

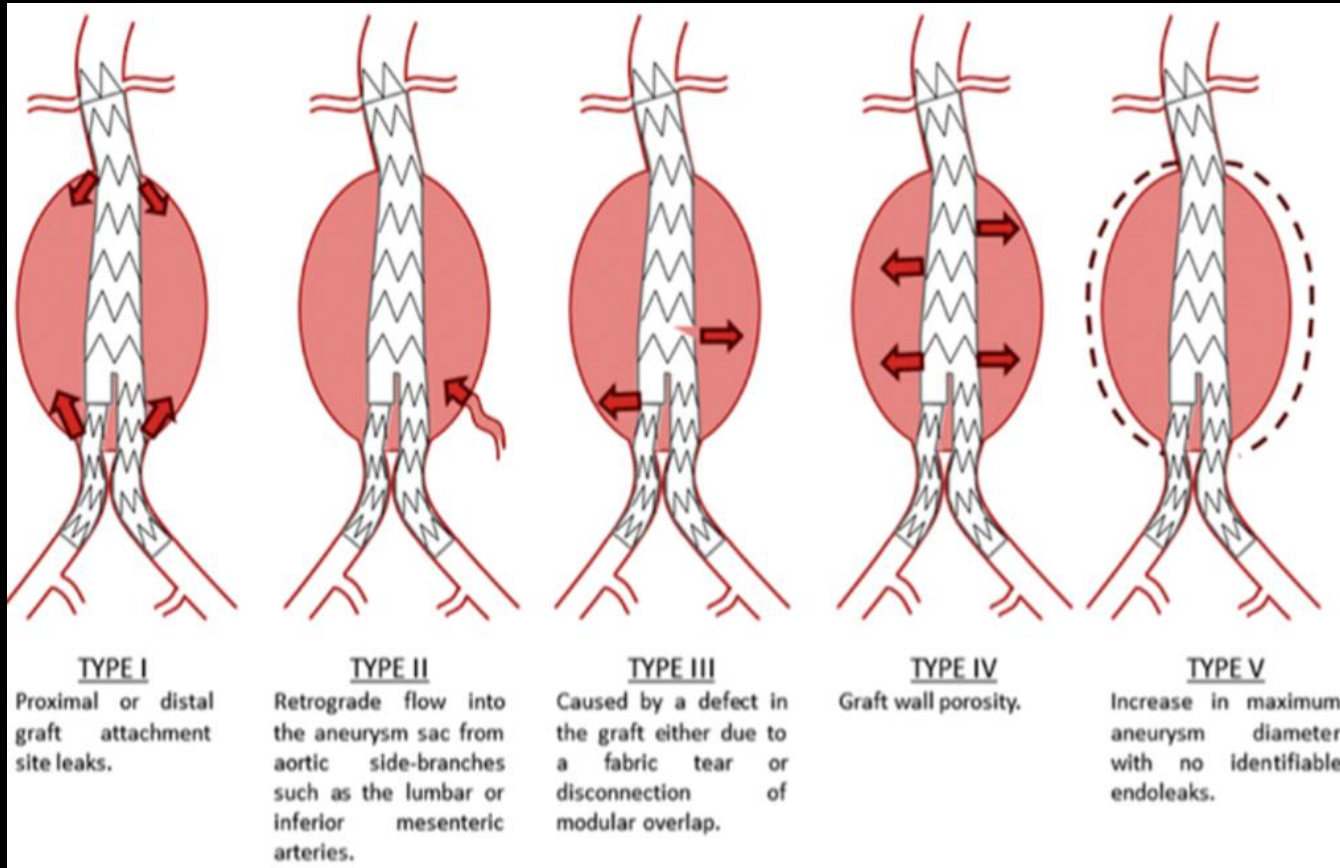
ENDOLEAK

Ved EVAR og Iliaca repair

ENDOLEAK

- Persisterende blod flow i aneurime sækken efter endovaskulær behandling. Medfører systemisk eller nær systemisk BT i sækken – risikoen for aneurisme vækst og ruptur øges.
- 30-40% EVAR intraoperativt, 20-40% in follow up.
- Asymptomatisk, kan opstå på et hvilket som helst tidspunkt.
- Livslang kontrol – typisk CT angiografi

KLASSIFIKATION



Primære endoleak
Sekundære endoleak


Ca. ½ af endoleak (primært Type II)
forsvinder spontant uden reintervention.

FORDELING PÅ TYPE

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)	20–40%, 10% persistent at 2 years
	Categorised as early or late/delayed (before or after 12 months) and as transient or persistent (resolved or not resolved ≤ 6 months)	
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%

References: [20,125,328,375,430,485,628,764].

- 
- Persisterende endolækage giver risiko for vækst af aneurismesækken og rupture, og ruptur risikoen er størst ved **type I og type III** endoleak.
 - “ Overall, the risk of rupture associated with **type II** endoleaks remains low (< 1%)”

THE SOCIETY FOR VASCULAR SURGERY CLINICAL PRACTICE GUIDELINES¹

Treatment is recommended for **type I and III** endoleaks (grade 1B evidence level).

- **Surveillance** is recommended for **type II** endoleaks not associated with aneurysm expansion (grade 1B evidence level).
- **Treatment** is suggested for **type II** endoleaks associated with aneurysm expansion (grade 2C evidence level).

- **Open repair** is recommended if endovascular intervention has failed to treat a **type I or type III** endoleak with ongoing aneurysm enlargement (grade 1B evidence level).

- **Open repair** is suggested if endovascular intervention fails to treat a **type II** endoleak with ongoing aneurysm enlargement (grade 2C evidence level).

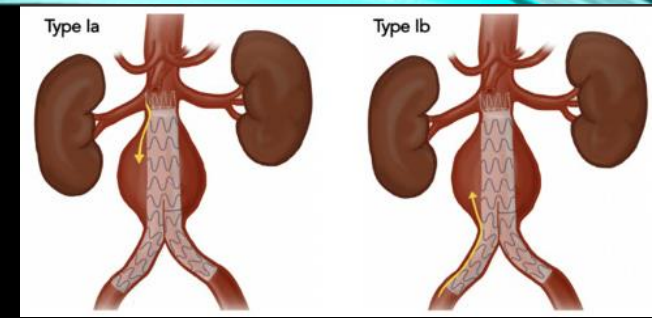
- **Treatment** is suggested for ongoing aneurysm expansion even in the absence of a visible endoleak, referred to as endotension or a **type V endoleak** (grade 2C evidence level).

- **Treatment** is **not** recommended for a **type IV** endoleak (grade 2C evidence level).

TYPE 1

- Endoleak opstår når der er en “gap” mellem graften og karvæggen i “sealzone” proksimalt (1a) eller distalt (1B).
- Opstår når anatomien af aneurismet er uegnet til EVAR eller p.g.a. dårlig device selection.
- Kan også opstå p.g.a. progredierende vækst af karret over tid og/eller protese migration.

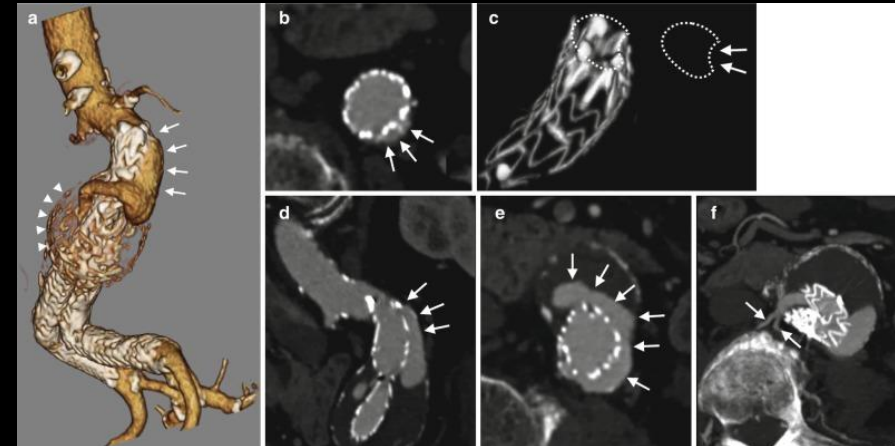
TYPE 1A - PROKSIMAL



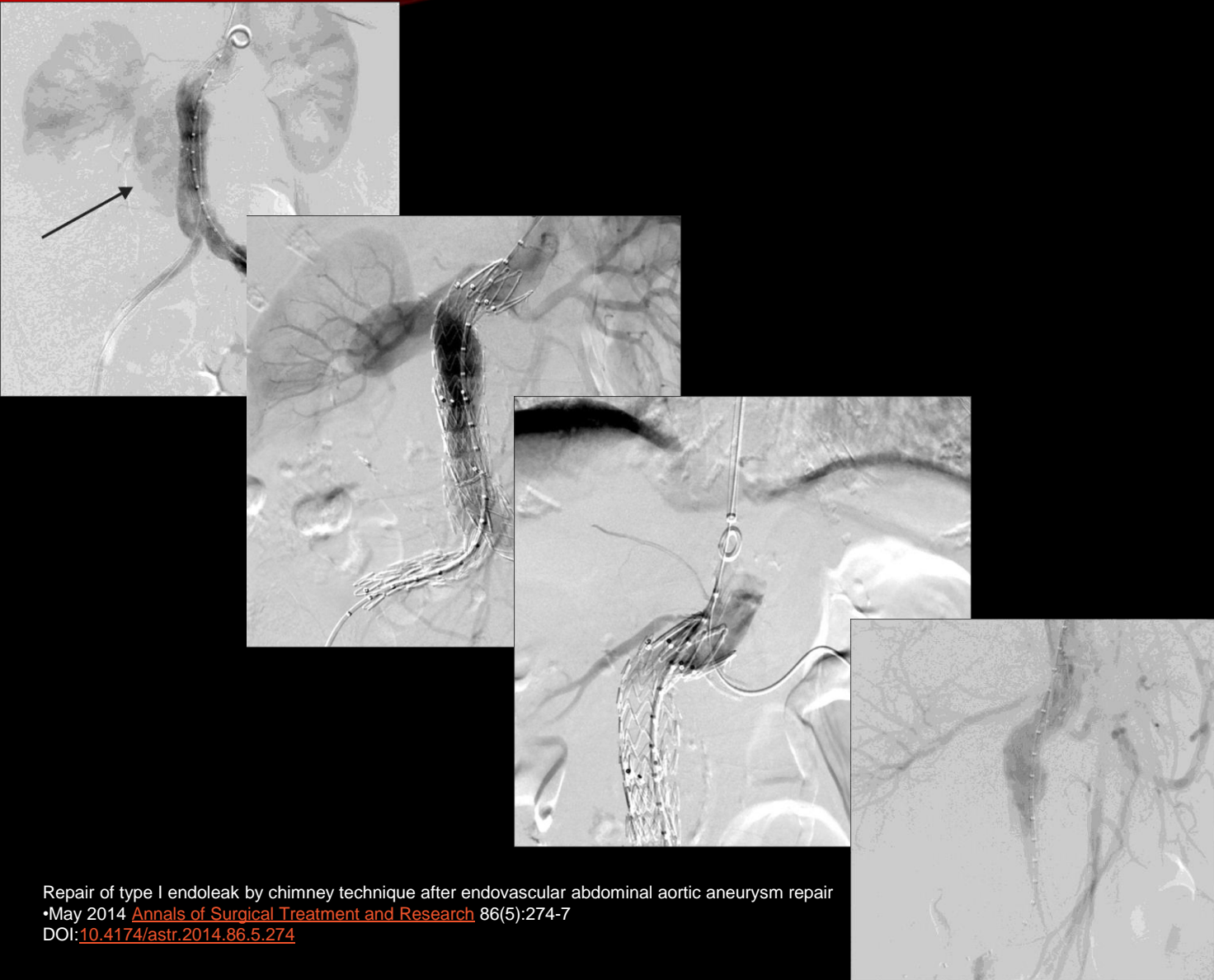
- **Type 1A-: Increased risk with hostile aortic neck**
- - calcification, thrombus, irregular shape, short necks, angulated necks, and larger-diameter necks

Treatment - Attempt proximal sealing :

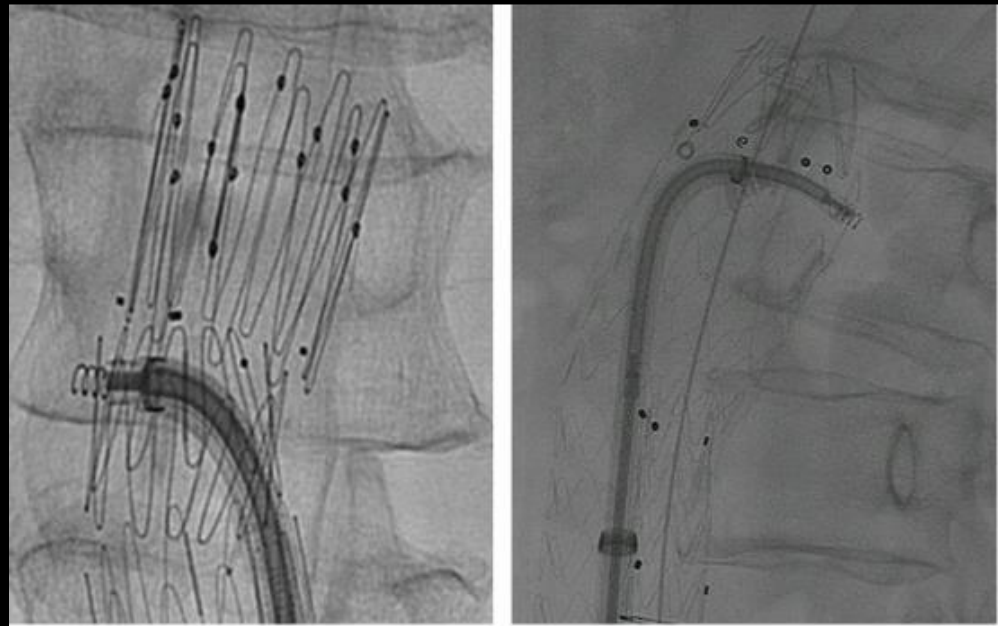
- **Extend to renal arteries**
Ballon , Aortic cuff
- **Extend above renal arteries**
Stent graft with renal chimney
Fenestrated
- **Secure graft to wall**
Aptus, Palmaz stent
- **Obliterate channel**
Coils, glue – obs endotension
- **Open surgical options**



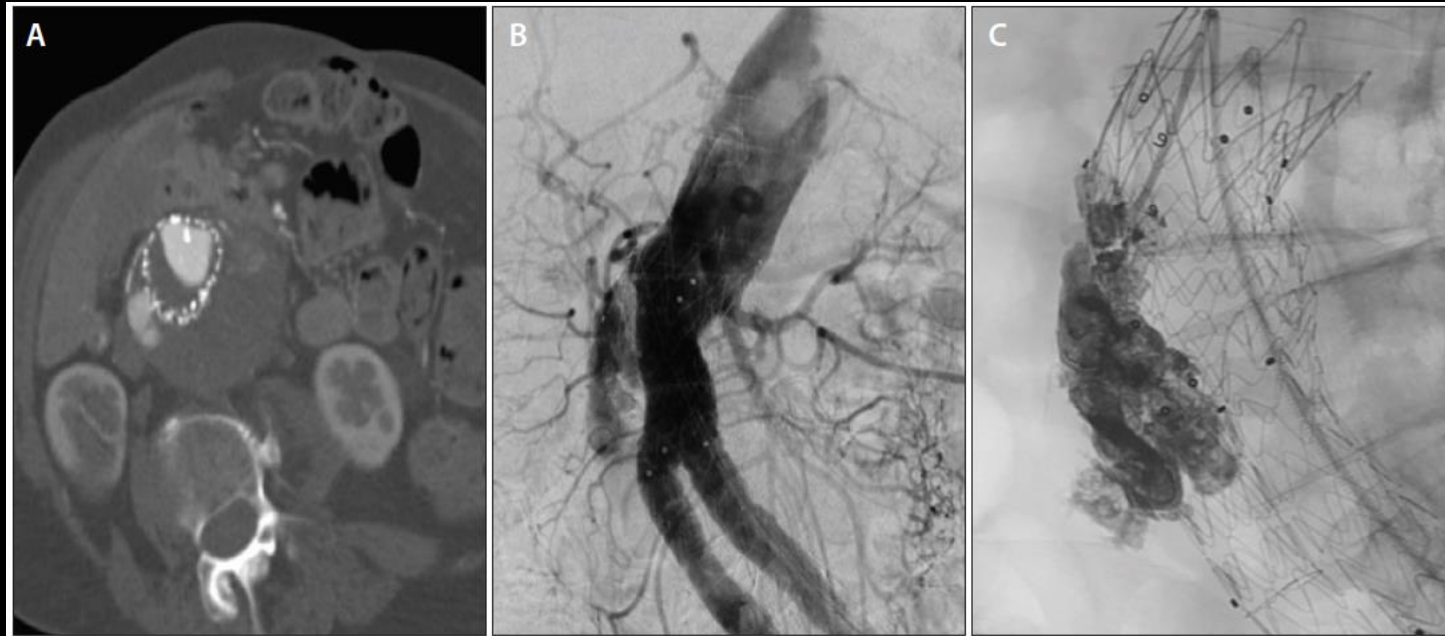
Stor type 1A, beh med viabahn stent i ve. nyrearterie (Chimney)



APTUS HELI FX ENDOANCHOR

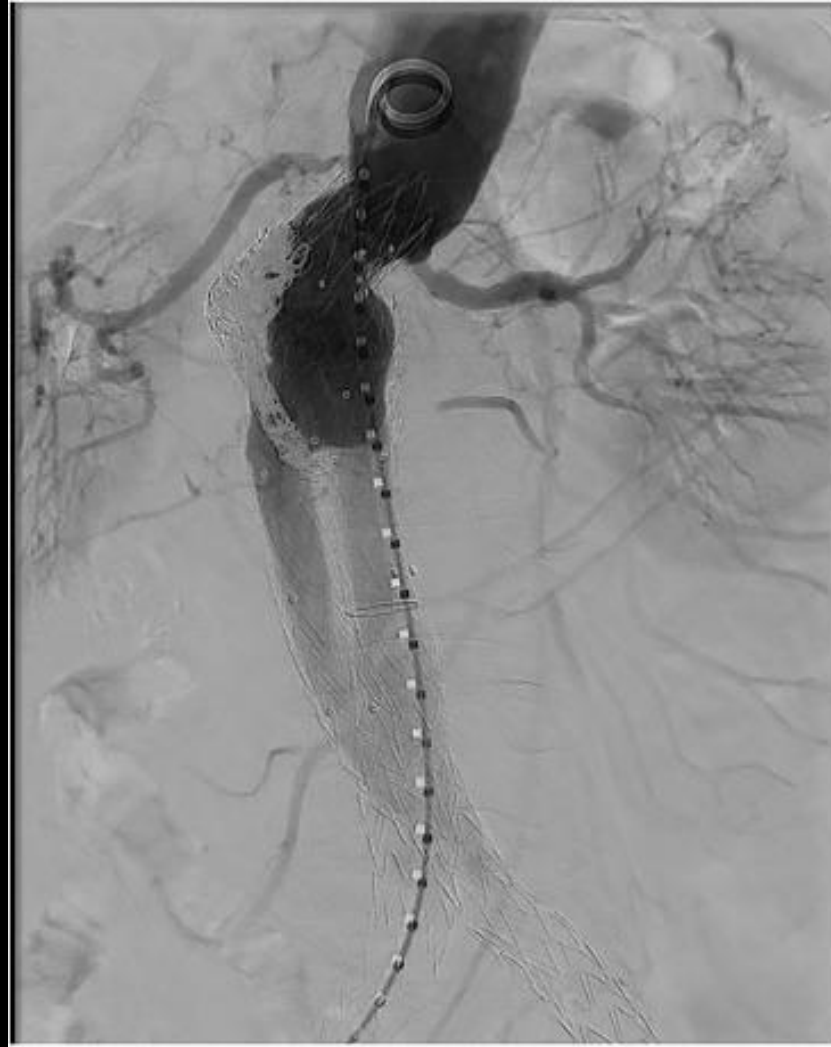


ONYX EMBOLISATION



[Type I Endoleak Embolization With Liquids: Does It Work? - Endovascular Today \(evtoday.com\)](http://evtoday.com)

Coil embolization Type 1A



Type 1B og 1C

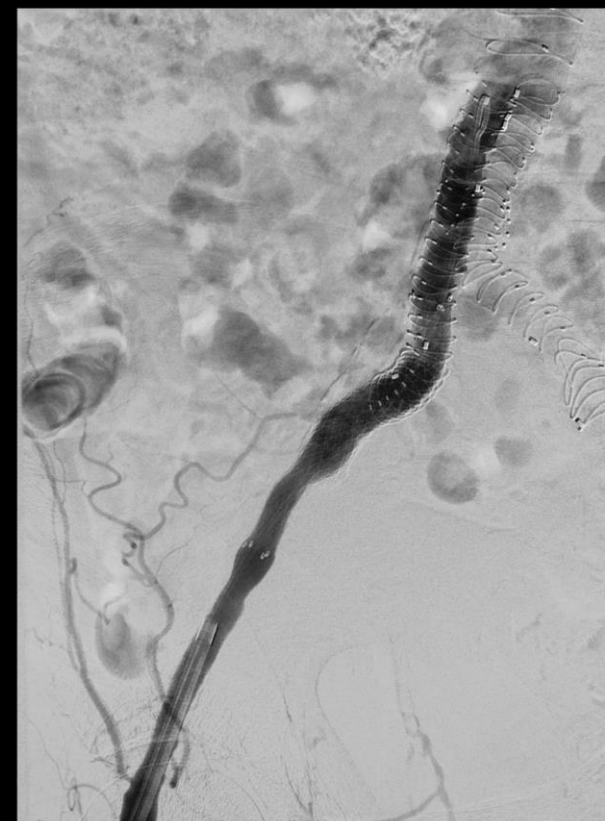
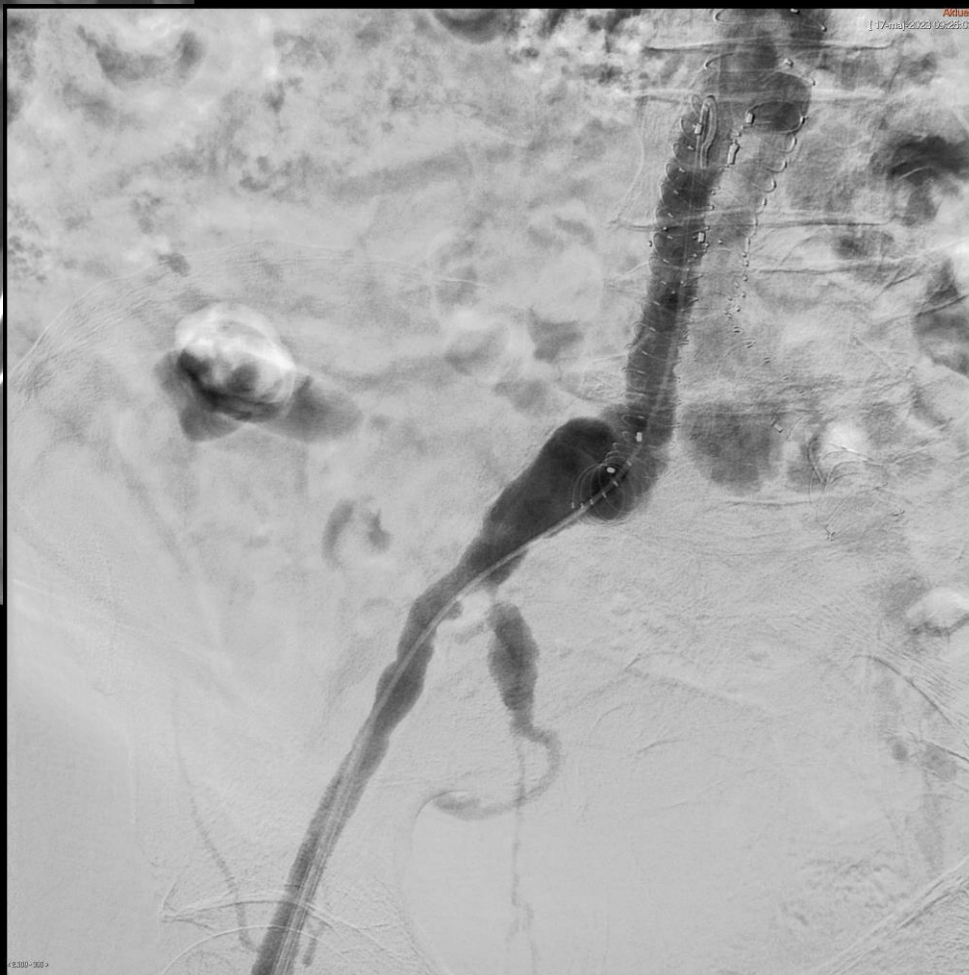
- **Type 1B(distal) og 1C(iliac occluder)– attempt distal sealing**
- Stentgraft ekstension in common or external iliac artery.
- Internal iliac occluded
- Internal iliac preserved- branch device, snorkel.
- Convert to aortomonoiliac.

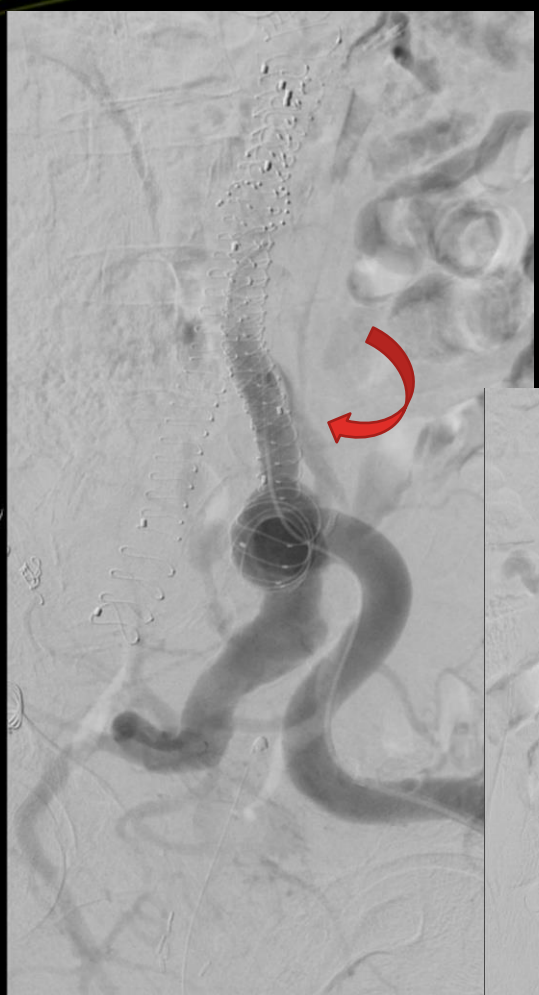
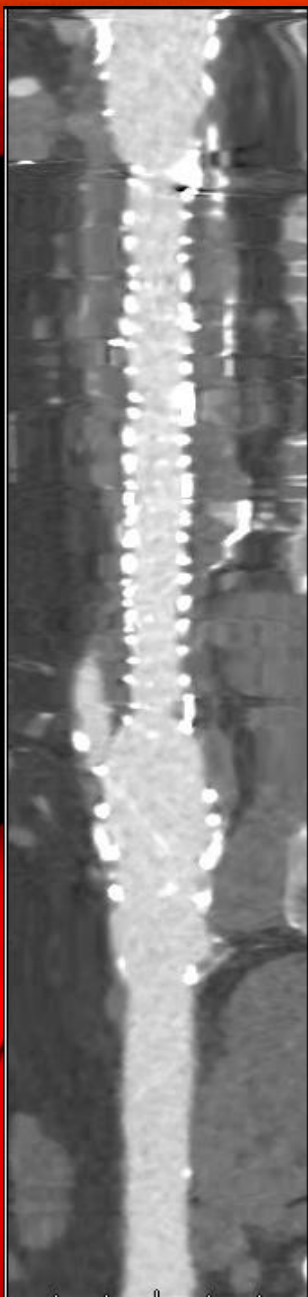
Tidligere 1

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Anaconda protese, type 1B endoleak, forlængelse med 12 mm fluencygraft i iliaca ext. Stenoeret iliaca int. så undladt coiling

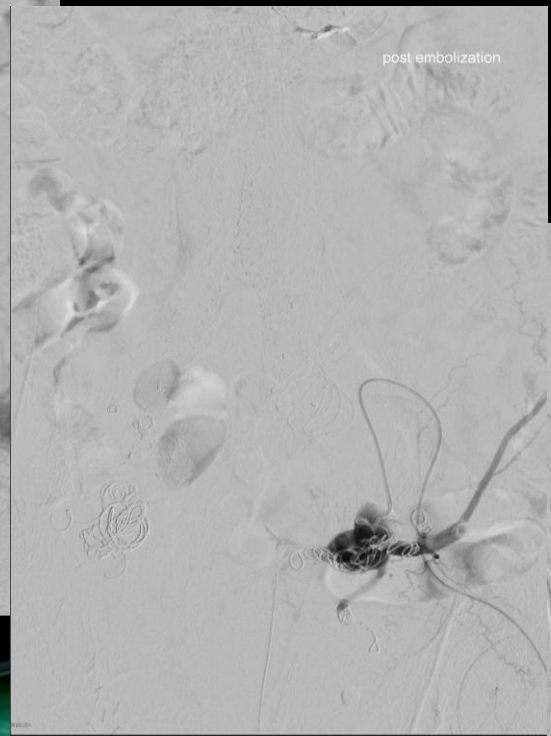
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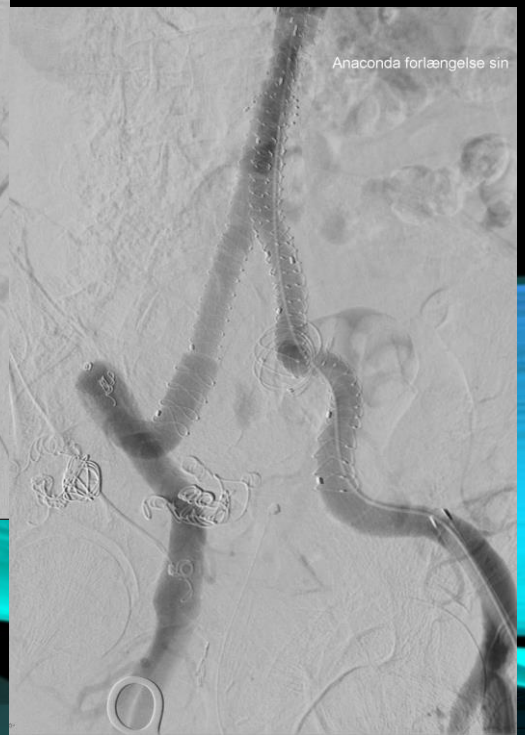


TYPE 1B

Coiling ve.ilica interna



Forlængelse med flaired Anaconda ben



TYPE II

- Endoleak from collateral vessel – (lumbar, IMA, accessory renal or medial sacral)
- **The risk factors for persistent type II endoleak**
 - Patent inferior mesenteric artery
 - Number and diameter of patent collateral arteries
 - Presence of accessory renal artery or median sacral artery
 - Ongoing anticoagulation
 - Limited preexisting sac thrombus volume

TYPE II

- Most common
- 20-40% - 10% persist at 2 years follow up - many resolve spontaneously.
- Most ruptures due to Type II endoleak seem to occur in the presence of sac expansion, but rupture has also been reported without sac expansion.
- Approximately half of the patients with persistent or late endoleaks developed sac growth, with a 50% re-intervention rate at 2 years.

TYPE II

- Treatment if and when: Still controversial
- Rule out other cause to aneurism growth like type I or Type III leak.
- **Society for Vasc. Surg.:**
 - Surveillance is recommended for **type II** endoleaks not associated with aneurysm expansion (grade 1B evidence level).
 - Treatment is suggested for **type II** endoleaks associated with aneurysm expansion (grade 2C evidence level).
- **European Society og vasc surg:**
 - There is no evidence for when intervention is indicated for Type II endoleak.
 - Some centres treat Type II endoleaks if the sac has expanded >1 cm, and others at 5 mm

TYPE II TREATMENT

Endovascular treatment consists of:

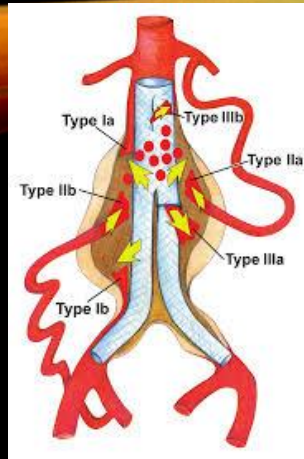
Transarterial, translumbar, transcaval, transsealing (between iliac graft and iliac arterial wall), transgraft embolisation of the aneurysm sac and feeding vessels

Successful in 60-80%

Translumbar embolisation may have a higher success rate with a lower rate of complications.

- Laparoscopic/open ligation

- **Transarteriel:**
- SMA to IMA
- Internal iliac to lumbar



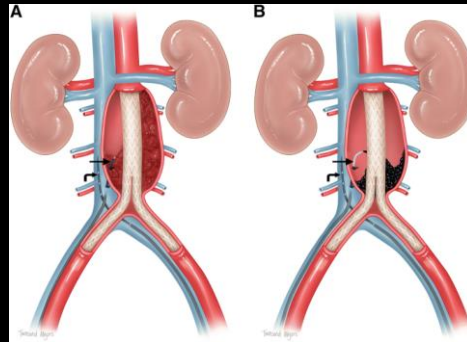
TYPE II

- **Direct sac access:**

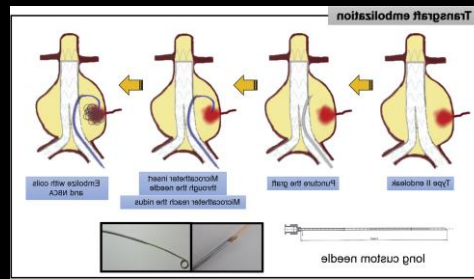
Catheter outside graft



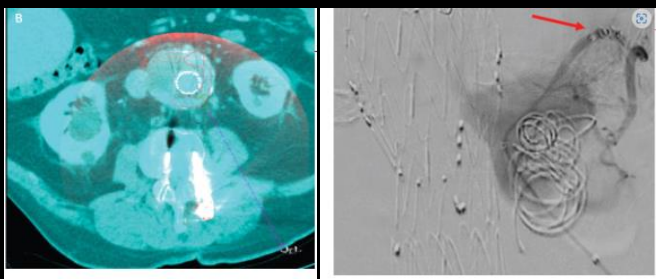
Transcaval



Transgraft



Translumbar

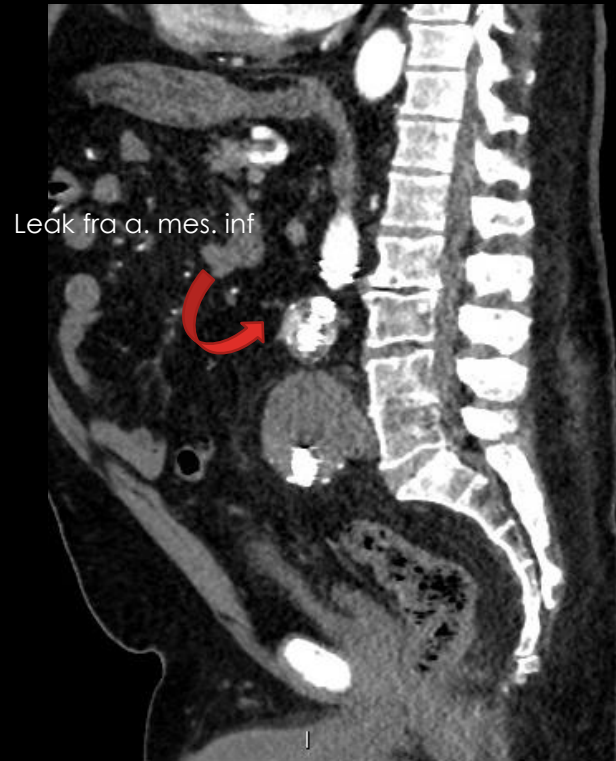


Agents:

- Coils
- Onyx
- Glue -N-butyl cyanoacrylate
- Thrombin

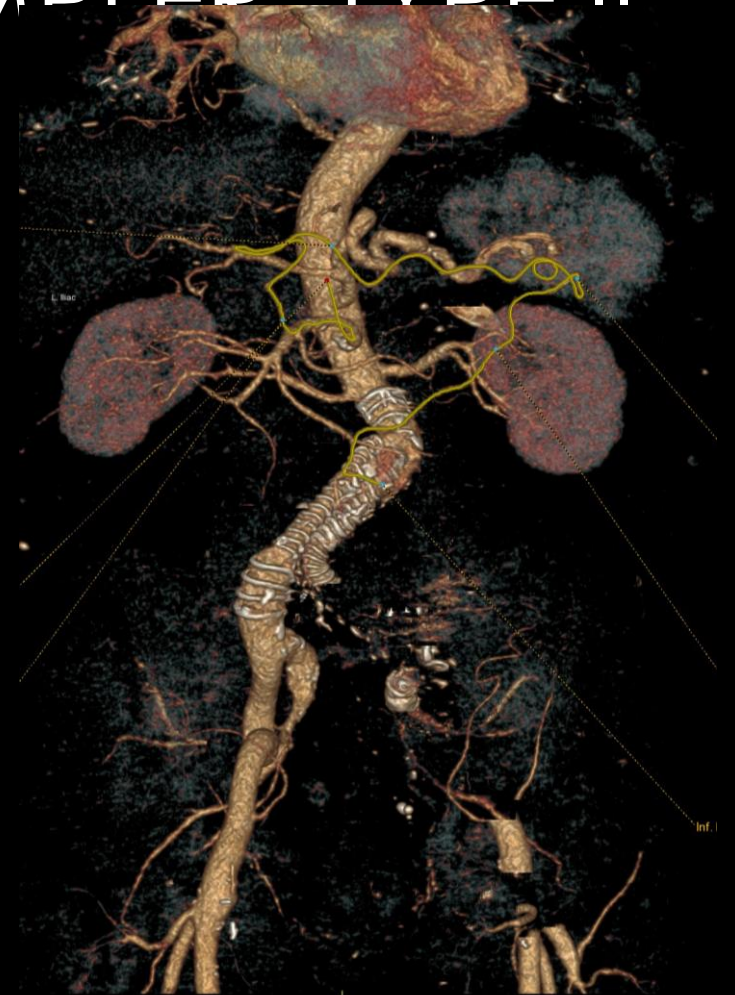
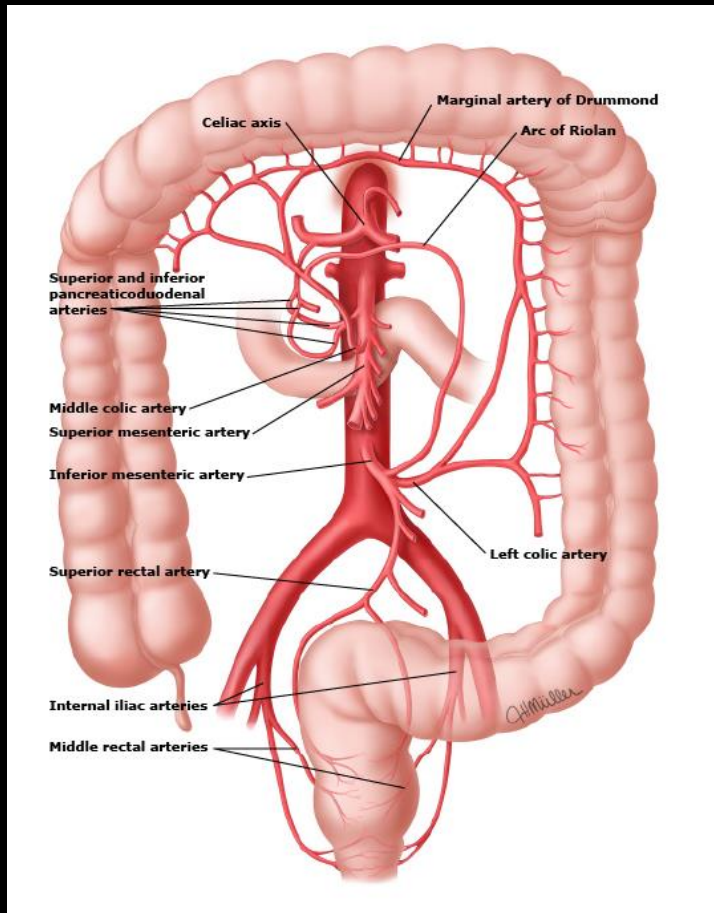
TYPE II ENDOLEAK, OG VÆKST AF ANACONDA BEHANDLET VE. ILIACA COMMUNIS ANEURISME.

Type II leak fra a. mesenterica inferior, via lang Riolan anastomose ml. a. colica media og a. mes. Inf.



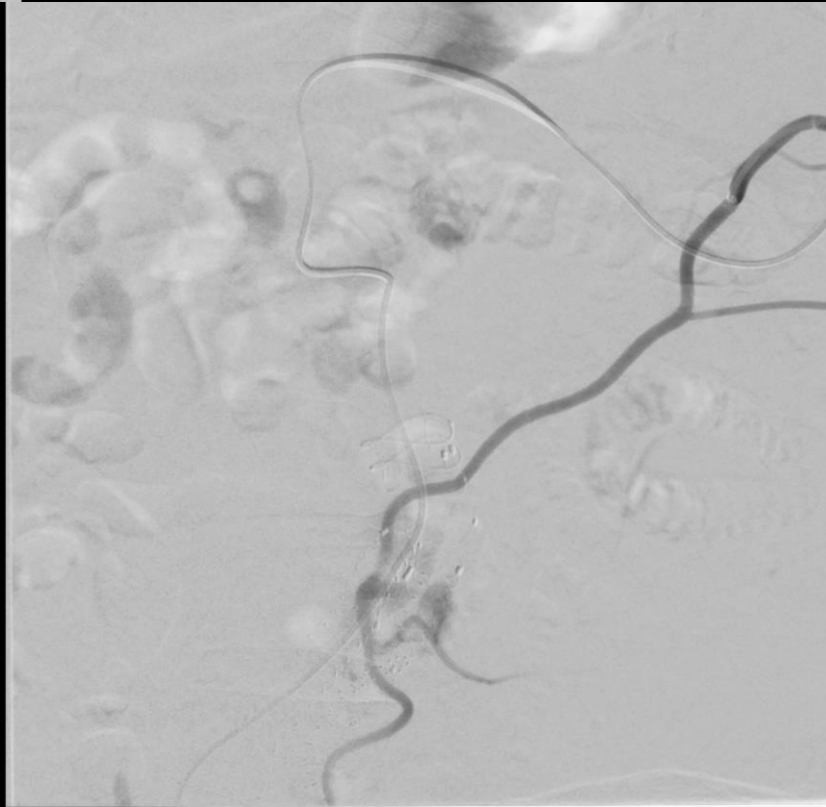
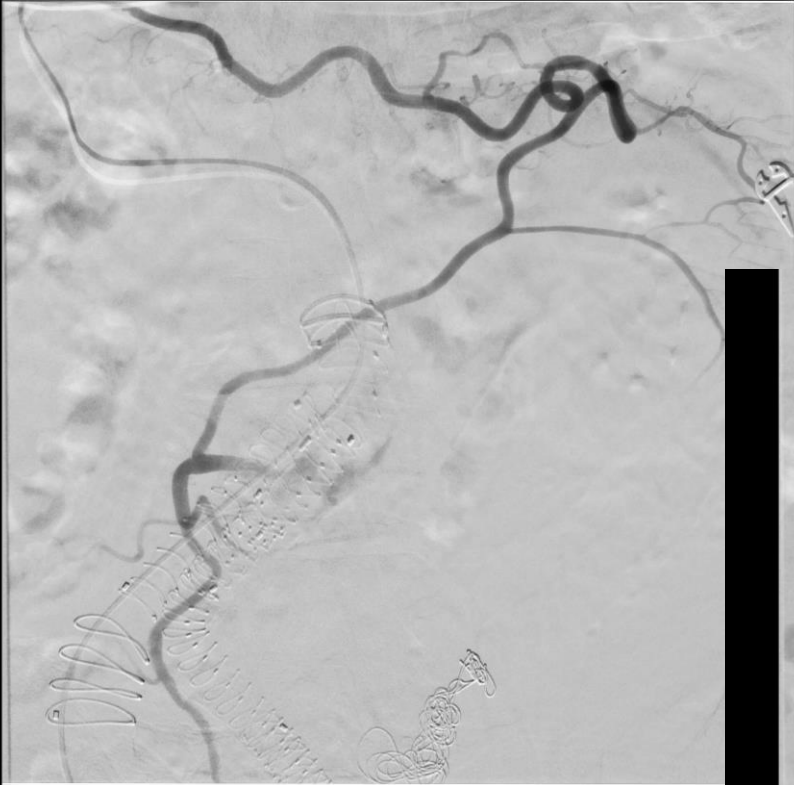
Den endovaskulære rute a. mes. sup, a. colica media, Drummonds artry/riolan til a. mes inf.

EKSEMPEL 2 TYPE II



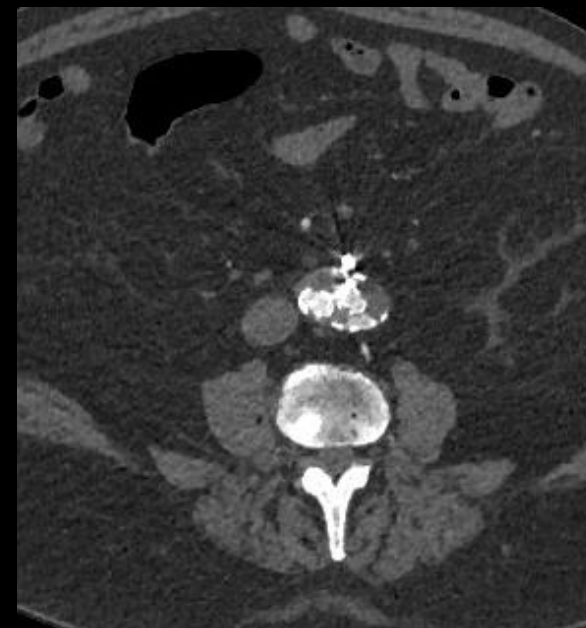
Abbas12
23-jun-2022 10:39:46

Hydrofil makro kateter og progreat mikrokateter



1.mdr postembolisering. Ophørt type II endoleak fra a. mes ins. Fortsat lille leak fra lumbal.

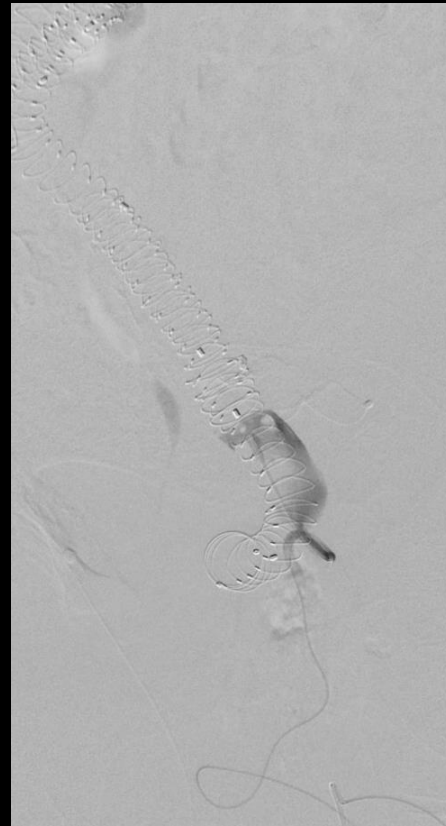
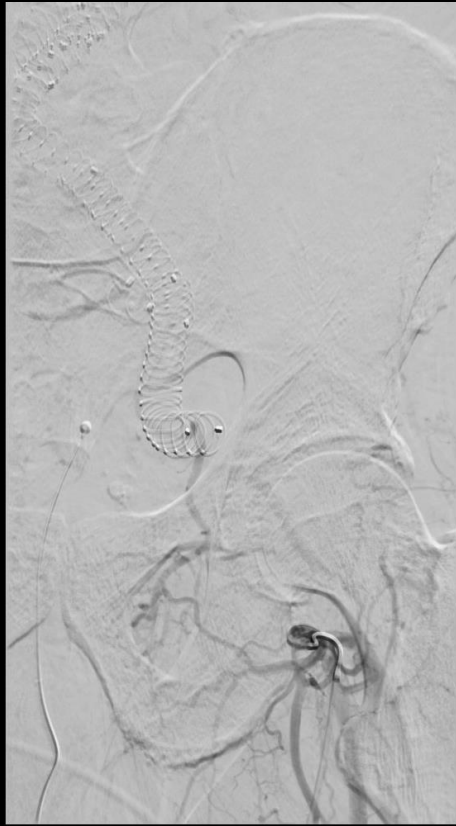
1 års kontrol ingen nye leak, og inden aneurisme vækst



TYPE II ENDOLEAK TIL ANACONDA BEHANDLET VE.
ILIACA COMMUNIS ANEURISME

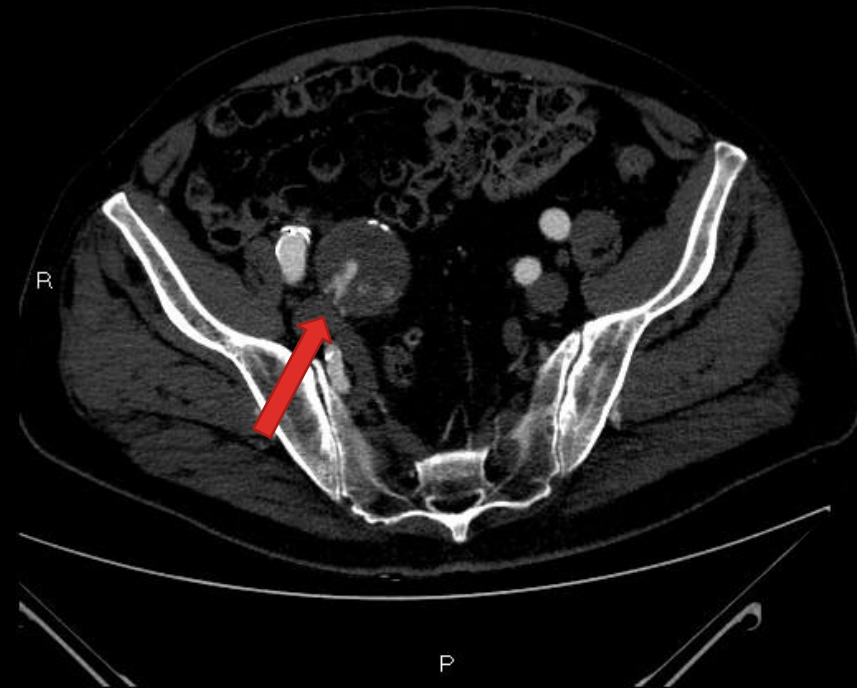


4 French sheath i prox. SFA med katerter i profundagren og forbindelse via obtoratoriusgren til aneurimesækken som coiles.



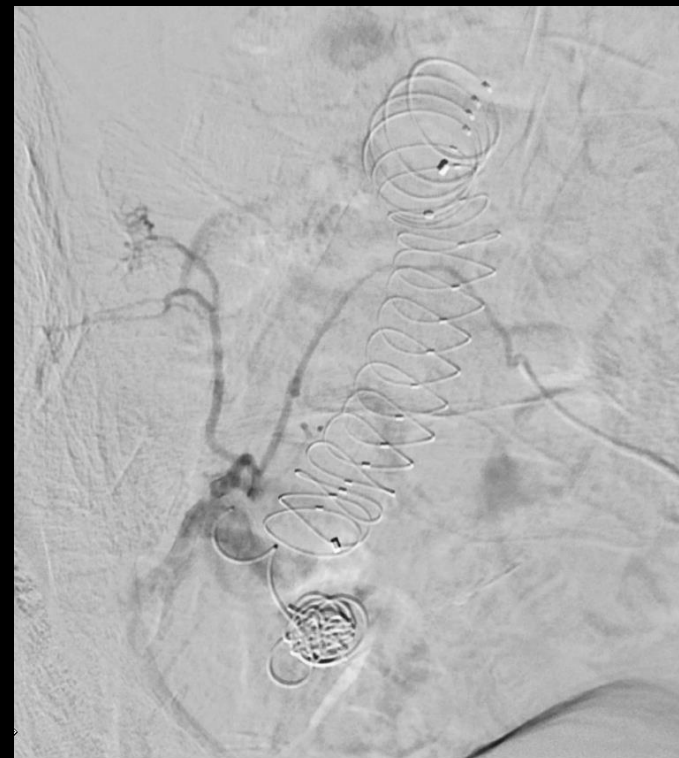
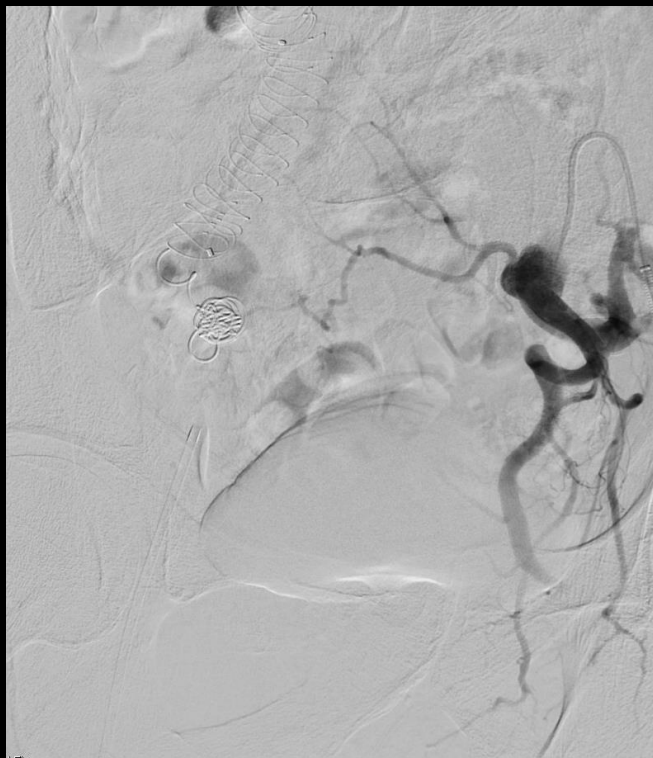
TYPE II ENDOLEAK FRA RESTFLOW I INTERNA GREN ,
ANACONDA OG TIDL COILBEHANDLET HØ. ILIACA INT. ANEURISME.

Tidligere 4
< 402 - 277 AXIAL >





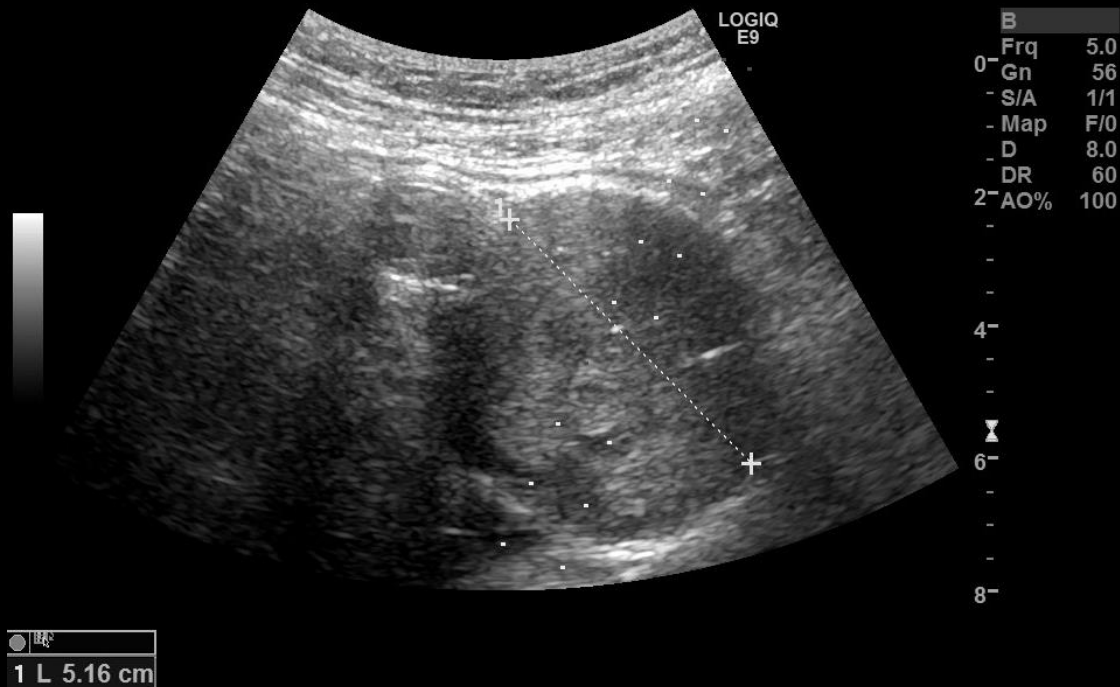
Først ind lavt i h \ddot{o} a. fem.



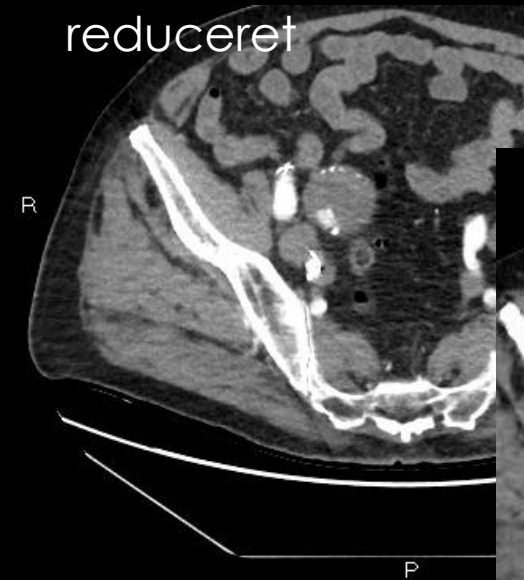
Adgang i ve iliaca int. via kollateraler der krydser midtlinjen, kan dog ikke avancere mikrokateter der sidste cm, der kommer perforation – coiles. Proceduren må opgives

UL VISER FLOW I ANEURIMSET

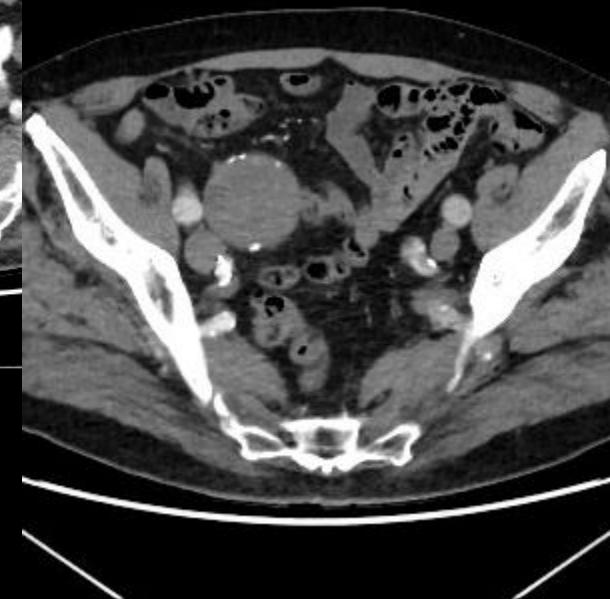
- Emboliseres percutant ul vejledt med 2 ml Tisseel

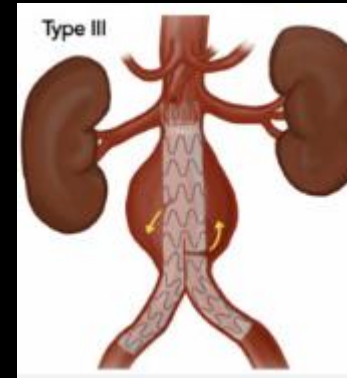


1 mdr. kontrol -
reduceret



Aktuelt 5 år- ophørt





TYPE III

- **Type III:** leak through defect in graft: junction failures or holes

TABLE 1. ENDOLEAK CLASSIFICATIONS FOR EVAR		
Endoleak		Definition
Type I	A	Inadequate seal at the proximal end of endograft
	B	Inadequate seal at the distal end of endograft
	C	Target vessel seal failure or inadequate seal at iliac or subclavian occluder plug
Type II	-	Retrograde endoleak through patent aortic side branch (ie, lumbar artery, inferior mesenteric artery)
Type III	A	Component separation (typically involving the bifurcate component and an iliac limb)
	B	Fabric tear - Minor < 2 mm - Major ≥ 2 mm
	C	Target vessel bridging stent disconnection or apposition failure
Type IV	-	Flow from porous fabric; < 30 d after graft placement
Undefined	-	Flow visualized but source unidentified

Modified from Oderich GS, Forbes TL, Chaer R, et al. Reporting standards for endovascular aortic repair of aneurysms involving the renal-mesenteric arteries. *J Vasc Surg.* 2021;73:4S-52A; and Chaikof EL, Blankensteijn JD, Harris PL, et al. Reporting standards for endovascular aortic aneurysm repair. *J Vasc Surg.* 2002;35:1048-1060.
Abbreviation: EVAR, endovascular aneurysm repair.

TYPE III

- **Type IIIA:**

- Insufficient device overlap, and/or secondary to conformational changes in aorta, stent migration

- **Type IIIB** are not common:

- wear and tear of the graft fabric. Degradation of polyethylene terephthalate (also known as polyester) occurs after 10 to 20 years as a result of hydrolysis
- additional factors may be at play

- Treatment

- Typically involves Ballon angioplasty and/or additional components
- Surgery

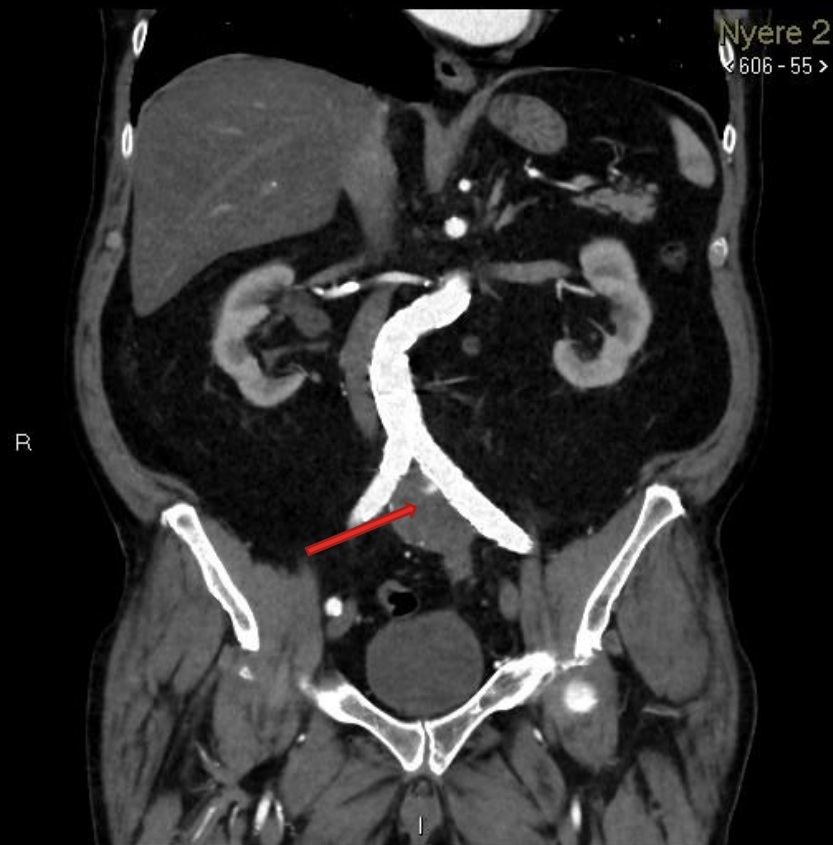
Rumperet iliaca communis
aneurisme/pseudoanerisme

Emergency Flyency covered stent
+ interna coiling

Ca. 1 mdr postop.



3.Mdr pos t- obs type 1 eller 3 endoleak

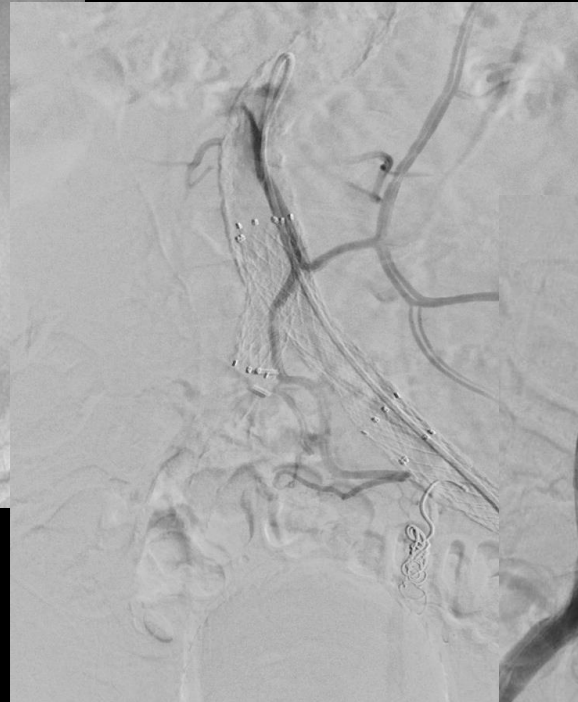




Ad flere omgange agrafer og CT : type 3 kunne ikke sikkert bekræftes, og mistænkes derfor type 2 - kan dog ikke verificeres ved selektiv agrafer.



En mellem liggende CT viser fortsat endoleak obs type 3. Ender derfor med covered re-stenting - men trods dette viser samme peroperativ agrafer fortsat mistanke om endoleak - således obs type II .

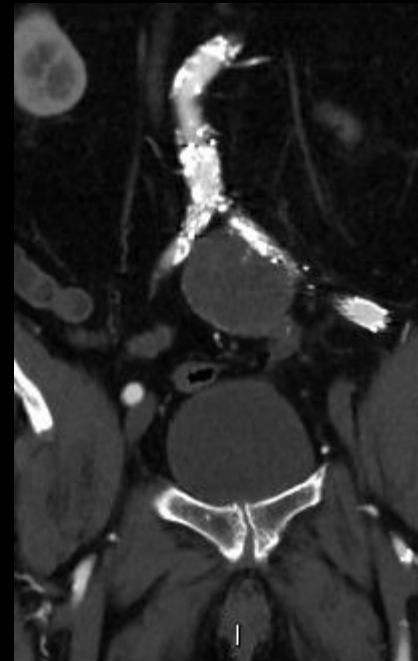


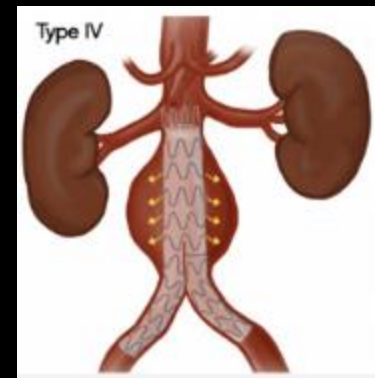
Covered restenting

Kontrol CT viser fortsat endoleak, agrafi igen efter 3 mdr. Agrafi igen kan ikke påvise genfinde leak



- Vedvarende endoleak på CT 10 mdr efter primærproceduren forsøges UL vejledt trombin injektion - Uden effekt på CT
- Igen ny covered stent jan 2022 - på mistanke om type III
- CT jan 2023:



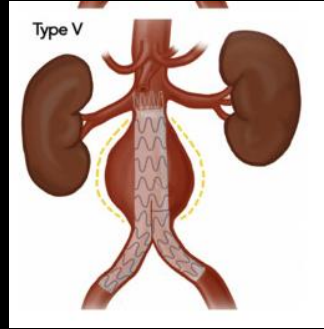


TYPE IV

- Leakage of blood through the stent graft due to material porosity in the early postoperative period is defined as Type IV endoleak
- Type IV endoleak is rare with most modern devices

Treatment:

- No treatment and typically resolves within a few days once the patient's coagulation status returns to baseline



TYPE V- ENDOTENSION

- **Sac expansion without any visible endoleak.**
- Cause is unknown, but maybe:
- Increased graft permeability - resulting in direct transmission of pressure through the graft to the aortic wall?
- Endoleak that cannot be defined with current imaging modalities?
- Endotension may result in AAA rupture, although this is exceedingly rare with only anecdotal cases in the literature.
- **Important to investigate unidentified alternative types of endoleak first:**
- CTA
- Diagnostic angiography, Balloon occlusion w. angio (to visualize other types)

- [Society for Vascular Surgery implementation of clinical practice guidelines for patients with an abdominal aortic aneurysm: Endoleak management - Journal of Vascular Surgery \(jvascsurg.org\)](#)
- [European Society for Vascular Surgery \(ESVS\) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms](#)
- [EVAR Versus the Endoleak - Endovascular Today \(evtoday.com\)](#)
- [Incidence, etiology, and management of type III endoleak after endovascular aortic repair - Journal of Vascular Surgery \(jvascsurg.org\)](#)
- [Type 2 Endoleak With or Without Intervention and Survival After Endovascular Aneurysm Repair - European Journal of Vascular and Endovascular Surgery \(ejves.com\)](#)