Unusual evolution after treatment of a popliteal aneurysm:

case report and review of the literature

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Summary

- Case Report
- Review of the literature
  - Aneurysms' fistulising inflammatory potential
  - Fate of the aneurysms after surgical or endovascular exclusion
- Discussion
- Conclusion
- References and Tables

Case Report

- September 2016 : First consultation with the patient.
  - An 87-year-old man who came for an arterial follow-up.
  - Cardiovascular risk factors : Hypertension.
  - Surgical history : Bilateral popliteal artery aneurysms (PAs), treated in 2014.

- Bilateral PAs treated in another hospital, by two different types of surgeries:

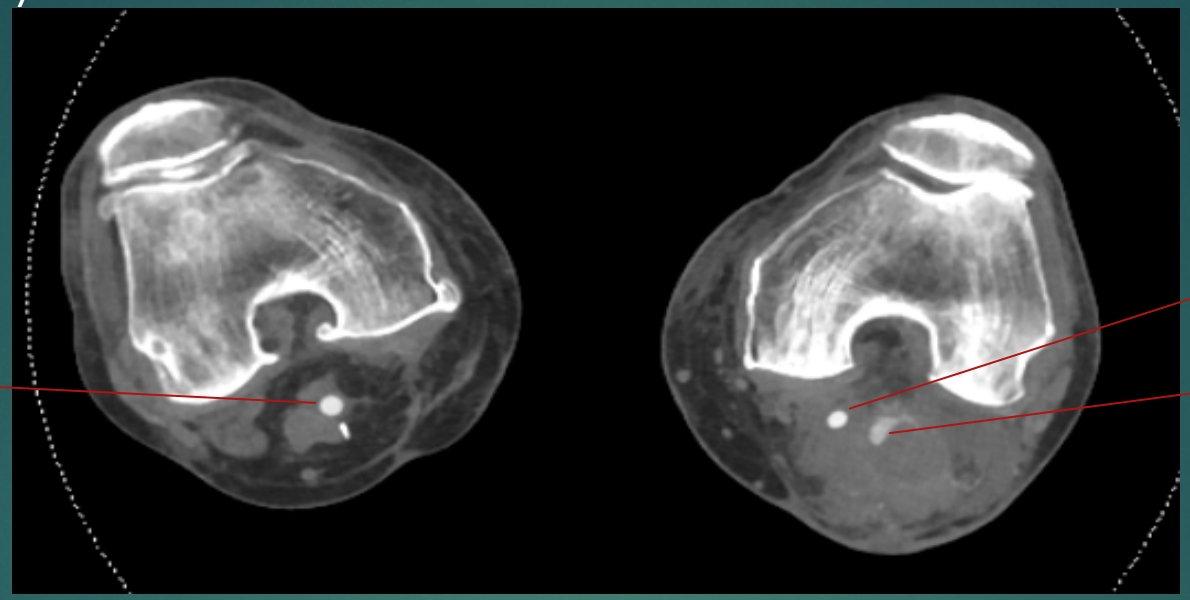
- Right aneurysm : resection, ligation and femoro-popliteal bypass, using the long saphenous vein.
  - Aneurysm resected.
- Left aneurysm : exclusion by proximal and distal ligation, and femoropopliteal venous bypass.
  - Aneurysm left in situ.

- Normal clinical examination.
- Arterial Doppler Ultrasound of the lower limbs :
  - Good permeability of both the bypasses.
  - Left PA, left in situ and measuring 5cm in diameter.

- Stable arterial condition ⟶ Annual follow-up, normal for 3 years.

- September 2019 : Emergency room
  - 3 cm diameter ulcerated and exudative skin lesion in the left popliteal fossa, present for 2 months.

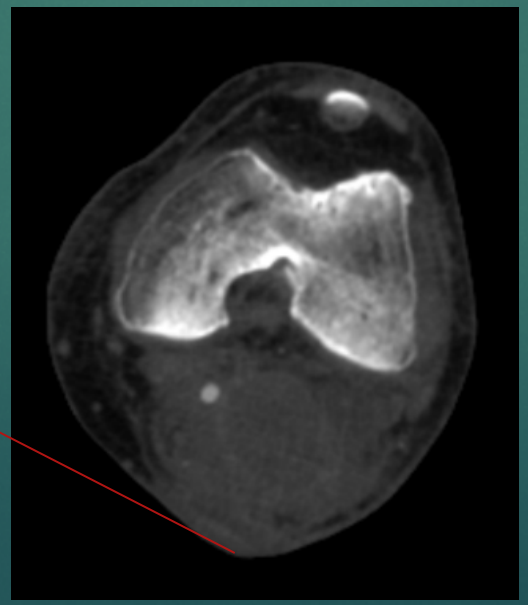
- CT-Angiography :



Right venous femoropopliteal bypass

Left venous femoro-popliteal bypass.

Intra-aneurysmal leak of contrast material



Left PA with a cutaneous fistula

- To summarize :

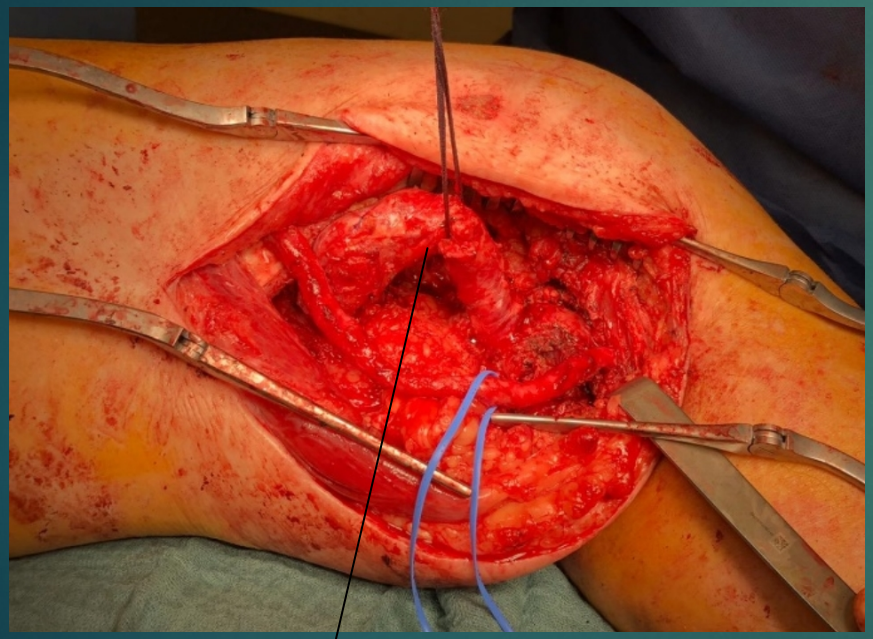
  - The left aneurysm continued to be perfused, despite its surgical exclusion.

  - It increased insidiously in size since the operation and eroded the skin on 3 cm, leading to the ulcerated lesion of the popliteal fossa.

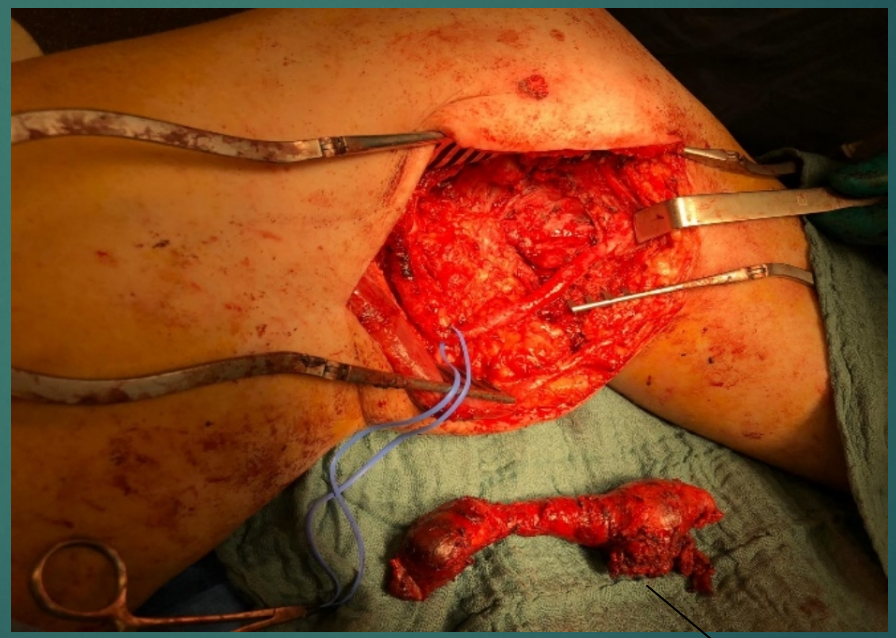
Necessity of surgical management.

- Surgical management:

  - Resection of the aneurysm and its fistulous path, by a medial approach.



Aneurysm's dissection in a strong fibrotic terrain.



Resected aneurysm; fistulous path.

Immediate post-operative status.

- After the operation :
  - The patient was discharged and returned home, after a 6-day hospitalisation without any complications.
  - The skin was completely healed after 2 months.

  - Good evolution since then, with a regular follow-up.
  - Stable and satisfactory arterial state at the last consultation in August 2021.

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Review of the literature

- **Aneurysms' fistulising inflammatory potential**
  - Although all aneurysms may cause a fistula, the most frequently described cases involve thoracic and abdominal aortic aneurysms (aorto-tracheal, - oesophageal, -duodenal, -colic, -cava, erosion of vertebral bodies),
  - Popliteal aneurysms :
    - Arteriovenous fistulas between the popliteal vessels[1]

- **Fate of the aneurysms after surgical or endovascular exclusion**
  - Surgical exclusion treatment by ligation and bypass [Table 1]:

Authors	Number of treated PAs	Surgical exclusion treatment technique	PAs' Outcome
Mehta et al [2]	26	All excluded by ligation and bypass	38% increased in size by a persistent perfusion (10 PAs), among which: - 3 ruptured (12%) - 1 resulted in limb loss (4%)
Ebaugh et al [3]	25	All excluded by ligation and bypass	Less than 50% decreased in size : 20% remained unchanged and 32% increased in size
Bellosta et al [4]	53	All excluded by ligation and bypass	17% remained unchanged and 8% grew
Naundorf [5]	47	42 excluded by ligation and bypass 5 resected	2 aneurysms increased in size due to persistent perfusion, both of which were ligated and left in situ

- Endovascular exclusion treatment by stenting [Table 2]:

Authors	Number of treated PAs	Endovascular exclusion treatment technique	PAs' Outcome
Möllenhoff et al [6]	251	All excluded by covered Viabahn stents	35% suffered complications: - Occlusions (18%) - Migrations (5%) - Endoleaks (12%)
Jung et al [7]	15	All excluded by covered Viabahn stents	13% presented endoleaks
Etezadi et al [8]	18	All excluded by covered stents	14% kept growing by a persistence of perfusion
Midy et al [9]	57	All excluded by covered stents	16% became occluded and 11% continued to be perfused

- Recent systematic review and meta-analysis about treatment of PAs [Table 3]:
  - Sousa et al[10] : 27 studies with 5425 patients (1651 ER, and 4166 OAR) ⟶ OAR is associated with greater limb salvage and fewer reintervention rates. Graft thrombosis, restenosis and endoleaks being the main causes of reintervention for ER.
  - Beuschel et al[11] : 32 original studies and 4 systematic reviews, describing 7485 PAs ⟶ OAR is associated with higher primary patency at 1 year, lower occlusion rate at 30 days, and fewer reinterventions, but a longer hospital stay and more wound complications.

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Discussion

- **Reference treatment of PAs**

- Since Edwards' report[12] in 1969 ⟶ Exclusion by proximal and distal ligation, with venous distal femoropopliteal, or femorotibial bypass.

- Development of endovascular techniques ⟶ Exclusion by self-expanding covered stents with a high degree of flexibility.

  ↳ These PAs, excluded, but not resected, generally decrease in size by thrombosis.

- These PAs are left in situ, without resection ⟶ More long-term post-operative complications than with the aneurysm resection treatment.

- **Studies' results**

- No optimal effectiveness of these exclusion treatments : A significant percentage of PAs continued to grow after surgical, or endovascular exclusion ⟹ Treatment failure.

  - Endovascular treatment failure : stent occlusion, migration and endoleak (all types combined).

  - Surgical treatment failure : persistence of PAs' perfusion by a retrograde collateral circulation through the knee's articular arteries = type 2 endoleak (endoleaks' classification after endovascular repair of aortic aneurysms).

- **To avoid the persistence of PAs' perfusion**
  - Necessity to ligate as many articular arteries as possible.
    - Technically difficult : - Complex anastomotic network around the knee.
      - Difficult access in a reshaped area.
      - Significant risk of venous haemorrhage.
  - Surgical alternatives to the exclusion treatment ⟶ Aneurysmal resection + popliteal anastomosis or femoropopliteal / tibial bypass.
    - Complete resection, preventing post-operative growth.

- **Our patient's situation**

- Right lower limb : Complete resection of the aneurysm ⟶ No post-operative complications.

- Left lower limb : Ligation and exclusion of the aneurysm, without resection, leaving it in situ ⟶ Persistent perfusion and increase in size, leading to the skin fistula and requiring a re-intervention.

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Conclusion

- Unique case of PA fistulising to the skin after surgical exclusion treatment by proximal and distal ligation, with femoropopliteal bypass.
- Confirmation of the aneurysms' inflammatory fistulising potential.
- Preference for a surgical resection of aneurysms, instead of a simple surgical or endovascular exclusion, as some studies have suggested.

  ↳ Safest and most effective method to prevent any post-operative complications, that may occur when the aneurysm is left in situ.

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References

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Tables

Table 1 : Fate of popliteal artery aneurysms after open repair

Authors	Number of treated PAs	Surgical exclusion treatment technique	PAs' Outcome
Mehta et al [2]	26	All excluded by ligation and bypass	38% increased in size by a persistent perfusion (10 PAs), among which: - 3 ruptured (12%) - 1 resulted in limb loss (4%)
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Table 2 : Fate of popliteal artery aneurysms after endovascular repair

Authors	Number of treated PAs	Endovascular exclusion treatment technique	PAs' Outcome
Möllenhoff et al [6]	251	All excluded by covered Viabahn stents	35% suffered complications: - Occlusions (18%) - Migrations (5%) - Endoleaks (12%)
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Table 3 : Sytematic reviews and meta-analysis of PAs' treatment: Open Repair (OR) versus Endovascular Repair (ER)

Authors	Number of studies and systematic reviews included	Number of treated PAs	Exclusion treatment technique	PAs' Outcome							
				30-day mortality	Technical success	Limb Salvage (= without amputation)			Reintervention Rate		
						1 year	3 years	5 years	1 year	3 years	5 years
Sousa et al [10]	27 studies	5.817	1.651 PAs treated with ER	0% - 6.4%	83.3% - 100%	84.2% - 100%	88.9% - 100%	64.7% -100%	3.7% - 21%	18.9% - 28%	34.5% - 38%
			4.166 PAs treated with OR	0% - 3.4%	79% - 100%	94.3% - 100%	94.5% - 99%	86.4% - 97%	12.8% - 13%	3.6% - 12%	15.7% - 30%
				PA's Outcome							
				Primary patency at 1 year	Occlusion rate at 30 days	Reinter-vention rate	Length of hospital stay	Wound compli-cations	Primary patency at 3 years	Mortality at 30 days	Amputation
Beuschel et al [11]	32 studies 4systematic reviews	7.485	1.891 PAs treated with ER	+ Odds Ratio 2.10	-_ Odds Ratio 0.41	_ Odds Ratio 0.28	+	+ Odds Ratio 5.18	= Odds Ratio 1.38	= Odds Ratio 0.28	= Incidence Rate Ratio 0.85
			5.594 PAs treated with OR	_	+	+	_	_	=	=	=

Caption: " + " means higher ; " - " means lower ; " = " means no difference