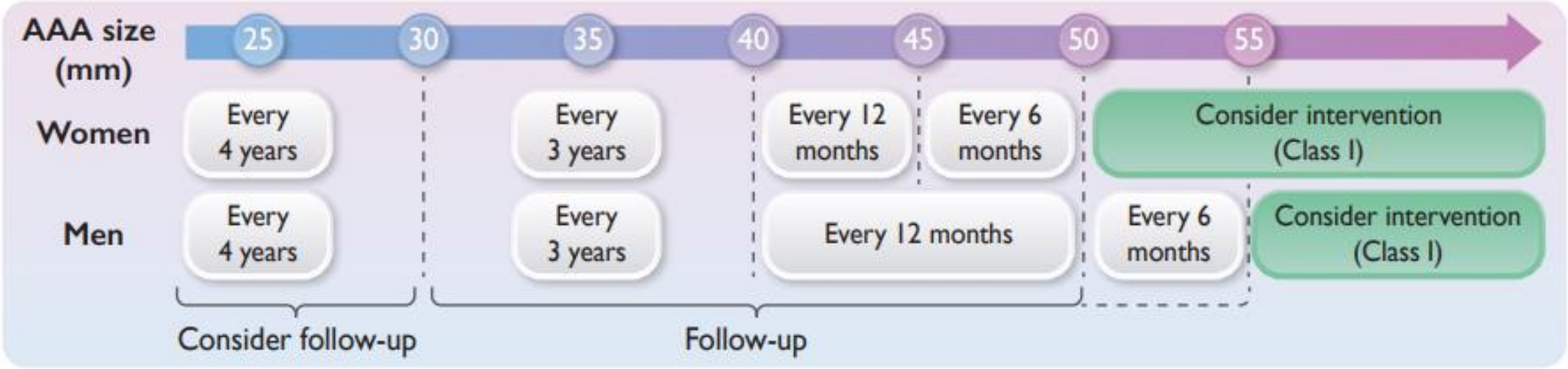
Wanhainen A et al. *EJVES* 2024

| Recommendations | Class[a] | Level[b] |
|---|---|---|
| In patients with aortic aneurysm (TAA and/or AAA), optimal implementation of CV risk management and medical treatment (see detailed recommendations in dedicated Tables of Recommendations[c]) are recommended to reduce MACE.[936] | I | C |
| Fluoroquinolones, while generally discouraged for patients with aortic aneurysms, may be considered if there is a compelling clinical indication and no other reasonable alternative.[951–960] | IIb | B |

Mazzolai L et al. *Eur Heart J* 2024

# AAA Verlaufskontrolle

**ESC**



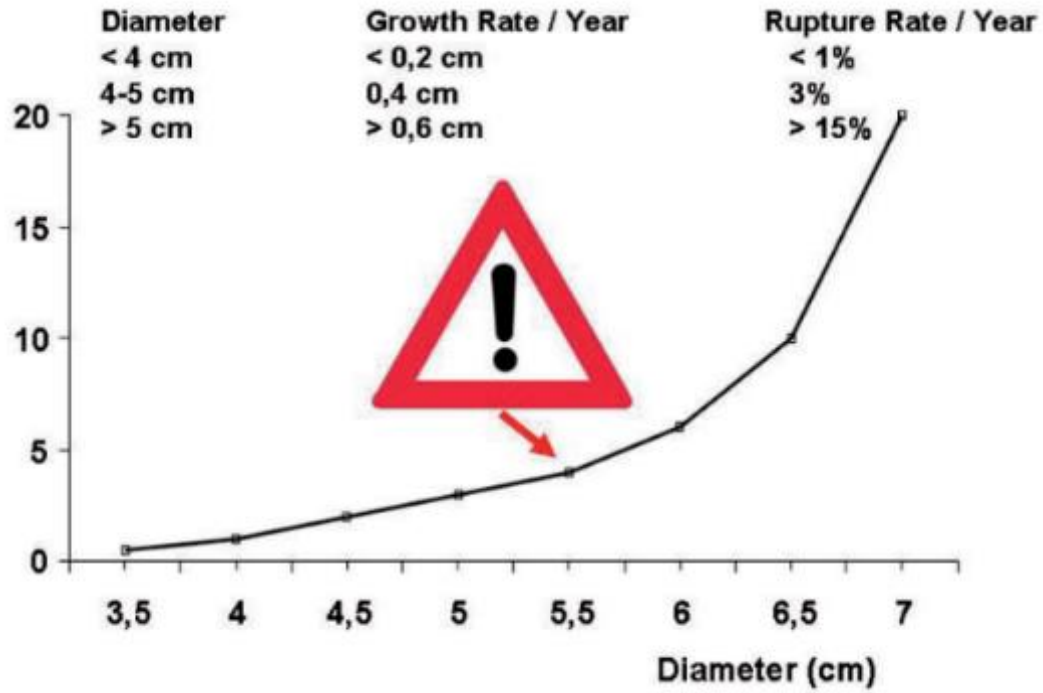

consider intervention in saccular aneurysm

**ESVS**

- Alle 5 Jahre bei sub-aneurysmaler Aortendilatation 2.5-2.9 cm
- Alle 3 Jahre bei AAA mit Durchmesser 3.0 - 3.9 cm
- Jährlich bei AAA mit Durchmesser 4.0 - 4.9 cm, bei Frauen 4.0 – 4.4 cm
- Alle 6 Monate bei AAA mit Durchmesser ≥ 5.0cm, bei Frauen ≥ 4.5 cm

Wanhainen A et al. *EJVES* 2024, Mazzolai L et al. *Eur Heart J* 2024

# Rupturrate des AAA in Abhängigkeit des Durchmessers und Wachstumsrate




- Gepoolte Analysen deuten darauf hin, dass das aktuelle Rupturrisiko bei AAAs mit einem Durchmesser von 5,5 bis 7,0 cm bei 5,3 % pro Jahr und bei AAAs mit einem Durchmesser von mehr als 7,0 cm bei 6,3 % pro Jahr liegt

**Zusätzliche Faktoren**

- **Frauen** (4-fach erhöht)
- **Raucher**
- wall-stress (**sacculäres AAA**)
- Hypertonie
- Immunosuppressiva nach Tx

| Systematic reviews | Question/comparison | Findings (quality of evidence) |
|---|---|---|
| Sweeting, 2012[9] | Factors affecting growth and rupture of small AAA | • Rupture was higher in women, in smokers, and with elevated blood pressure (moderate) |
| RESCAN Collaborators, 2013[10] | Surveillance intervals for small AAA | • For each 0.5-cm increase in AAA diameter, growth rates increased on average by 0.59 mm/y and rupture rates increased by a factor of 1.91 (moderate) |

Weiss N et al. *VASA* 2014, Lederle FA Ann *Intern Med* 2009, Parkinson F et al. *J Vasc Surg* 2015

# AAA-Behandlungs-Indikation (invasive Therapie)

**Asymptomatisches AAA**:

Männer Durchmesser ≥ 5.5cm  Frauen Durchmesser ≥ 5.0cm

| Recommendations | Class[a] | Level[b] |
|---|---|---|
| Elective repair is recommended if AAA diameter is ≥55 mm in men or ≥50 mm in women.[1064–1067] | I | A |

AAA-Wachstum ≥ 1.0cm/Jahr

| | | |
|---|---|---|
| In patients with unruptured AAA and aneurysm growth ≥5 mm in 6 months or ≥10 mm per year, repair may be considered.[1064,1065] | IIb | C |

Sacculäres Aneurysma > 4.5cm

| | | |
|---|---|---|
| Elective repair for patients presenting with a saccular aneurysm >45 mm may be considered.[1144] | IIb | C |

Mazzolai L et al. *Eur Heart J* 2024

**Symptomatisches AAA**:

- Spontan geäusserte Schmerzen
- Bei Palpation dolent
- Rupturiertes AAA

| | | |
|---|---|---|
| In ruptured AAA with suitable anatomy, endovascular repair is recommended over open repair to reduce peri-operative morbidity and mortality.[1116–1118] | I | B |

Wanhainen A et al. *EJVES* 2024

Lebenserwartung

| | | |
|---|---|---|
| In patients with AAA and limited life expectancy (<2 years), elective AAA repair is not recommended.[1098,1099] | III | B |

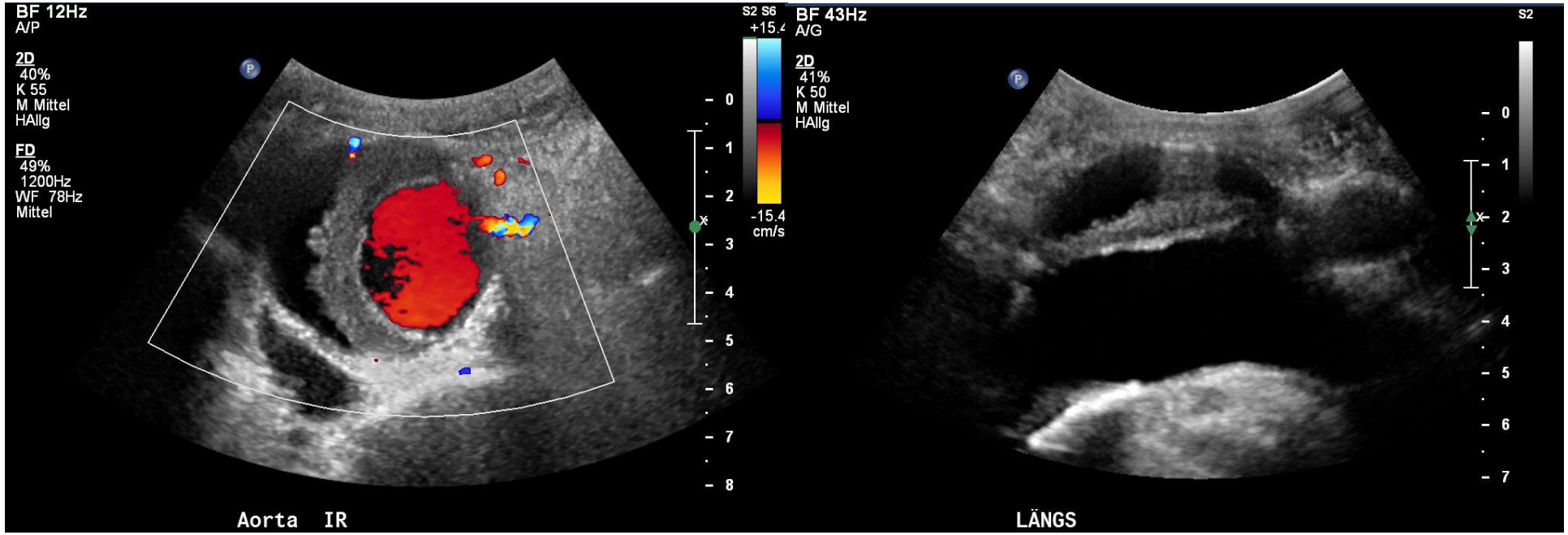
# Gedeckte Ruptur eines AAA

## 65-jähriger Patient mit Flankenschmerzen

# Wandhämatom eines AAA

## 64-jähriger Patient

# Wandhämatom eines AAA



# Vielen Dank

## Für ihre Aufmerksamkeit!

Universitätsspital Basel

SGUM SSUM