

Aortenaneurysma: Diagnostik und Verlaufsuntersuchungen

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Editor's Choice — European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms

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2014 ESC Guidelines on the diagnosis and treatment of aortic diseases

Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult

The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC)



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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Abdominal aortic aneurysm: diagnosis and management

NICE guideline

Published: 19 March 2020

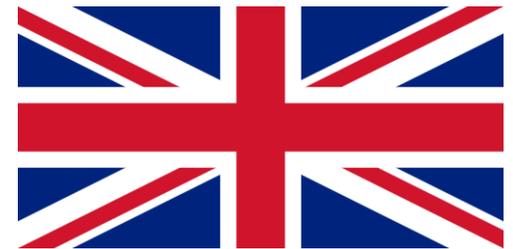
www.nice.org.uk/guidance/ng156

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

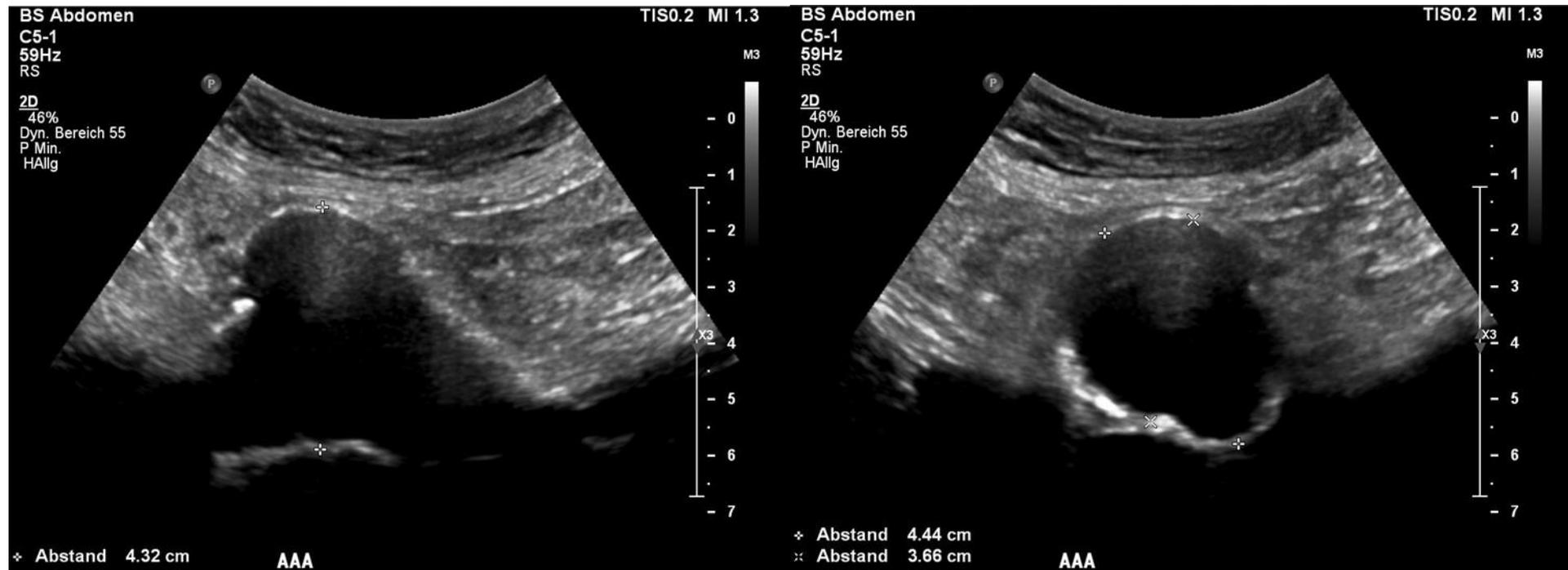
Endorsed by the Society of Interventional Radiology and Society for Vascular Medicine



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		
Ultrasonography is recommended for the first line diagnosis and surveillance of small abdominal aortic aneurysms		
Class	Level	References
I	B	[111,71,103,112]

Recommendation 8		
The antero-posterior measuring plane with a consistent calliper placement should be considered the preferred method for ultrasound abdominal aortic diameter measurement		
Class	Level	References
IIa	B	[108,106,75,76,103,77]

Anterior-posteriorer Durchmesser



Bildgebung

Systematic reviews	Question/comparison	Findings (quality of evidence)
Alamoudi, 2015 ⁷ Concannon, 2014 ⁸	Diagnostic accuracy of imaging for AAA compared with digital subtraction angiography	<ul style="list-style-type: none"> The mean reported sensitivities and specificities were as follows: <ul style="list-style-type: none"> DUS: 81% and 91.1% CTA: 84.3% and 98.4% MRA: 95.8% and 95.8% Non-radiologist-performed ultrasound achieved acceptable sensitivity and specificity for both detection and measurement of AAA

Diagnostische Genauigkeit

- Gute Sensitivität und Spezifität

Recommendation 9			Recommendation 10		
In patients with abdominal aortic aneurysms computed tomography angiography is recommended for therapeutic decision making and treatment planning, and for the diagnosis of rupture			Aortic diameter measurement with computed tomography angiography should be considered using dedicated post-processing software analysis in three perpendicular planes with a consistent calliper placement		
Class	Level	References	Class	Level	References
I	C	[120,103,113]	IIa	C	[114]

CTA:

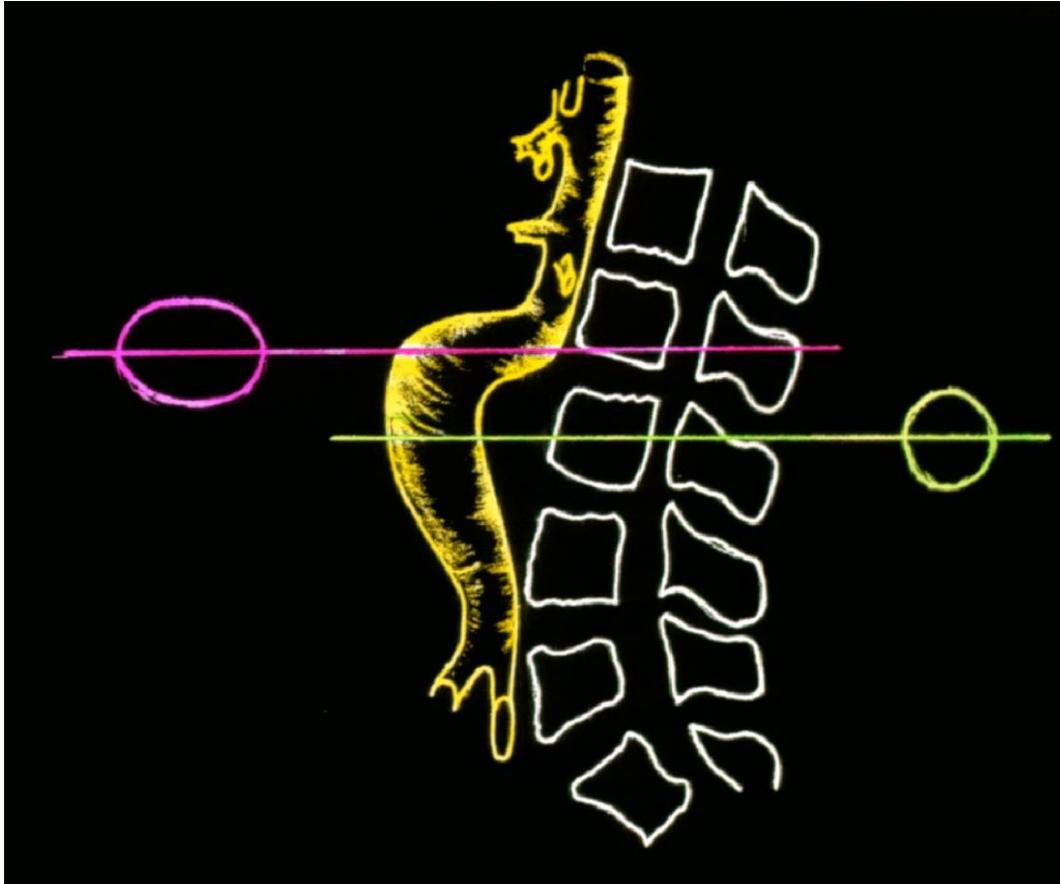
- Entscheidung der Therapie
- Planung der Behandlung
- Diagnose einer Ruptur

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:

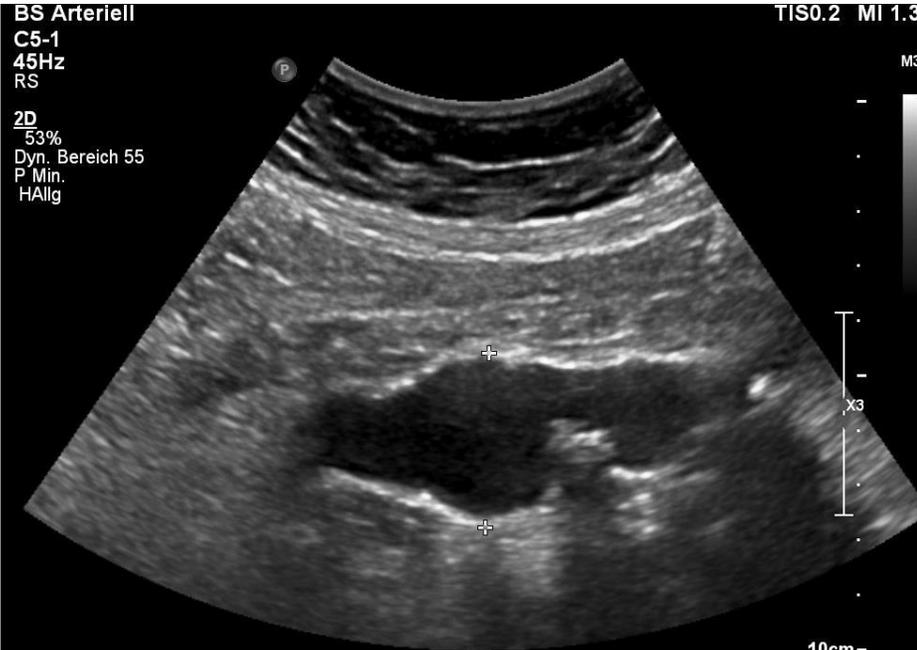
- Proximale Landungszone
- Iliacalarterien
- Zugangsgefäße
- Viszeralgefäße und Nierenarterien
- Thorakale Aorta

AAA: Schnittebene



Senkrecht zur
Gefäßachse
(nicht zur Körperachse)
Querschnitt: Gefahr der
Überschätzung des
Durchmessers
(üblicherweise wird a.p.
gemessen)

Längsschnitt: keine
Überschätzung (Cave:
Unterschätzung)



✦ Aorta ir d 3.18 cm

Aorta



✦ Abstand 3.15 cm
✕ Abstand 3.20 cm

Aorta



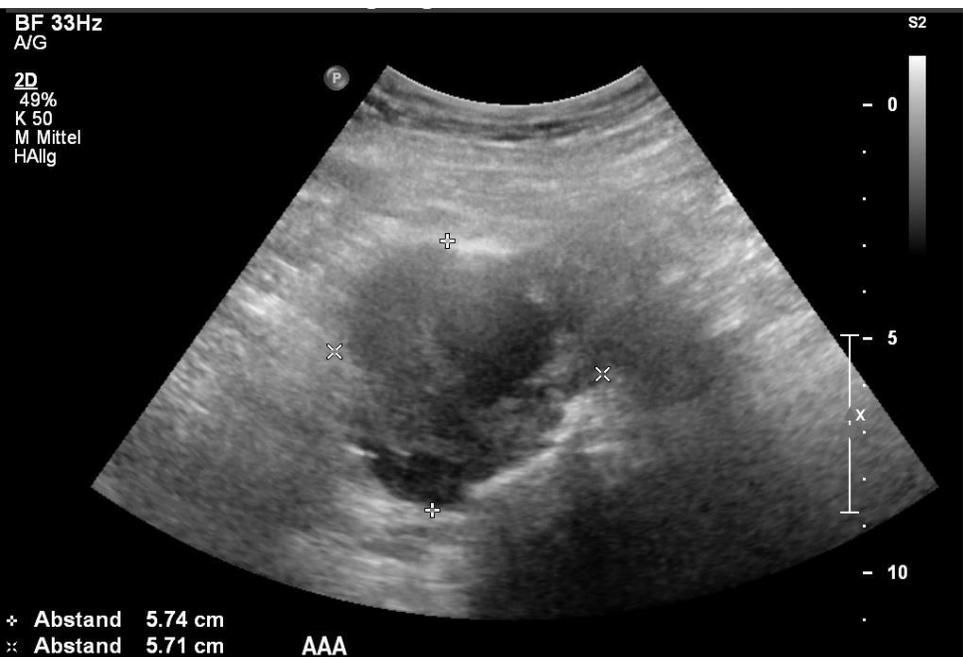
✦ Abstand 4.32 cm

AAA



✦ Abstand 4.44 cm
✕ Abstand 3.66 cm

AAA



Duplexsonographie Abschlusskurs, 25./26. April 2024



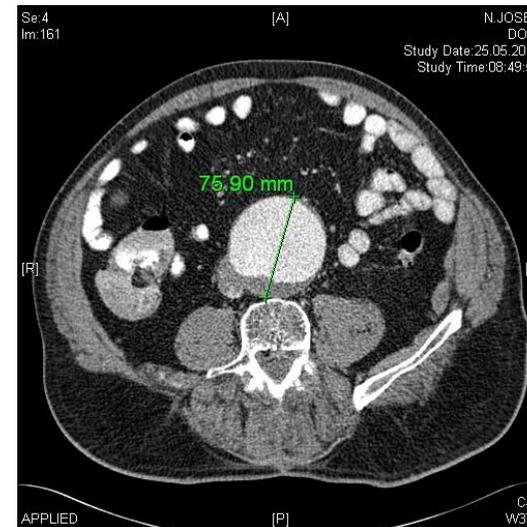
Inner-to-inner (Differenz 2-5mm)



Leading-edge-to-leading-edge



Outer-to-outer (± 2 mm)



CT axial (nicht achsenkorrigiert)

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 $\pm 5\text{mm}$

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/II/004-014.html>

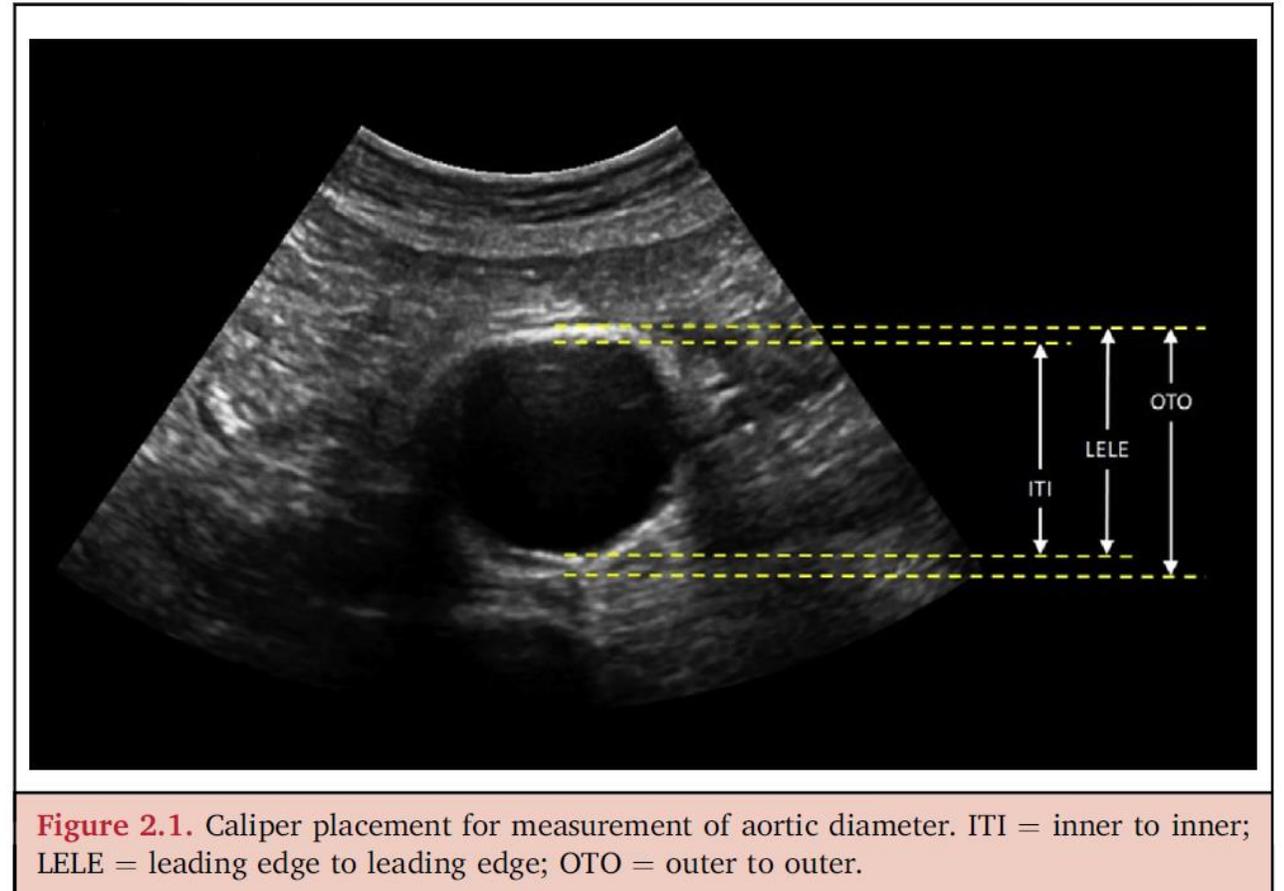


Figure 2.1. Caliper placement for measurement of aortic diameter. ITI = inner to inner; LELE = leading edge to leading edge; OTO = outer to outer.

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.

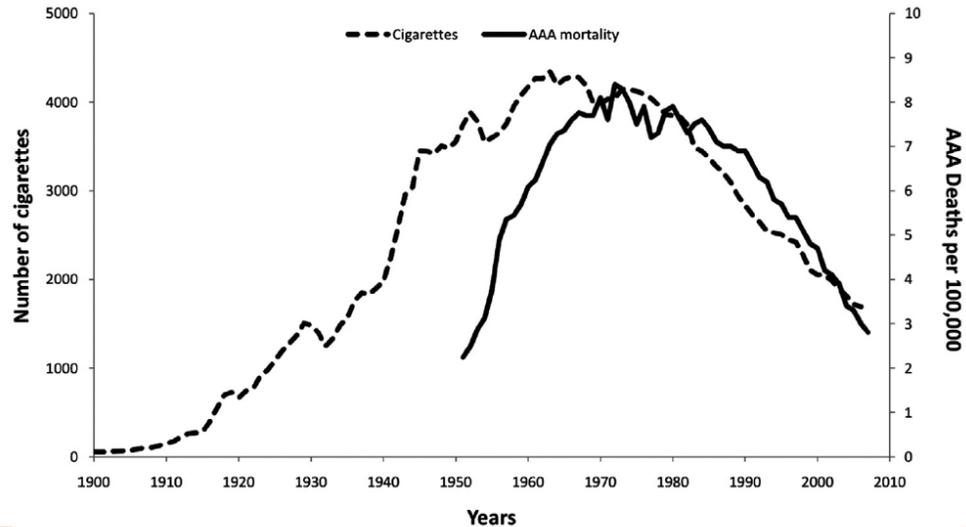
Table 2.1. Summary of randomised trials of population based screening for abdominal aortic aneurysm in men.

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%

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)



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

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.)

Systematic reviews	Question/comparison	Findings (quality of evidence)
Guirguis-Blake, 2014 ⁴ Cosford, 2011 ⁵ Takaji, 2010 ⁶	Effectiveness of screening for AAA	<ul style="list-style-type: none"> • 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

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

Männer ≥ 65 Jahre
(senkt AAA-Mortalität, NNS 238)

Recommendation 12		
Population screening for abdominal aortic aneurysm with a single ultrasound scan for all men at age 65 years is recommended		
Class	Level	References
I	A	[139,142,132,144,133-137,143]

Periphere Aneurysma alle 5-10 Jahre

Recommendation 16		
Screening for abdominal aortic aneurysm at 5–10 year intervals may be considered for all men and women with a true peripheral arterial aneurysm		
Class	Level	References
IIb	C	[167]

Frauen nicht

Recommendation 14		
Population screening for abdominal aortic aneurysm in women is not recommended		
Class	Level	References
III	B	[161,138,162,74]

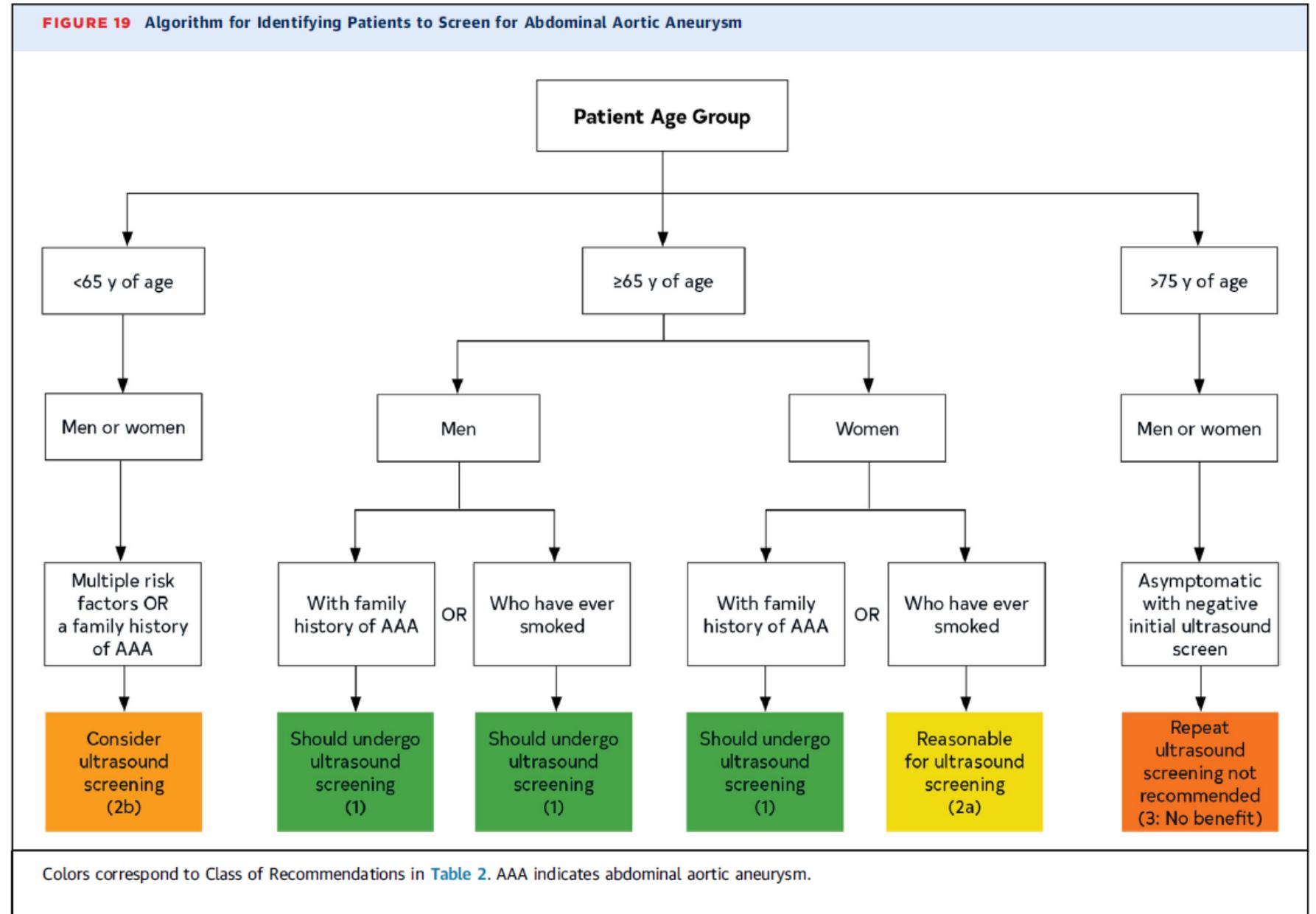
Subaneurysmale Ektasie alle 5-10 Jahre

Recommendation 13		
Men with an aorta 2.5–2.9 cm in diameter at initial screening may be considered for rescreening after 5–10 years		
Class	Level	References
IIb	C	[159,92,151-154,158,157]

Positive FA ab 50 Jahre alle 10 Jahre

Recommendation 15		
All men and women aged 50 years and older with a first degree relative with an abdominal aortic aneurysm may be considered for abdominal aortic aneurysm screening at 10 year intervals		
Class	Level	References
IIb	C	[165,164,166]

AAA-Screening



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: **kein Effekt** (trials ongoing)
- Bewegung: kein Effekt

Rauchstopp

Recommendation 18		
Patients with a small abdominal aortic aneurysm are recommended to stop smoking (to reduce the abdominal aortic aneurysm growth rate and risk of rupture) and to receive help to do this		
Class	Level	References
I	B	[176,91]

Recommendation 19		
No specific medical therapy has been proven to slow the expansion rate of an abdominal aortic aneurysm, and therefore is not recommended		
Class	Level	References
III	A	[172,174]

Verbesserung des Langzeitüberleben bei Patienten AAA

- **Statine** (68% vs. 42%)
- **Thrombozyten-Aggregationshemmer** (64% vs. 40%)
- **Antihypertensiva** (62% vs. 39%)

Blutdruck-Kontrolle, Statin, Aspirin

Recommendation 21		
Blood pressure control, statins and antiplatelet therapy should be considered in all patients with abdominal aortic aneurysm		
Class	Level	References
IIa	B	[180,184,181,182,186]

AAA Verlaufskontrolle

Recommendation 17		
Ultrasonography is recommended for aneurysm surveillance; every three years for aneurysms 3–3.9 cm in diameter, annually for aneurysms 4.0–4.9 cm, and every 3–6 month for aneurysms ≥5.0 cm		
Class	Level	References
I	B	[171]

We suggest surveillance imaging at 3-year intervals for patients with an AAA between 3.0 and 3.9 cm.	
Level of recommendation	2 (Weak)
Quality of evidence	C (Low)
We suggest surveillance imaging at 12-month intervals for patients with an AAA of 4.0 to 4.9 cm in diameter.	
Level of recommendation	2 (Weak)
Quality of evidence	C (Low)
We suggest surveillance imaging at 6-month intervals for patients with an AAA between 5.0 and 5.4 cm in diameter.	
Level of recommendation	2 (Weak)
Quality of evidence	C (Low)

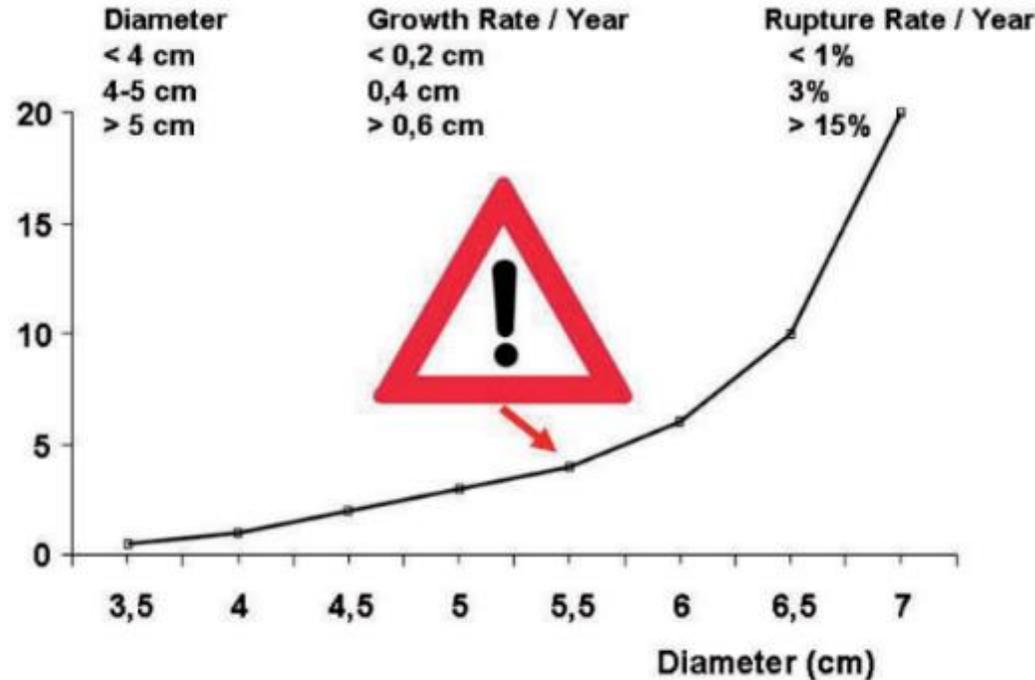
- Alle 3 Jahre bei AAA mit Durchmesser 3.0 - 3.9 cm
- Jährlich bei AAA mit Durchmesser 4.0 - 4.9 cm
- Alle 6 Monate bei AAA mit Durchmesser ≥ 5.0cm

NICE:

If the AAA measures:

- 3.0-4.4 cm, a follow-up will be arranged in one year
- 4.5–5.4 cm, a follow-up will be arranged in three months

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	<ul style="list-style-type: none"> • Rupture was higher in women, in smokers, and with elevated blood pressure (moderate)
RESCAN Collaborators, 2013 ¹⁰	Surveillance intervals for small AAA	<ul style="list-style-type: none"> • 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)

AAA-Behandlungs-Indikation (invasive Therapie)

Asymptomatisches AAA:

Männer Durchmesser $\geq 5.5\text{cm}$

Recommendation 22		
In men, the threshold for considering elective abdominal aortic aneurysm repair is recommended to be ≥ 5.5 cm diameter		
Class	Level	References
I	A	[189]

Recommendation 23		
In women with acceptable surgical risk the threshold for considering elective abdominal aortic aneurysm repair may be considered to be ≥ 5.0 cm diameter		
Class	Level	References
IIb	C	[199,171,91,198,200]

Frauen Durchmesser $\geq 5.0\text{cm}$

AAA-Wachstum $\geq 1.0\text{cm/Jahr}$

Recommendation 24		
When rapid abdominal aortic aneurysm growth is observed (≥ 1 cm/year), fast track referral to a vascular surgeon with additional imaging should be considered		
Class	Level	References
IIa	C	[194,195]

Recommendation 62		
In patients with limited life expectancy, elective abdominal aortic aneurysm repair is not recommended		
Class	Level	References
III	B	[52,53,203,204]

Lebenserwartung

Symptomatisches AAA:

- Spontan geäußerte Schmerzen
- Bei Palpation dolent

Recommendation 65		
Symptomatic non-ruptured abdominal aortic aneurysms should be considered for deferred urgent repair ideally under elective repair conditions		
Class	Level	References
IIa	B	[373-375,196,376,197]

Gedeckte Ruptur eines AAA

65-jähriger Patient mit Flankenschmerzen



Wandhämatom eines AAA

64-jähriger Patient



Wandhämatom eines AAA



Vielen Dank

Für ihre Aufmerksamkeit!

