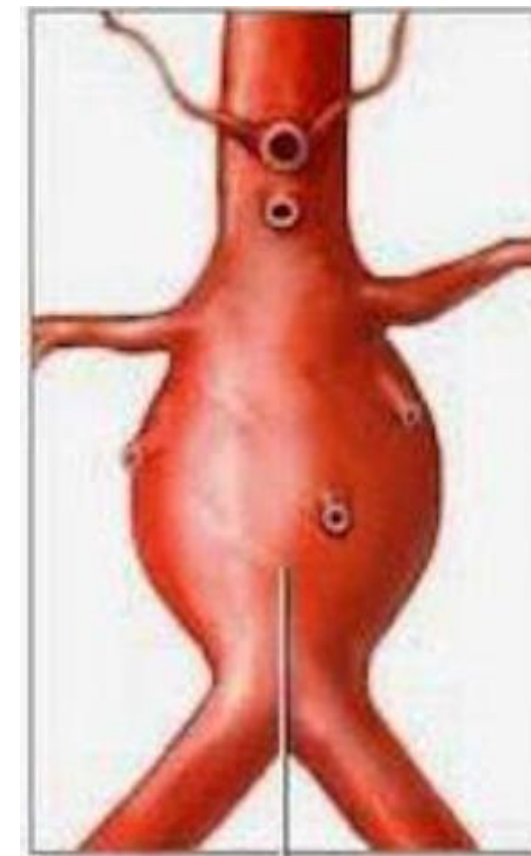
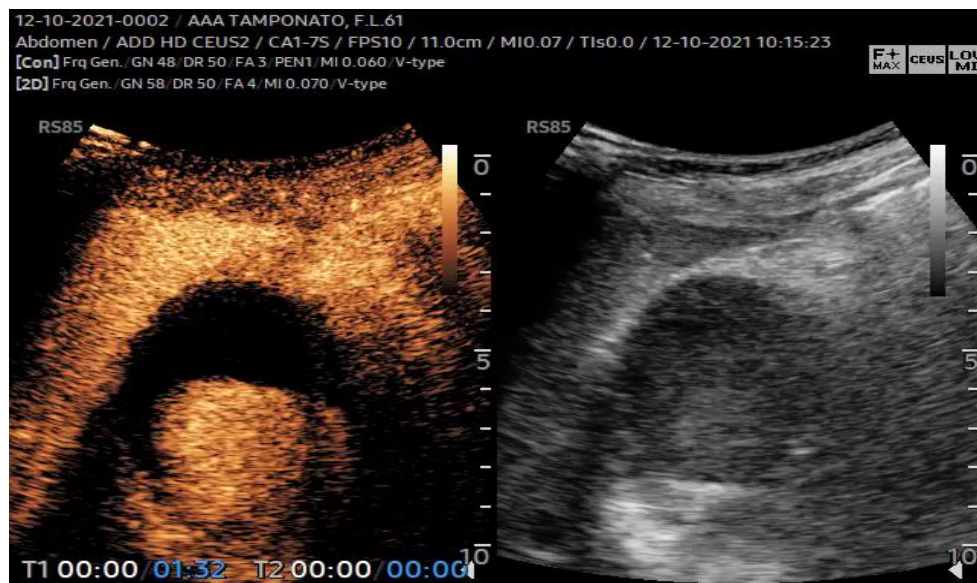


CEUS ED ANEURISMA DELL'AORTA ADDOMINALE: RUOLO NELLA DIAGNOSI E NEL FOLLOW-UP DOPO TRATTAMENTO



Prevalenza di AAA negli adulti > 50 aa:

3.9% - 7.2% in ♂

1.0% - 1.3% in ♀

200.000 **nuove diagnosi annuali** stimate negli USA.

Più frequenti negli uomini che hanno fumato (almeno 100 nella vita): 6%.

> 90% degli AAA identificati dallo screening sono < 5.5 cm → *long-term (potentially lifelong) surveillance*.

Rischio annuale di rottura:

0% 3.0 - 3.9

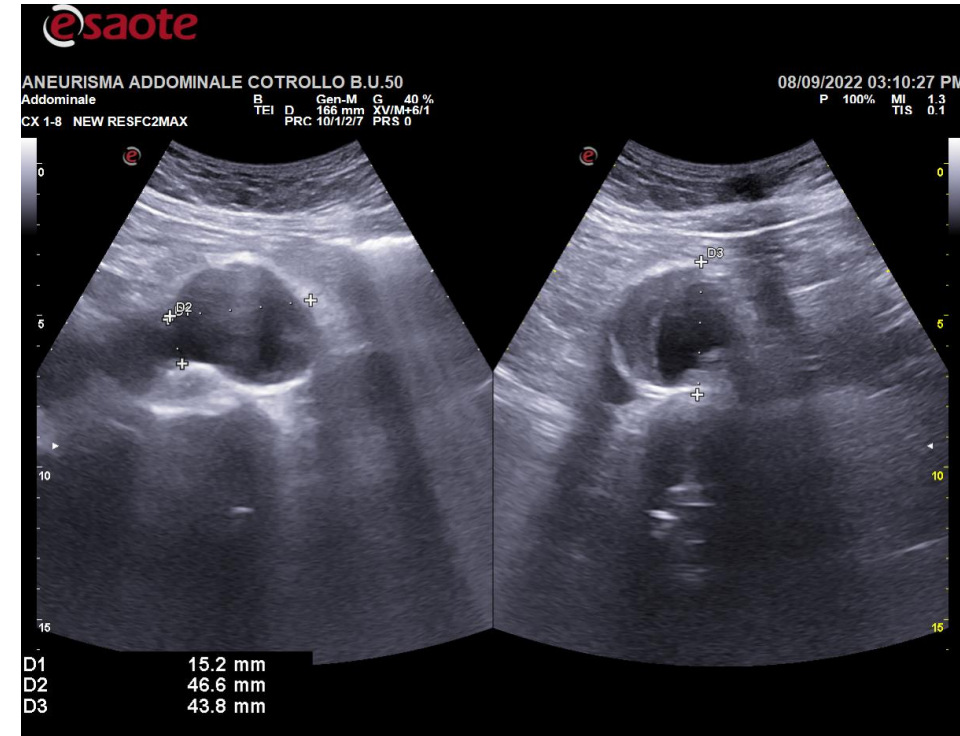
1% 4.0 - 4.9

11% 5.0 - 5.9

Fra il 59 e l'83% dei pazienti che incorrono in rottura muore prima dell'ospedalizzazione,
la **mortalità** intraoperatoria in rottura è del 40% circa.

Screening

- E' fondamentale non cadere nell'*over-diagnosis* e *overtreatment*.
- In uno studio di 24.000 consecutive autopsie presso il Massachusetts General Hospital ha evidenziato che il 75% dei 473 pazienti deceduti con AAA è associato a una causa non AAA- relata (41% erano 5.1 cm).
- Considerando anche che il trattamento in elezione è associato ad alcuni rischi, l'indicazione va sempre ragionata.



Annals of Internal Medicine

CLINICAL GUIDELINE

Screening for Abdominal Aortic Aneurysm: U.S. Preventive Services Task Force Recommendation Statement

Michael L. LeFevre, MD, MSPH, on behalf of the U.S. Preventive Services Task Force*



SOCIETÀ ITALIANA DI CHIRURGIA
VASCOLARE ED ENDOVASCOLARE



SCREENING FOR ABDOMINAL AORTIC ANEURYSM CLINICAL SUMMARY OF U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATION

Population	Men aged 65 to 75 y who have ever smoked*	Men aged 65 to 75 y who have never smoked	Women aged 65 to 75 y who have ever smoked*	Women who have never smoked
Recommendation	Screen once for abdominal aortic aneurysm (AAA) by ultrasonography. Grade: B	Selectively screen for AAA. Grade: C	No recommendation. Grade: I statement	Do not screen for AAA. Grade: D
Risk Assessment	<p>Risk factors for AAA include older age; a positive smoking history; having a first-degree relative with an AAA; and having a history of other vascular aneurysms, coronary artery disease, cerebrovascular disease, atherosclerosis, hypercholesterolemia, obesity, or hypertension.</p> <p>Factors associated with a reduced risk for AAA include African American race, Hispanic ethnicity, and diabetes.</p>			
Screening Tests	<p>Abdominal duplex ultrasonography is the standard approach for AAA screening. Screening with ultrasonography is noninvasive and easy to perform and has high sensitivity (94% to 100%) and specificity (98% to 100%) for detection.</p>			
Treatment	<p>Patients with large AAAs (≥ 5.5 cm) are referred for open surgical repair or endovascular aneurysm repair. Patients with smaller aneurysms (3.0 to 5.4 cm) are generally managed conservatively via surveillance (e.g., repeated ultrasonography every 3 to 12 mo).</p> <p>Early open surgery for the treatment of smaller AAAs does not reduce AAA-specific or all-cause mortality. Surgical referral of smaller AAAs is typically reserved for rapid growth (>1.0 cm per year) or once the threshold of ≥ 5.5 cm on repeated ultrasonography is reached.</p> <p>Short-term treatment with antibiotics or β-blockers does not seem to reduce AAA growth.</p>			
Balance of Benefits and Harms	There is a moderate net benefit of screening for AAA with ultrasonography in men aged 65 to 75 y who have ever smoked.	There is a small net benefit of screening for AAA with ultrasonography in men aged 65 to 75 y who have never smoked.	The evidence of screening for AAA in women aged 65 to 75 y who have ever smoked is insufficient, and the balance of benefits and harms cannot be determined.	The harms of screening for AAA in women who have never smoked outweigh any potential benefits.

Moderate benefit

Small benefit

2014 ESC Guidelines on the diagnosis and treatment of aortic diseases

Recommendations for abdominal aortic aneurysm screening

Recommendations	Class ^a	Level ^b	Ref. ^c
Population screening for AAA with ultrasound:			
<ul style="list-style-type: none"> is recommended in all men >65 years of age. 	I	A	357,367
<ul style="list-style-type: none"> may be considered in women >65 years of age with history of current/past smoking. 	IIb	C	
<ul style="list-style-type: none"> is not recommended in female non-smokers without familial history. 	III	C	
Targeted screening for AAA with ultrasound should be considered in first-degree siblings of a patient with AAA.	IIa	B	338,339

SOCIETY FOR VASCULAR SURGERY

The Society for Vascular Surgery practice care of patients with an abdominal aortic aneurysm

Aneurysm imaging. We recommend using ultrasound, when feasible, as the preferred imaging modality for aneurysm screening and surveillance.

Level of recommendation	1 (Strong)
Quality of evidence	A (High)

We recommend a one-time ultrasound screening for AAAs in men or women 65 to 75 years of age with a history of tobacco use.

Level of recommendation	1 (Strong)
Quality of evidence	A (High)

We suggest ultrasound screening for AAA in first-degree relatives of patients who present with an AAA. Screening should be performed in first-degree relatives who are between 65 and 75 years of age or in those older than 75 years and in good health.

Level of recommendation	2 (Weak)
Quality of evidence	C (Low)

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.

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

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]

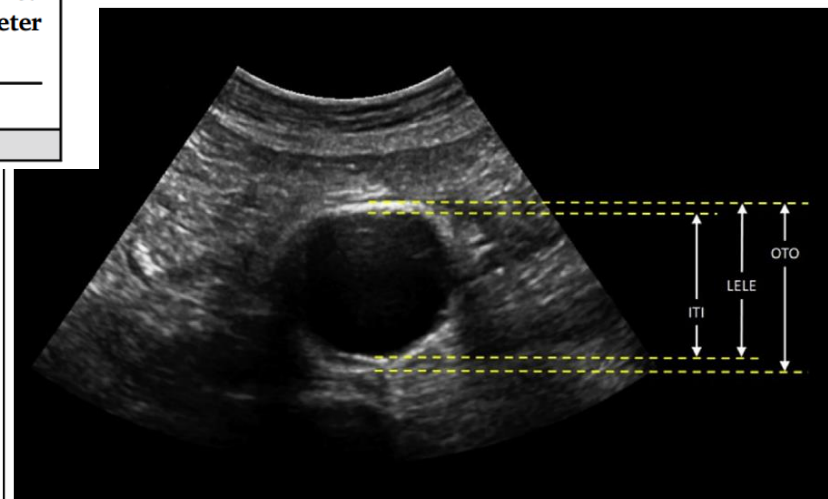


Figure 2.1. Caliper placement for measurement of aortic diameter. ITI = inner to inner; LELE = leading edge to leading edge; OTO = outer to outer.

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]

Recommendation 14

Population screening for abdominal aortic aneurysm in women is not recommended

Class	Level	References
III	B	[161,138,162,74]

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]

The high mortality associated with rupture combined with low elective peri-operative risk results in the number of men needed to screen of 667 and to treat with AAA repair of 1.5 in order to prevent one premature AAA related death

Screening

Diametro trasversale poco affidabile

diametro antero-posteriore acquisito in scansione longitudinale è il più affidabile

Misurazioni acquisite durante la sistole

Piano di valutazione perpendicolare al flusso sanguigno

Diagnostic accuracy of imaging for AAA compared with digital subtraction angiography

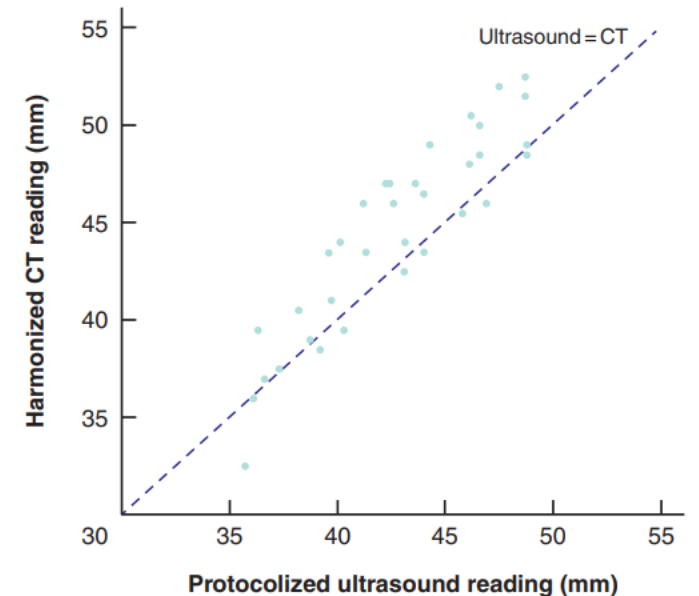
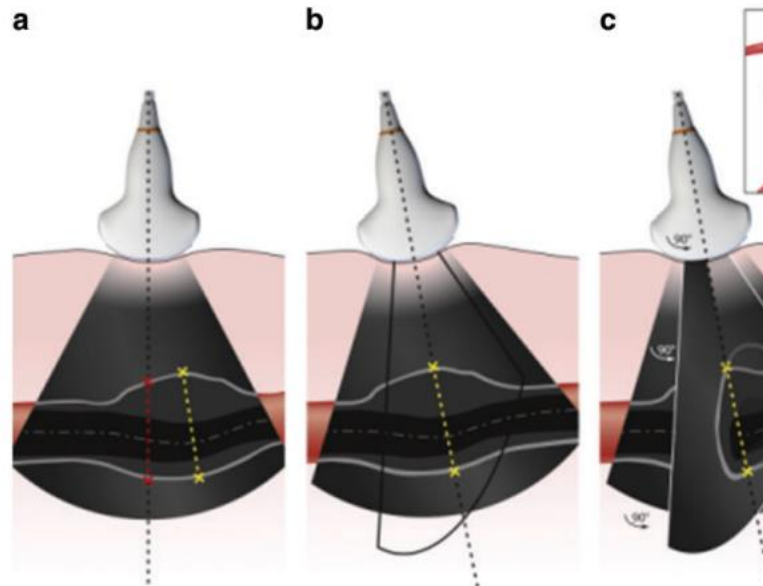
Table 2 Causes of discrepancy in abdominal aortic aneurysm size estimates between ultrasound imaging and CT

- Cardiac cycle (diastole/systole pulse wave in aorta)
- Positioning/respiratory movements of patient
- Angulation of the aorta (measuring perpendicular to blood flow)
- Caliper placement (anterior-posterior on ultrasound imaging versus maximum diameter in any plane on CT)
- Presence of thrombus in the aneurysm
- Differences in slice thickness on CT

OXFORD

Systematic approach towards reliable abdominal aortic aneurysm size and CT

S. M. Tomee¹, C. A. Meijer^{2,3}, D. A. Kies², S. le Cessie^{4,5}, M. N. J. M. Wasser¹, J. H. N. Lindeman^{1,*}



were

The EFSUMB Guidelines and Recommendations for the Clinical Practice of Contrast-Enhanced Ultrasound (CEUS) in Non-Hepatic Applications: Update 2017 (Long Version)

Abdominal aortic

CEUS can overcome some limitations of conventional US by improving the delineation of the aortic lumen and the detection of the main branching arteries. CEUS also improves the diagnosis of aortic rupture by detecting contrast extravasation [276].

Aortic dissections

A dissection of the abdominal aorta is usually an extension of a thoracic aortic dissection. In most cases, the true and false lumen can be discriminated with CEUS, because both early (true lumen) and late (false lumen) contrast enhancement can be detected, provided the false lumen is not thrombosed [277].

Inflammatory Abdominal Aortic Aneurysm

Inflammatory aneurysm of the abdominal aorta is a variant of atherosclerotic aneurysm that is characterized by inflammatory and/or fibrotic changes in the peri-aortic region of the retroperitoneum [278]. CEUS of the inflammatory aneurysm improves differentiation between covered rupture and inflammatory aortic aneurysm [279].

Endovascular Aortic Graft Endoleak

An endoleak, classified into subtypes depending on the site of the leak, represents blood flow outside the stent graft lumen but within the aneurysm sac and conventionally detected by CT angiography, although CT angiography is limited in the detection of some endoleak subtypes [280]. CEUS is able to identify and characterize an endoleak more accurately than CT angiography, with analysis of velocity and flow direction [281 – 285]. CEUS is particularly useful in the management of “endotension” often finding an occult endoleak, not seen on CT angiography [286]. CEUS enhancement quantification by time-intensity curves provides additional accuracy [287]. CEUS for the follow-up of patients with endoleak is possible [288, 289].

RECOMMENDATION 43

CEUS can help differentiate between total carotid and/or vertebral artery occlusion and residual flow in a tight stenosis (LoE 3, GoR B). Strong consensus (17/0/0, 100 %)

RECOMMENDATION 44

CEUS can be useful for the evaluation of carotid plaque neovascularization which suggests plaque instability (LoE 1b, GoR B). Strong consensus (20/0/0, 100 %)

RECOMMENDATION 45

CEUS can aid the identification of dissection of the extracranial carotid and vertebral arteries, as well as the abdominal aorta and its major branches (LoE 3, GoR C). Strong Consensus (17/0/3, 100 %)

RECOMMENDATION 46

CEUS may be an additional tool in the characterization of suspected inflammatory large vessel and abdominal aortic disease (LoE 5, GoR C). Strong Consensus (17/0/2, 100 %)

RECOMMENDATION 47

CEUS should be used in the follow-up of endovascular aortic repair (EVAR) for the detection and classification of endoleaks (LoE 1a, GoR A.). Strong consensus (20/0/0, 100 %)

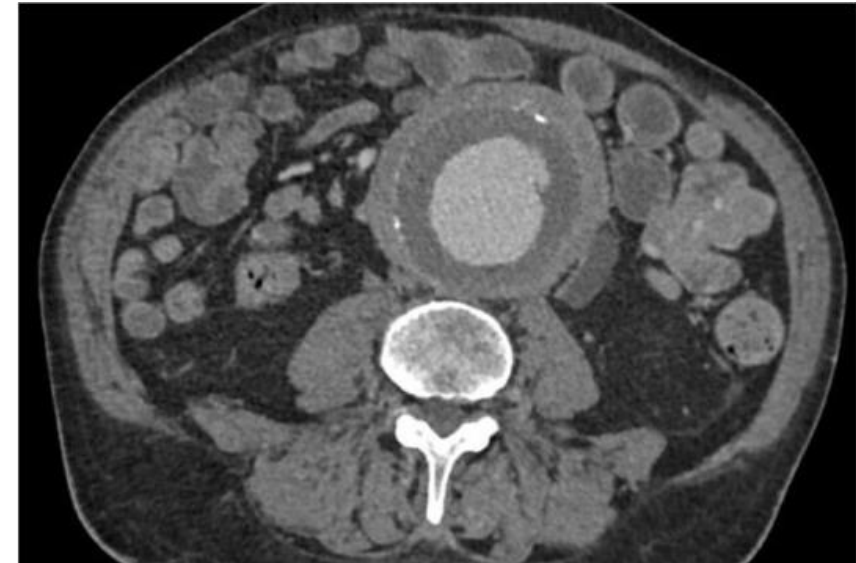


**ANEURISMA
INFIAMMATORIO**

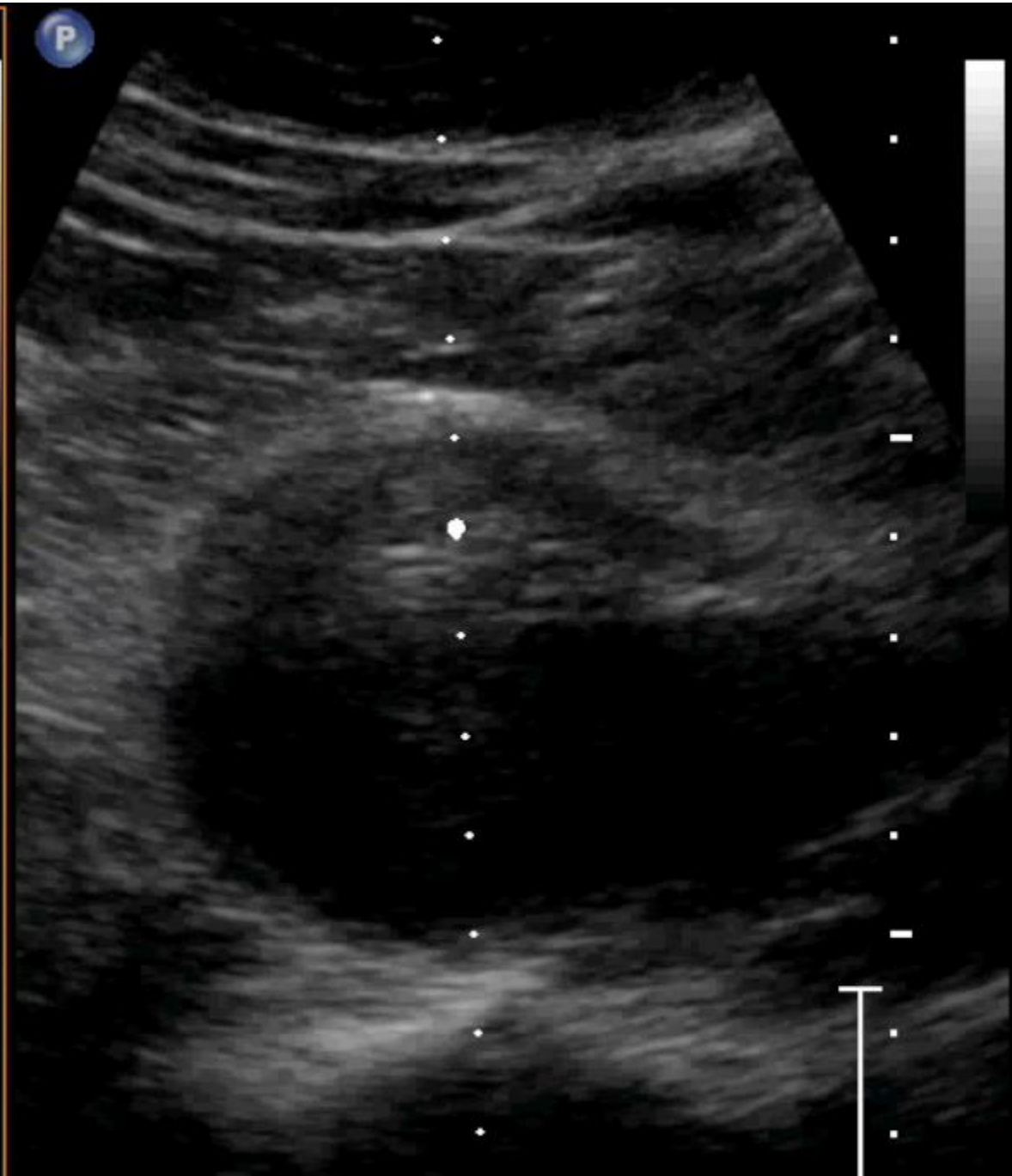
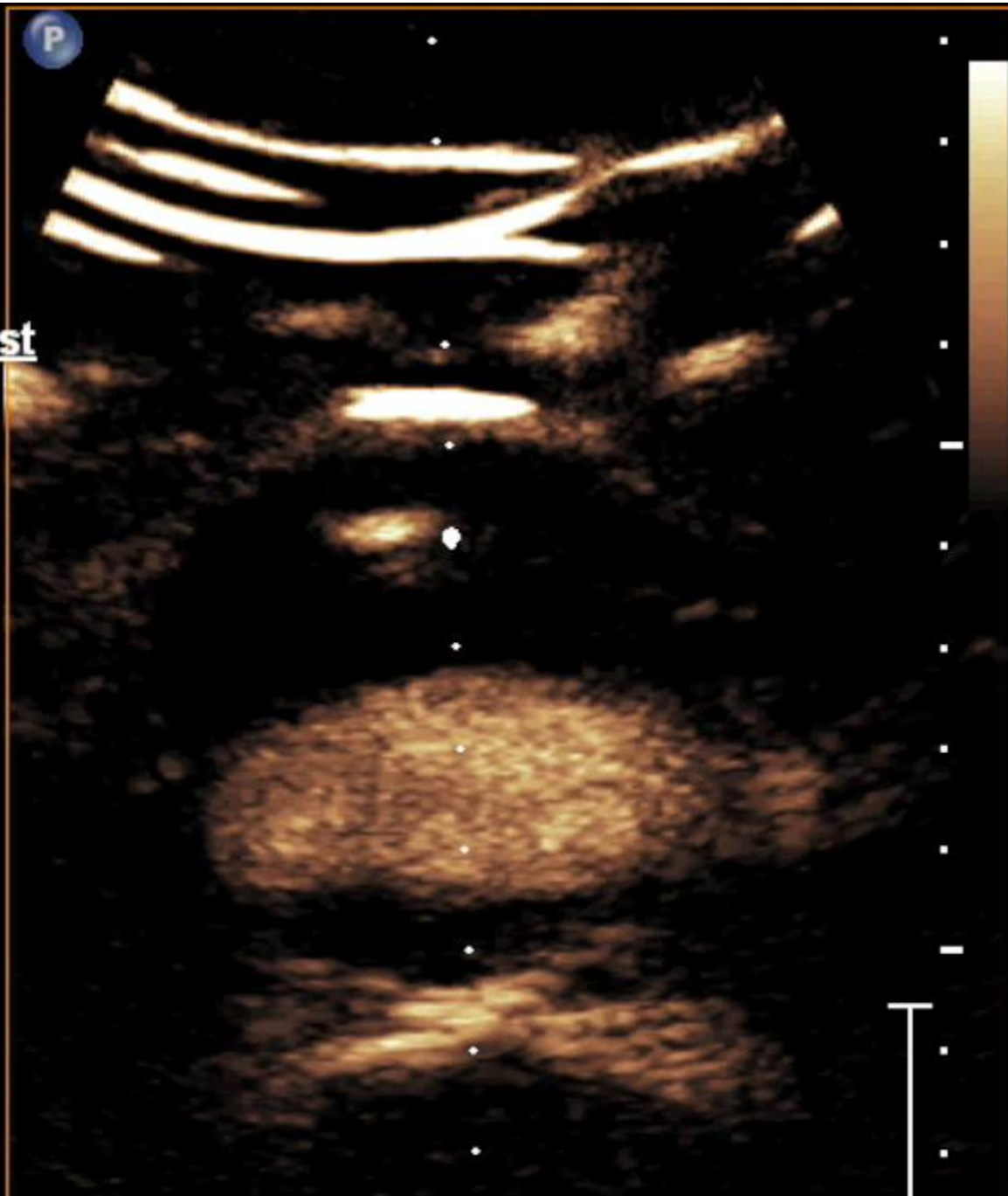
ENDOLEAK

1) ANEURISMA AORTICO INFIAMMATORIO

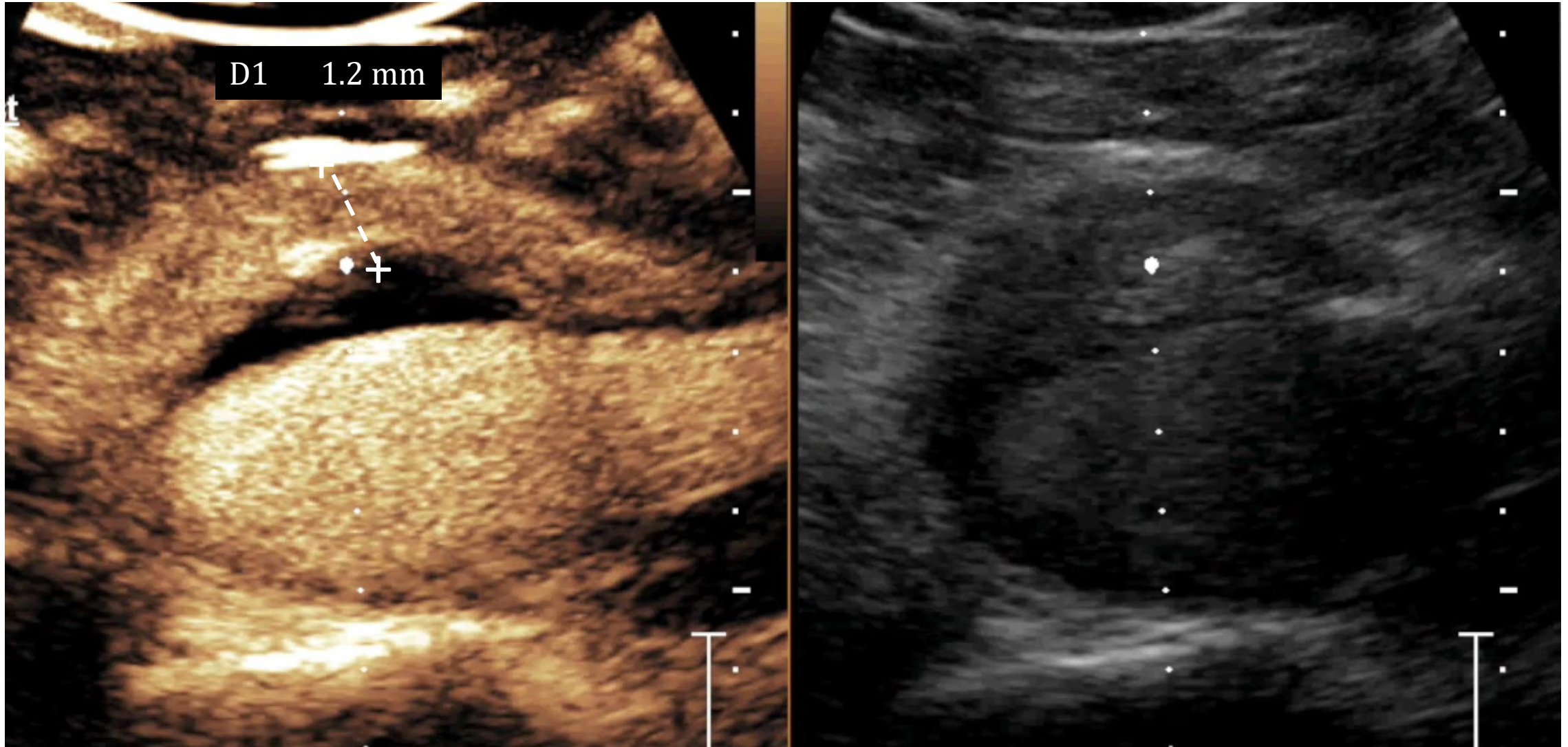
- 3-10 %,
- prevalenti nel sesso ♂,
- maggiormente sintomatici (dolore),
- aumento della VES
- Diagnosi ecografica pre op: 13.5%
- Diagnosi TC: 50%
- infiltrazione dei tessuti peri-aneurismatici (determinata dalla fibrosi retro-peritoneale), con formazione di una vera e propria “cotenna” attorno ai margini calcifici della parete, capace di inglobare organi o strutture vicine, determinando una sintomatologia specifica in base alla sede coinvolta: es uropatia ostruttiva
- alone di tessuto retroperitoneale periaortico ipoecogeno/ipodenso talora dotato di impregnazione contrastografica, DD con ematoma retroperitoneale



RS
Z 1.1
Tissue
60%
C 42
Gen
MI0.05
Contrast
69%
C 34
CPen
MI0.07



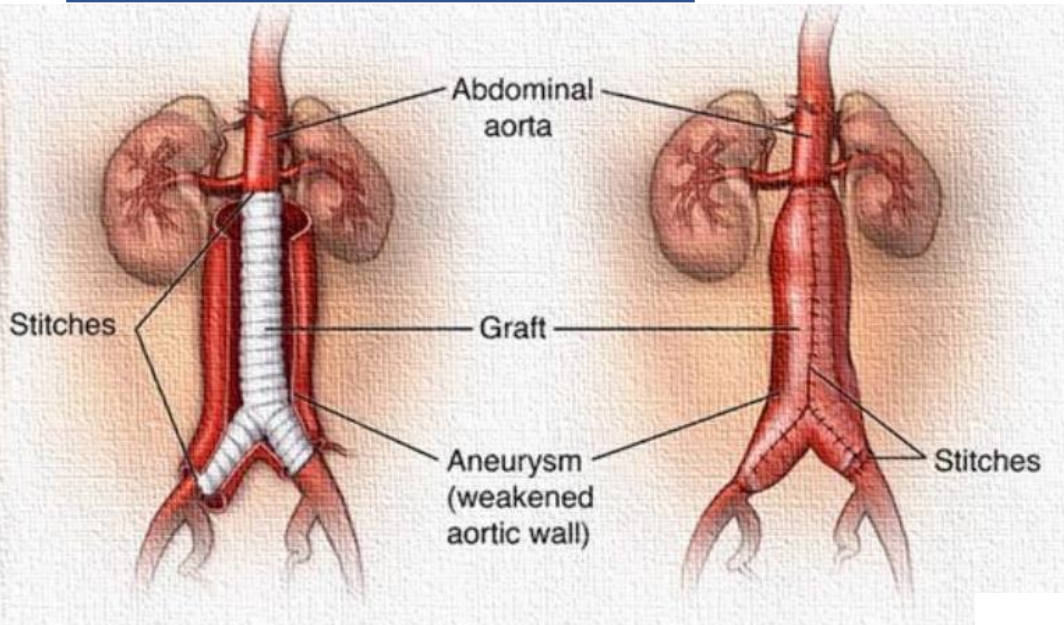
Wall Inflammatory Activity



Surveillance

open

endovascular



L' Endovascular aneurysm repair EVAR presenta
→ Vantaggi a breve termine: evita l'anestesia generale, riduce il tempo operatorio la necessità di trasfusioni e il dolore post chirurgico con una mortalità intraoperatoria ridotta
→ Svantaggi : un più elevato tasso di reintervento, la necessità di follow up regolare a vita, via US o CT

Nei pazienti non idonei al trattamento chirurgico degli aneurismi toracoaddominali, in assenza di malattie del tessuto connettivo potrebbe essere indicata una procedura endovascolare (Raccomandazione debole a favore, livello di evidenza 2-).

open

No randomised studies are available regarding the potential benefit of post-operative imaging surveillance after OSR of AAA.

Recommendation 85		
In all patients after open repair for abdominal aortic aneurysm, imaging follow up of the aorta and peripheral arteries may be considered every five years		
Class	Level	References
IIb	C	[549,548]

EVAR

Table 6.2. Long-term graft related complications after endovascular aneurysm repair.

Complications	Definition	Estimated frequency during 5 year follow up
Type I endoleak	Peri-graft flow occurring from attachment sites	5%
A	proximal end of stent graft	
B	distal end of stent graft	
C	iliac occluder	
Type II endoleak	Perigraft flow occurring from collateral branches to the aneurysm; inferior mesenteric artery (IIA) and lumbar arteries (IIB) Categorised as early or late/delayed (before or after 12 months) and as transient or persistent (resolved or not resolved ≤ 6 months)	20–40%, 10% persistent at 2 years
Type III endoleak	Peri-graft flow occurring from stent graft defect or junction sites	1–3%
A	leak from junctions or modular disconnection	
B	fabric holes	
Type IV endoleak	Peri-graft flow occurring from stent graft fabric porosity <30 days after placement	1%
Endotension	AAA sac enlargement without visualised endoleak	<1%
Migration	Movement of the stent graft in relation to proximal or distal landing zone	1%
Limb kinking and occlusion	Graft thrombosis or stenosis	4–8%
Infection	Stent graft infection	0.5–1%
Rupture	Aortic rupture	1–5%

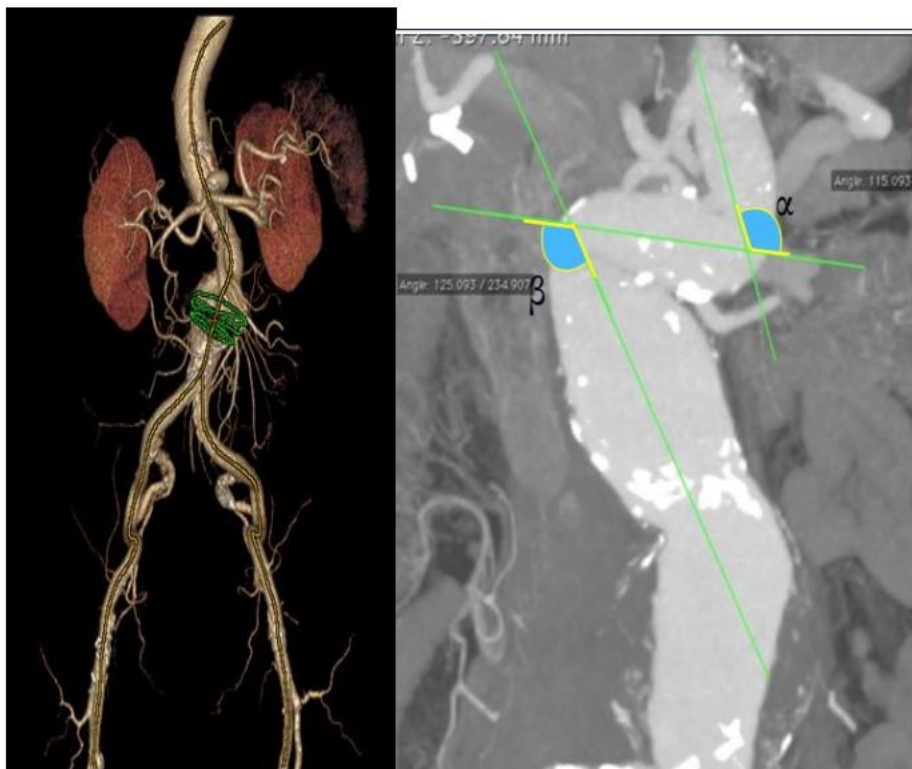
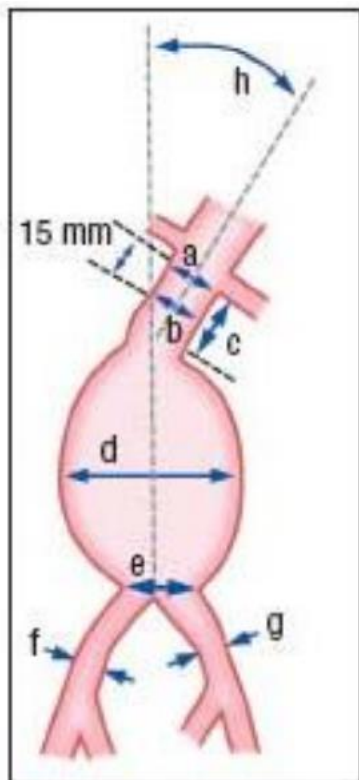
The EFSUMB Guidelines and Recommendations for the Clinical Practice of Contrast-Enhanced Ultrasound (CEUS) in Non-Hepatic Applications: Update 2017 (Short Version)

- ✓ Detection and characterisation of EL after AAA repair

Recommendation Level: A;1a

- ✓ Follow-up of AAA endoleaks

Recommendation Level: A;1a



EVAR SOTTO-RENALE

Zona di sealing prossimale (colletto) > 10 mm

Diametro colletto \leq 28mm

Angolo colletto < 60°

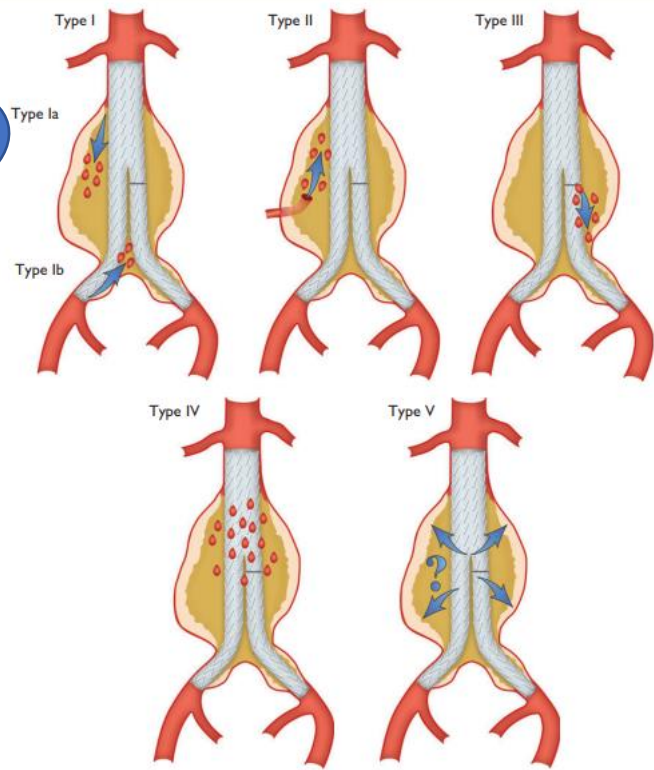
EVAR SOVRA-RENALE

↑incidenza infarti renali, perlopiù clinicamente non significativi, associati in particolare a occlusione AR pre-esistente

INTERNAL ILIAC BRANCHES

Monitoraggio pervietà ed EL per le iliache interne

25%



20%
A SEI
MESI

FATTORI PREDITTIVI PERSISTENT TYPE II EL

- Pervietà di almeno 3 coppie di a.lombari con dimensioni > 3mm
- Le dimensioni dell'a.mesenterica inferiore > 6mm
- L'età del paziente > 70aa
- Diametro max aneurisma
- Volume della sacca
- Spessore e volume del Trombo

Table 3 Various types of endoleaks

Type of endoleak	Cause	Description
Type I	Attachment site leak	Leak at the proximal and/or distal end of graft due to ineffective seal to the aortic wall
Type II	Branch vessel leak	Retrograde blood flow in branch vessels such as IMA and lumbar arteries with back bleeding into aneurysmal sac
Type III	Mechanical graft failure	Separation of modular components such as fracture of stent, fabric tear, or rupture at joined segments
Type IV	Graft wall porosity	Porous graft material
Type V	Endotension	Expansion of the aneurysmal sac with no obvious leak

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



Elliot L. Chaikof, MD, PhD^a, Ronald L. Dalman, MD^b, Mark K. Eskandari, MD^c, Benjamin M. Jackson, MD,^d W. Anthony M. Hassar, MD^e, Madhukar M. Madhukar, MD^f, Boston, Massachusetts, Rochester, New York, Starnes, MD,^g United Kingdom;

Recommendation for postoperative surveillance. We recommend baseline imaging in the first month after EVAR with contrast-enhanced CT and color duplex ultrasound imaging. In the absence of an endoleak or sac enlargement, imaging should be repeated in 12 months using contrast-enhanced CT or color duplex ultrasound imaging.

Level of recommendation	1 (Strong)
Quality of evidence	B (Moderate)

If a type II endoleak is observed 1 month after EVAR, we suggest postoperative surveillance with contrast-enhanced CT and color duplex ultrasound imaging at 6 months.

Level of recommendation	2 (Weak)
Quality of evidence	B (Moderate)

If neither endoleak nor AAA enlargement is observed 1 year after EVAR, we suggest color duplex ultrasound when feasible, or CT imaging if ultrasound is not possible, for annual surveillance.

Level of recommendation	2 (Weak)
Quality of evidence	C (Low)

If a type II endoleak is associated with an aneurysm sac that is shrinking or stable in size, we suggest color duplex ultrasound for continued surveillance at 6-month intervals for 24 months and then annually thereafter.

Surveillance EVAR

1 mese: angio-TC e color Doppler

Endoleak II ?

si

no

6 mesi: angio-TC e color Doppler

12 mesi: color Doppler/ TC

RECOMMENDATION 47

CEUS should be used in the follow-up of endovascular aortic repair (EVAR) for the detection and classification of endoleaks (LoE 1a, GoR A.). Strong consensus (20/0/0, 100%)

B-MODE

- decorso, rapporti, morfologia parietale del vaso;
- diametri della sacca aneurismatica;
- studio del trombo residuo in termini di ecogenicità per valutarne l'evoluzione;
- integrità strutturale del graft, sede del corpo principale e rapporto con le braghette iliache, estremi prossimali e distali

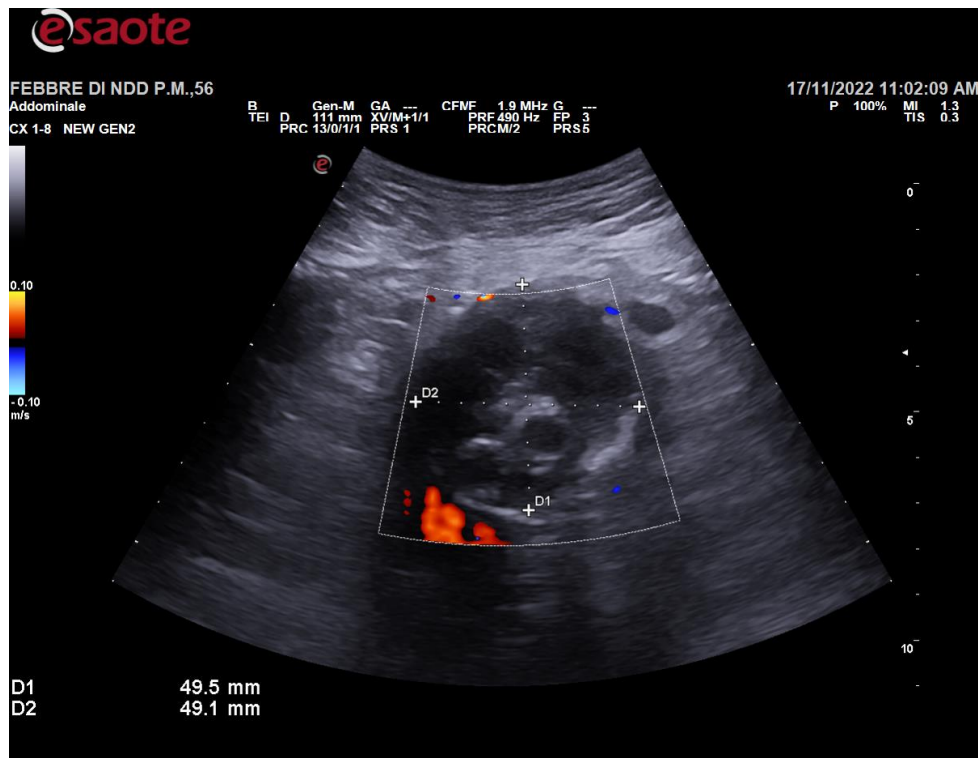


scansione longitudinale sulla sacca aneurismatica con visualizzazione dell'estensione cranio-caudale e valutazione della posizione dello stent

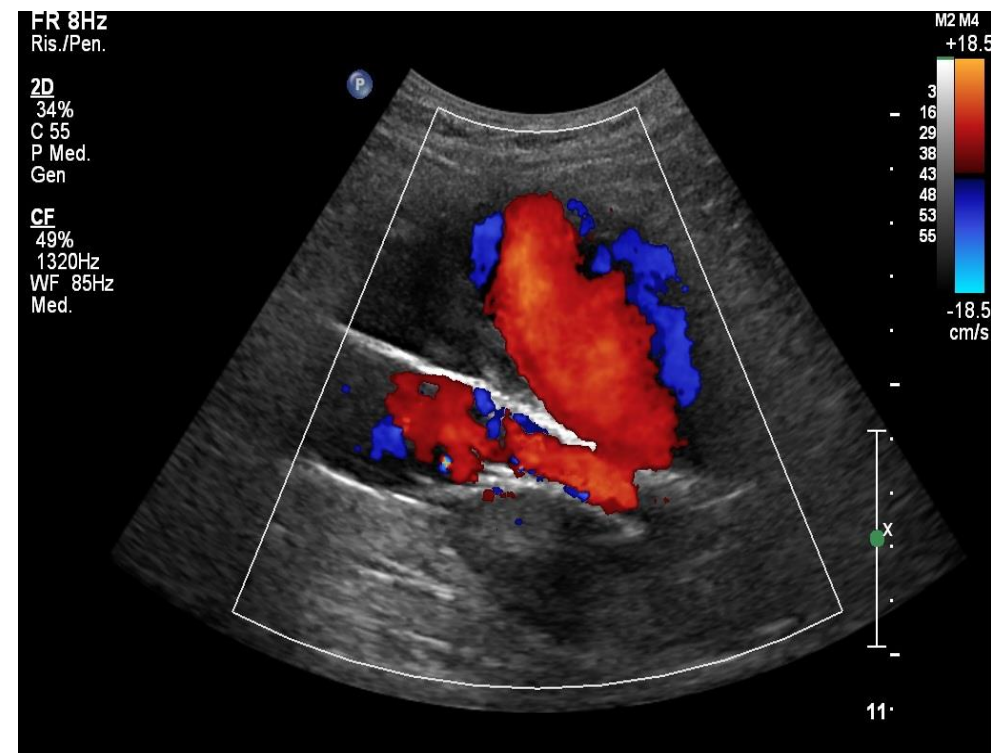


Scansione trasversale del vaso con valutazione dei diametri anteroposteriore e trasverso.

Color-Doppler

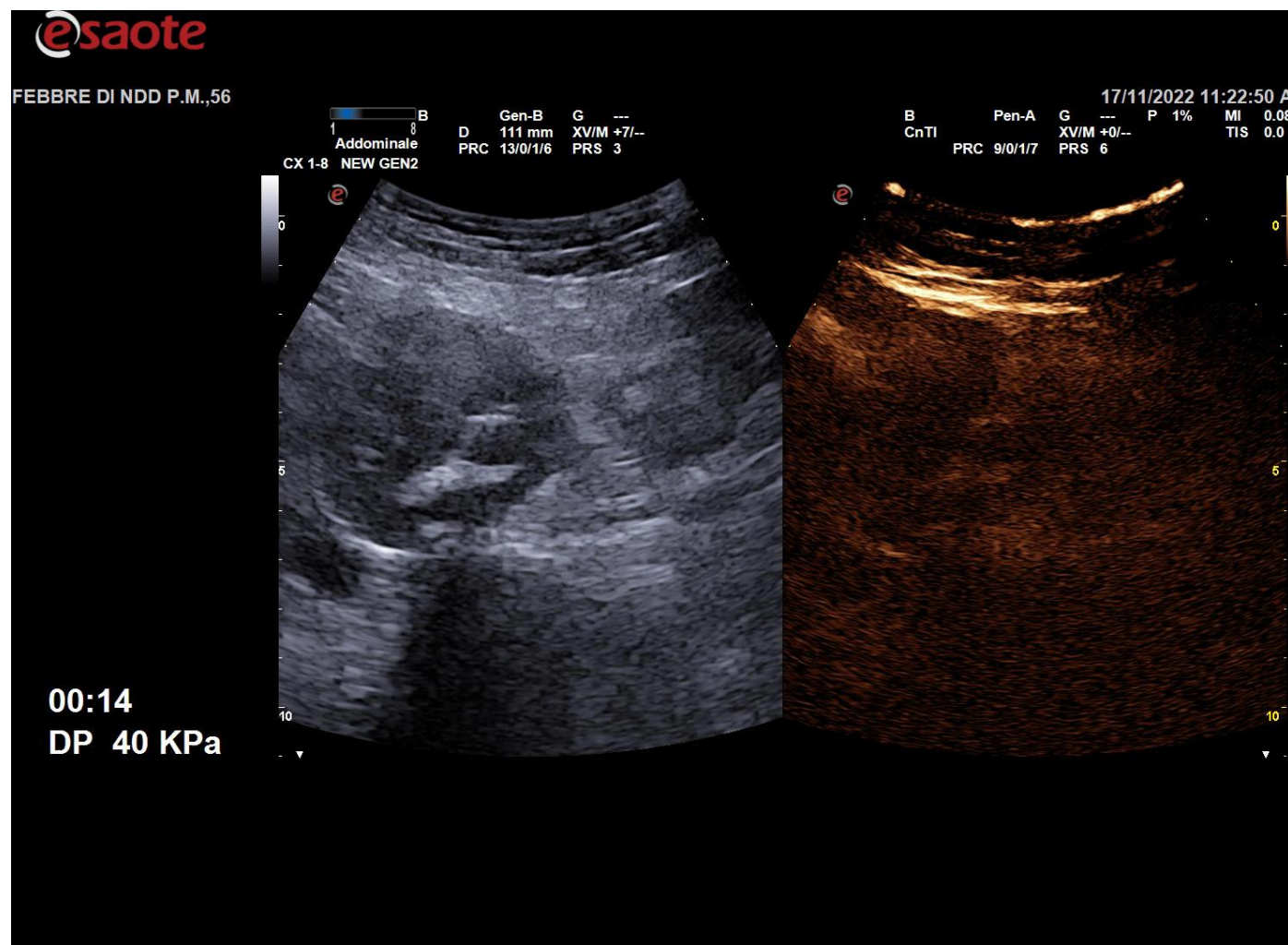
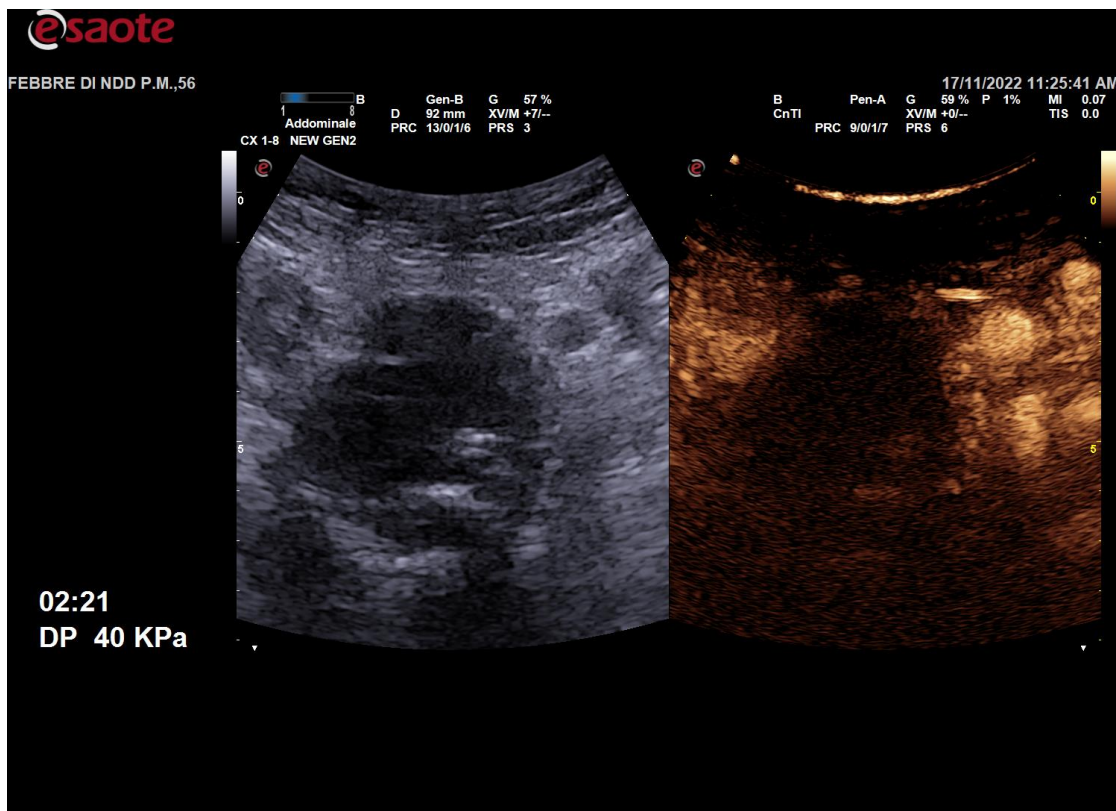


Valutare la presenza di flusso



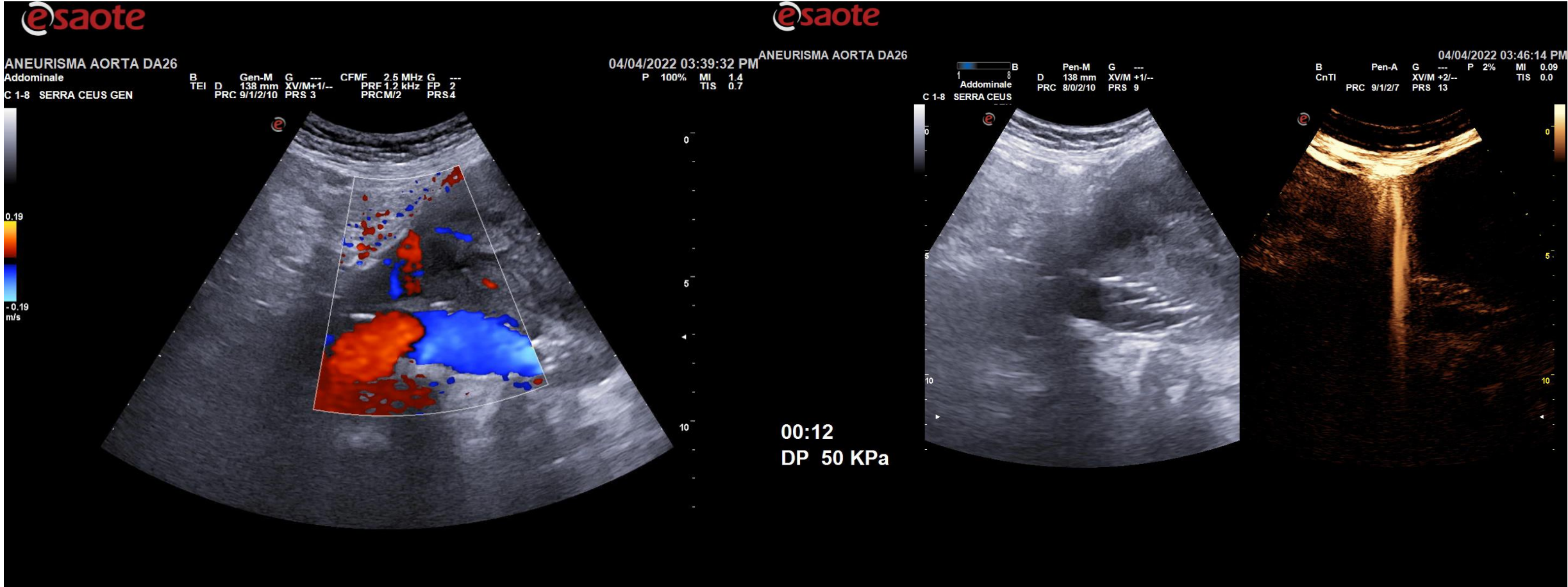
Escludere endoleaks

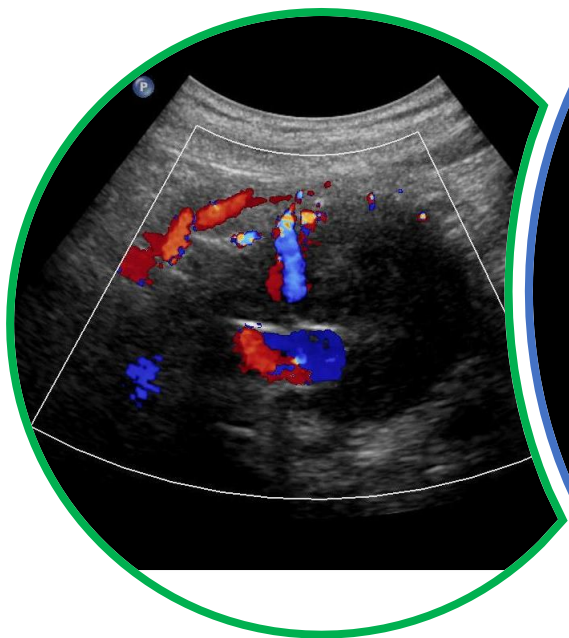
CEUS



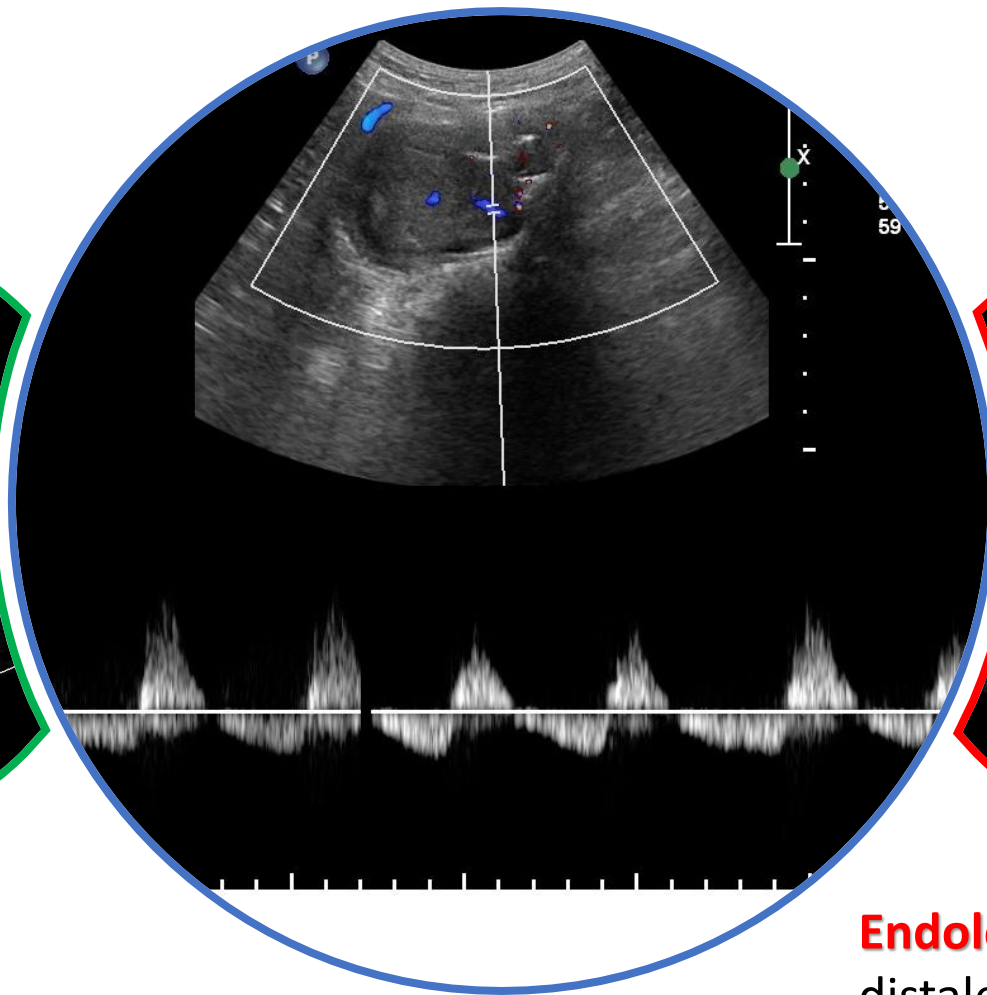
Valutare la presenza di flusso

Escludere endoleaks

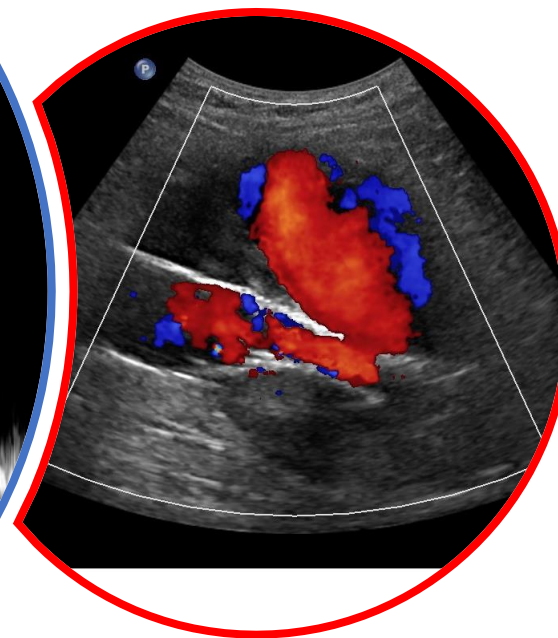




ELII dall'arteria mesenterica inferiore blu in allontanamento



EL II lombare ad elevate resistenze, centripeto

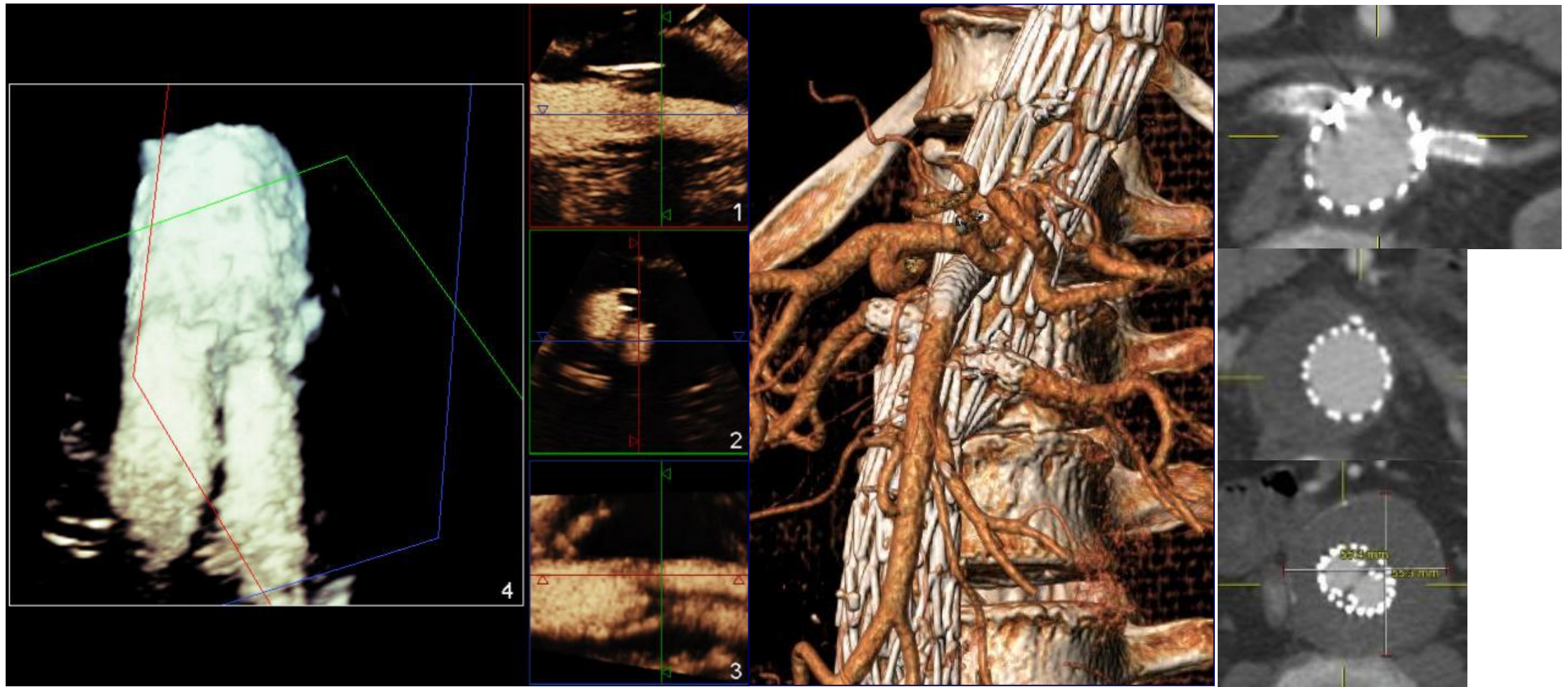


Endoleak di tipo Ib livello dell'attacco distale di braghetta iliaca: ad alto flusso, sincrono al flusso nell'endoprotesi, centrifugo, in avvicinamento verso la sonda

Could Four-dimensional Contrast-enhanced Ultrasound Replace Computed Tomography Angiography During Follow up of Fenestrated Endografts? Results of a Preliminary Experience

M. Gargiulo ^a, E. Gallitto ^{a,*}, C. Serra ^b, A. Freyrie ^a, C. Mascoli ^a, C. Bianchini Massoni ^a, M. De Matteis ^c, C. De Molo ^a, A. Stella ^a

European Journal of Vascular and Endovascular Surgery 2014



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European Journal of Vascular and Endovascular Surgery 2014

Endpoints	4D-CEUS	CTA	Δ	p
AAA diameter (mm)	45 ± 2	48 ± 9	3 ± 3	<0.001 *
AAA volume (cc)	156 ± 67	159 ± 68	3 ± 7	<0.001 *
Endoleaks	9% (2/22)	14% (3/22)	5% (1/22)	1
TVV visualization	92% (72/78)	100% (78/78)	8% (6/78)*	.031
TVV patency	100% (77/78)	100% (77/78)	-	1

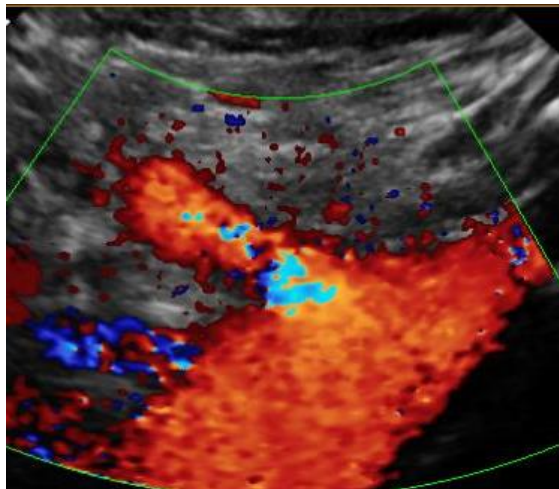
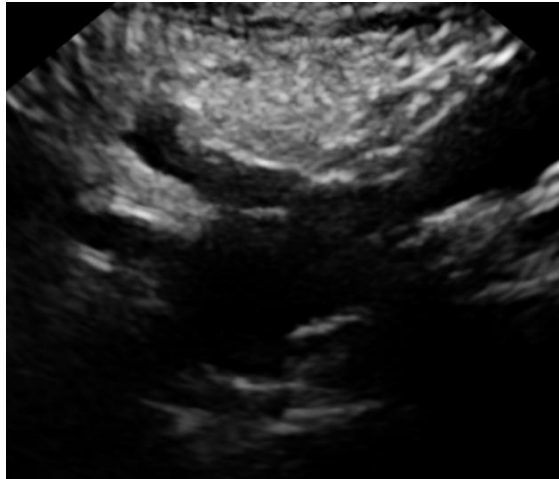
* p of agreement

Vascular Surgery - University of Bologna

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Patency according to
Direct TVV Visualization

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European Journal of Vascular and Endovascular Surgery 2014

Patency according to
Indirect TVV Visualization

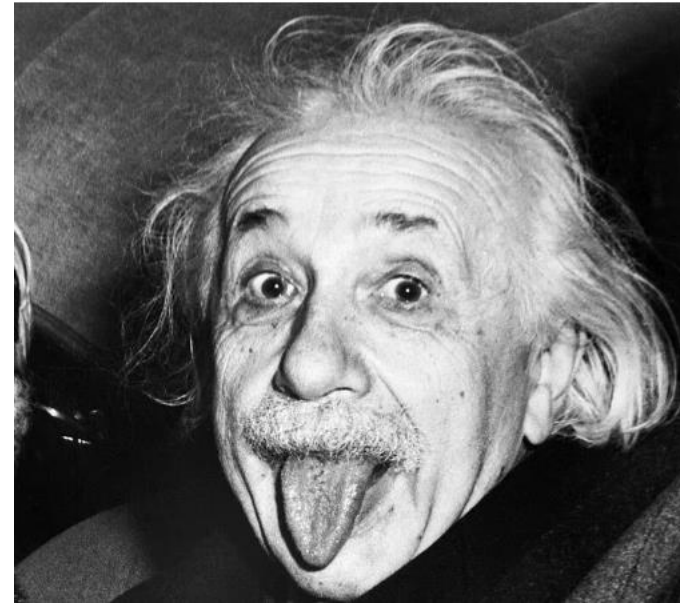
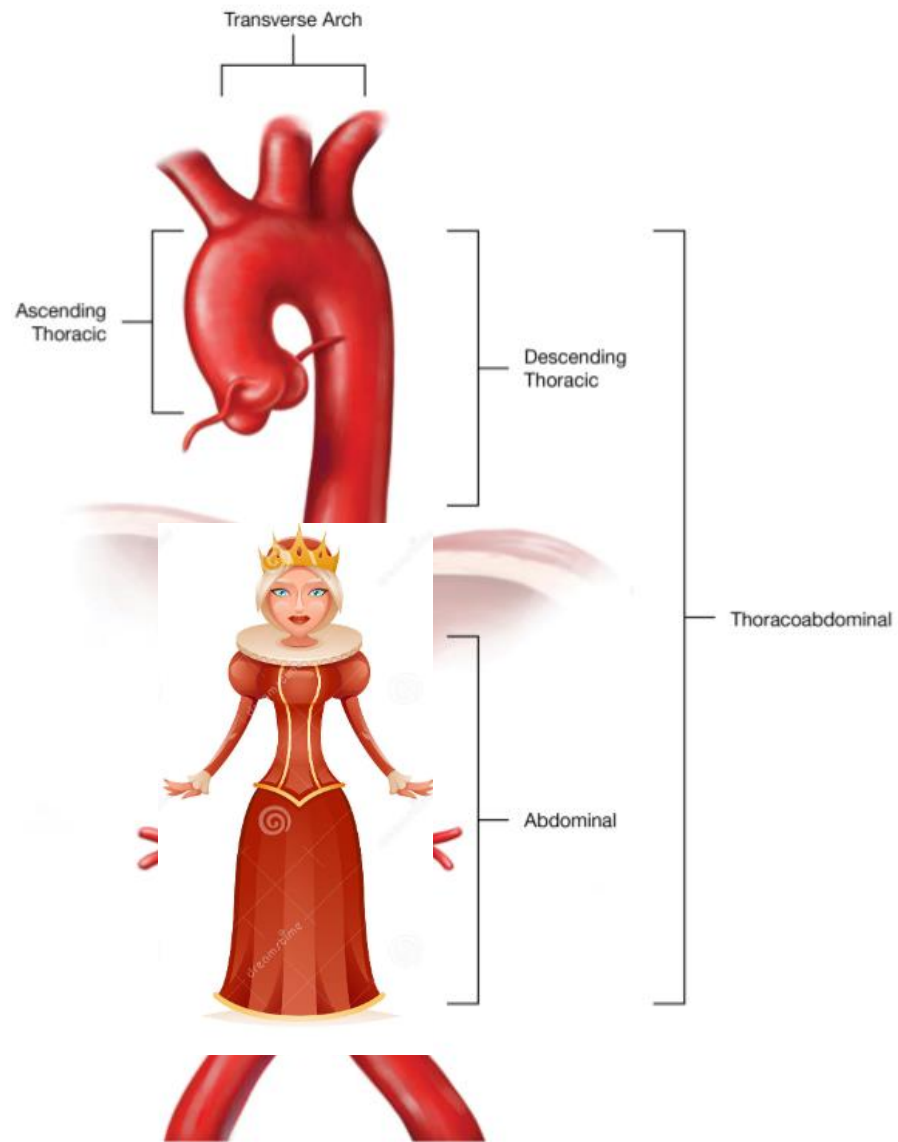


FEVAR Follow-up

Hypothesis

4D-CEUS + Abdominal X-ray could replace CTA during post-FEVAR surveillance

BMI	X-ray	4D-CEUS	CTA
< 30	1,6,12,24 months	Discharge 1,6,12,24 months yearly	Discharge Diagnostic suspicion



«breve è questa esistenza, come una visita fugace in una casa sconosciuta... La via da seguire è scarsamente rischiarata dal lume tremolante della coscienza»

GRAZIE!