Management of Endoleaks

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Questions

- Advantages of endovascular repair
- Definition of an endoleak
- Types of endoleaks
- Management of type III endoleak
- Diagnosis of type II
Case Presentation

- 86 male s/p endovascular repair of left internal iliac artery aneurysm in 2004 - expanding left iliac aneurysm on follow up imaging.

- Patient complained of left hip pain
Case Presentation

- PMH – HTN, BPH

- PSH – Endovascular repair of left internal aneurysm, LIHR

- Meds – labetalol, lisinopril, nexium, flomax
Evaluation

- PE
  - NAD
  - Abd – soft, nt, nd
  - Extr – warm, 2+ pulses throughout

- Labs wnl
- Creatinine 1.3
Case Presentation

- Work-up – Abd. US showed a 4.9 cm dilatation of the left internal iliac artery

- The decision was made to take the patient to the OR for formal angiogram to rule out an endoleak and for possible embolization
Case Presentation

- Intra-operative finding - no endoleak
- Patient was discharged after adequate observation
Management of Endoleaks

Questions?
Introduction

- An arterial aneurysm - permanent localized enlargement of > 1.5 times its expected diameter
- Common morphology is a fusiform, symmetrical, circumferential enlargement that involves all layers of the arterial wall.
- Most common cause - atherosclerotic degeneration of the arterial wall
**Introduction**

- Most common - infrarenal aorta aneurysm

- In the United States, AAAs result in approximately 15,000 deaths/yr

- Death rate - reduced by identifying and treating aortic aneurysms before they rupture
Introduction

- **Annual risk of rupture**
  - 1% to 2% for aneurysms < 5 cm
  - 10% for aneurysms 5 to 6 cm
  - 25% or higher for aneurysms > 6 cm

Large aneurysms - much more likely to rupture but small aneurysms can and do rupture

Decision to treat - assessment of the risk rupture relative to the risk associated with treatment rather than on an absolute size criterion.
Pathogenesis

• Multifactorial process
  • Genetic predisposition (e.g. Ehlers-Danlos syndrome, Marfan syndrome)
  • Aging
  • Atherosclerosis
  • Inflammation (tertiary syphilis)
  • localized activation of proteolytic enzymes
Diagnostic modalities

- Ultrasound -
  - ready availability in both inpatient and outpatient settings
  - low cost
  - safety
  - good performance

- Limitations
  - imaging of the thoracic and suprarenal aorta is poor
  - quality of the images is considerably lower - obesity or large amounts of intestinal gas
  - requires a skilled imaging technician
Diagnostic modalities

- Aortography
  - excellent images of the contours of the aortic lumen
  - not a reliable method for determining the diameter of an aneurysm or even for establishing its presence because the mural thrombus within the aneurysm tends to reduce the lumen to near-normal size.
  - helpful in determining the extent of an aneurysm especially when there is iliac or suprarenal involvement
Aortography
Diagnostic modalities

- **CT scan**
  - reliable information about the size of the entire aorta
  - allows accurate determination of both the size and the extent of the aneurysm
  - permits identification of the visceral and renal arteries and their relationship to the aneurysm.
  - I.V. contrast material allows assessment of the aortic lumen, the amount and location of mural thrombus, and the presence or absence of retroperitoneal hematoma.
  - currently the most useful imaging method for evaluation of the abdominal aorta

- **MRI**
  - no nephrotoxic contrast agents are used.
Classification of Patients For Repair

- 3 categories according to presentation:
  - elective patients
  - symptomatic patients
  - patients with ruptured aneurysms.
Indications for elective repair

- Asymptomatic patients who have aneurysms 5.0 cm in diameter or larger
- An acceptable level of operative risk and life expectancy of 1 year or more.
- <5.0 cm who are not at high operative risk who live in a remote area where proper medical care is not readily available.
- 4.0 and 5.0 cm in diameter and have shown growth of more than 0.5 cm on serial images in less than 6 to 12 months.
- Peripheral embolization originating from the aneurysm, regardless of the size of the aneurysm.
Classification of Patients for Elective or Urgent Repair

● Urgent operation
  • symptomatic aneurysms, regardless of the size of the aneurysm.

● Emergency operation
  • all patients with known or suspected rupture of an aneurysm.
Operative method

- Endovascular vs Open

- Endovascular aneurysm repair (EVAR)
  - Introduce certain morphologic criteria into the process of patient selection,
  - Stent grafting is appropriate only for patients in whom the infrarenal neck and the iliac arteries are suitable
Endovascular repair was introduced during the 1990s - less invasive approach

- Stent-graft is placed endoluminally via bilateral groin incisions;
- No need for a major abdominal incision and aortic clamping.
- Results to date have been promising
Endovascular repair of Aneurysms

- **Advantages**
  - Blood loss is decreased
  - Hospital stay is shortened
  - Earlier return to function is achieved


PREOPERATIVE PREPARATION

- Both CTA and angiography are used for this purpose. CTA is currently preferred.

- CTA accurately defines:
  - proximal and distal characteristics of the aneurysm
  - detects any significant renal, visceral, or iliac occlusive disease.
  - helpful in defining the infrarenal neck between the renal arteries and the proximal portion of the aneurysm.
PREOPERATIVE PREPARATION

- Angiography - complement to spiral CTA
  - defines renal, mesenteric, and distal arterial anatomy;
  - characterize tortuosity, calcification, and stenoses in access arteries
  - determine the angles between the aorta, the proximal neck, and the aneurysm.
Intra-operative imaging

- Intravascular ultrasonography (IVUS)
  - Intraoperative imaging adjunct in the process of sizing and selecting endograft components.
  - Used to measure vessel diameters and landing zone lengths.
  - Determine the amount of mural thrombus in the aneurysm neck.
  - Can also be used to identify the renal and hypogastric arteries, allowing the endograft to be deployed with minimal or no resort to angiography.
Post–op monitoring

- CT scan with IV contrast
  - Within 1 month after EVAR
  - Then at 6 months if any problems detected
  - Annually if no problems detected
Complications

- Procedure-related mortality - 1% to 2% (5% open)
- Endoleaks
- Endograft migration over time
- Aneurysm enlargement
- Occasional aneurysm rupture
Complications

- Lower Extremity Ischemia
  - Technical error such as a poor anastomosis, graft kinking, or compression
  - Requires immediate surgical correction.
**ENDOLEAK**

- Persistent blood flow outside the lumen of the endoluminal graft but within an aneurysm sac being treated by the device.
- Failure of the stent-graft to totally exclude blood flow to the aneurysm sac.
- Major cause of complications and failure in endoluminal treatment of aneurysms.
- Continued pressurization of the aneurysm sac and may leave the patient at risk of an rupture.
Endoleak Types

Four types

- **Type I endoleak**: Incomplete seal or ineffective seal at the end of the graft.
  - early course of treatment, but may also occur later.

- **Type II endoleak**: due to opposing blood flow from collateral vessels.
  - Inflow and outflow develops creating active blood flow within channel created within the aneurysm sac.
Type I endoleak
Type II endoleak
Endoleak Types

- **Type III endoleak:** Inadequate or ineffective sealing of overlapping graft joints or rupture of the graft fabric.
  - occur early after treatment
  - due to technical problems
  - later due to device breakdown

- **Type IV endoleak:**
  - due to the porosity of the graft fabric, causing blood to pass through from the graft and into the aneurysm sac.
Type III leak
Endoleak Types

● **Type V endoleaks**
  - Continued expansion of the aneurysm sac in the absence of a visualised endoleak on conventional imaging.
  - ‘Endotension’ - continued pressurisation of the aneurysm sac.
  - Important to exclude the presence of a subtle endoleak by further investigation such as contrast enhanced ultrasound

Management of Type I leaks

- Type 1
  Small type IA leaks observe, for, at, least 1 month then in at 6 months. If a leak is still present at 6 months, investigate with angiographically and provide treatment:
  - Treatment of type IA endoleaks most often involves ballooning the site
  - If a leak persists, additional stents or extension cuffs can be deployed over the attachment areas.


Management

• Many early ruptures were linked to type IB endoleaks seen with first-generation tube grafts.
  • Bifurcated or monoiliac grafts are now the standard of care.
  • Imperative to create an adequate distal seal between the graft and iliac artery
  • Majority require reintervention
  • Late endoleaks can occur at the distal attachment site when the length of the seal is short.
  • Coils have been successfully though primarily used for type II endoleaks
Diagnosis of Type II leaks

- Timing of contrast injection during the CT scan will determine whether a type II endoleak is visible.
- Due to the nature of retrograde flow, these can be very low-flow systems.
- Delayed films may be necessary to assess late perfusion within the sac and should be performed with any suspicion of type II endoleak.

Management of Type II leaks

- Most spontaneously resolve, regardless of graft type.

- Some patients will demonstrate stability or even shrinkage of the aneurysm sac in the presence of a patent type II endoleak.

- Current treatment of type II endoleaks - behavior of the aneurysm sac, most of which can be safely observed for 6 months.
  
  - If the sac expands during this time or at a later date,
  - Patient should undergo angiography and
  - Treatment usually in the form of embolization of feeding and draining vessels.
Management of Type III

- Disjunction between modular components (type IIIA) or
- Hole in the fabric of the graft (type IIIB).
- Type III endoleaks are very graft-specific and can be serious because they are invariably associated with a sudden elevation of intrasac pressure.
- All should be repaired as soon as they are detected.
- Successfully corrected with a modular extension or covered stent

Management of Type IV

- Type IV endoleaks
  - caused by fabric porosity
  - subside within 30 days.
  - No specific treatment is necessary.
Conclusion

- Type I and Type III endoleaks - secondary treatment to prevent possible aneurysm rupture.
- Significance of type II endoleaks is less certain.
- No clear evidence that type II endoleaks lead to aneurysm rupture.
- Endoleaks should be treated if associated with aneurysm enlargement.
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