Direct Sac Puncture and Liquid Embolization of a Popliteal Artery Aneurysm with Recurrent Type II Endoleak

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Purpose

To explore the various management options for popliteal artery aneurysms (PAA) and describe various endovascular and extravascular approaches to treat complications secondary to type II endoleaks, specifically direct sac puncture with Onyx™ liquid embolization (Medtronic, Minneapolis, MN).

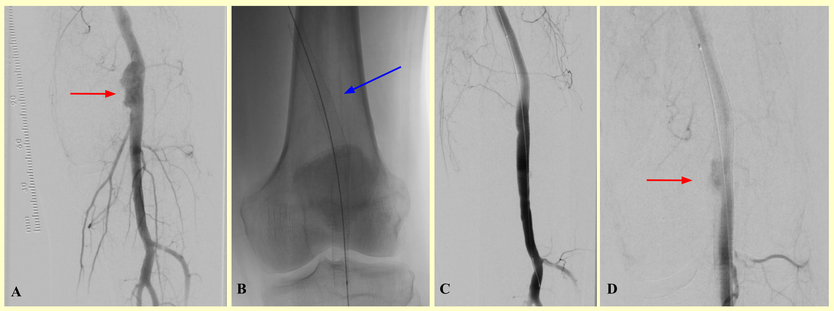
Material and Methods

80-year-old male with a history of peripheral arterial disease and multifocal arterial aneurysms presents with an expanding left popliteal artery aneurysm requiring endovascular stent-graft exclusion in 2012. This was complicated by a type II endoleak refractory to several sessions of transarterial geniculate artery embolization in 2018. At that point, direct percutaneous sac puncture and liquid embolization was performed.

Pre-procedural doppler ultrasound visualized a partially thrombosed PAA with arterial vascular waveforms. Under ultrasound-guidance, the superior portion of the sac was percutaneously accessed yielding pulsatile bright red blood. A 3 French short sheath and microcatheter system was introduced and digital subtraction angiography demonstrated regional filling of the sac with delineation of various afferent and efferent vessels. Various consistencies of Onyx™ liquid embolic were administered into the sac under real-time fluoroscopic guidance.

Transarterial Stent-Graft Exclusion: 2012

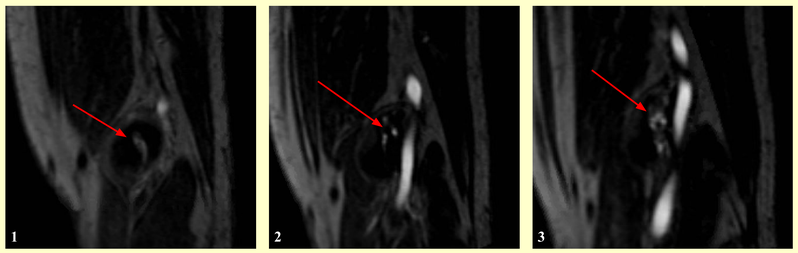
In 2012, the incidentally noted left PAA measured 2.1 cm in its greatest dimension. Left lower extremity angiography was performed with subsequent placement of a 9 mm Viabahn covered stent (Gore, Flagstaff, AZ) excluding the left PAA. This was post-dilated to 9 mm with patency of the stent.



A. Pre-intervention digital subtraction angiogram (DSA) demonstrated the left PAA (red arrow).
B. Placement of a 9 mm Viabahn covered stent excluding the left PAA (blue arrow).
C. Early post-intervention DSA with exclusion of the left PAA.
D. Late post-intervention DSA with residual filling of the sac on late arterial phase, likely reflecting endoleak (red arrow).

Follow-Up Surveillance Imaging: 2016

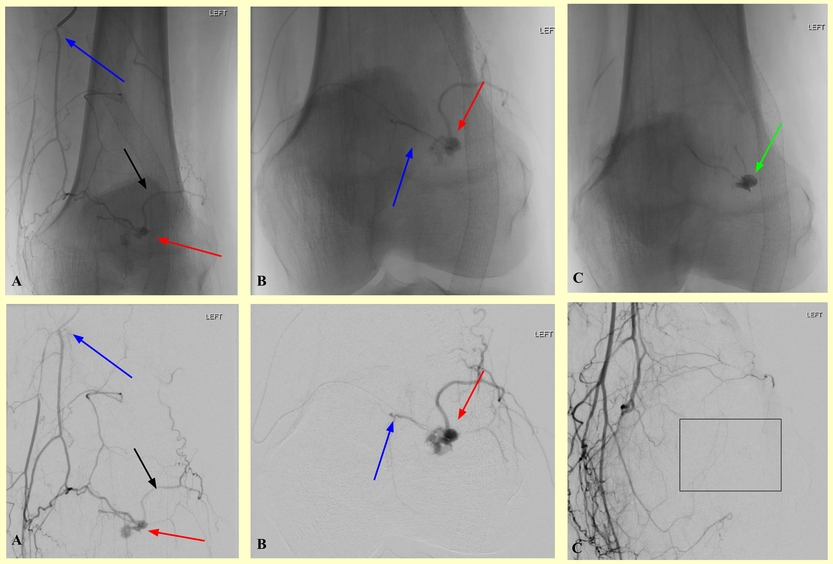
Magnetic resonance angiography (MRA) of the left lower extremity performed in October 2016 demonstrated patency of the left popliteal artery stent. However, there was abnormal signal within the left PAA suggestive of endoleak, and now measuring 4.1 x 4.0 cm. No feeding vessel was identified.



Images 1-3. Coronal reformatted MRA images of the left knee with residual filling of the left popliteal artery aneurysm (red arrow). The left popliteal artery stent was widely patent.

Transarterial Glue Embolization: 2018

In July 2018, left lower extremity angiography was performed showing sac filling from the superior medial geniculate artery with outflow via the superior lateral geniculate artery. Tranarterial embolization of the sac was performed with a 1:4 n-butyl cyanocrylate (NBCA) to lipiodol mixture with reflux visualized into both the afferent and efferent vessels. Post-embolization digital subtraction angiogram demonstrated no residual filling of the sac.

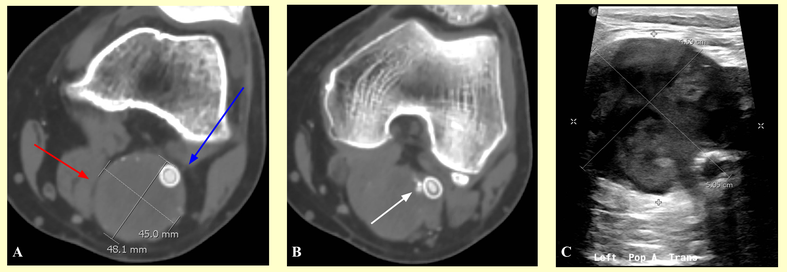


A. Selective catheterization and DSA at the origin of the descending genicular artery (blue arrow) with feeding of the PAA sac (red arrow). Drainage via the superior lateral geniculate artery was seen (black arrow).
B. Superselective catheterization and DSA of the superior medial geniculate artery just proximal to the PAA sac (blue arrow) with extensive filling of the sac (red arrow).
C. Post-embolization angiography and DSA with lipiodol/n-BCA mixture within the left PAA (green arrow). No evidence of residual filling within the sac (black box).

Follow-Up Surveillance Imaging: 2019, 2020

Follow-up computed tomography angiography (CTA) of the left lower extremity performed in December 2019 with evidence of recurrent endoleak. Surveillance doppler ultrasound performed in June 2020 demonstrated persistent doppler flow in the left PAA with interval growth from December 2019.

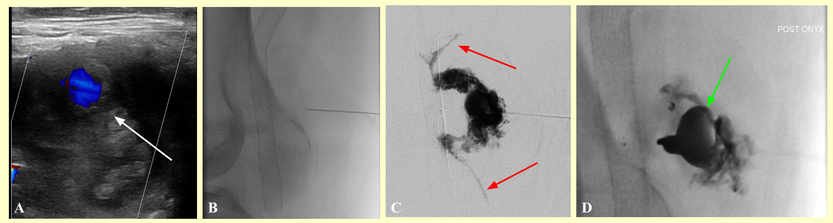
Repeat transarterial embolization was performed in July 2020 with selective angiography failing to reveal the vessel causing the type II endoleak of the left PAA.



A. Axial computed tomography angiography of the left lower extremity demonstrates wide patency of the left popliteal artery stent (blue arrow). The PAA measures 4.5 x 4.8 cm (red arrow).
B. Axial CTA of the left lower extremity demonstrates contrast filling along the inferior margin of the left PAA (white arrow).
C. Transverse grayscale ultrasound image of the left PAA measures 5.1 x 4.6 cm, slightly increased in size from prior CTA.

Direct Sac Puncture with Liquid Embolization: 2020

The patient was brought back in August 2020 for percutaneous direct sac puncture with liquid embolization. Pre-procedural ultrasound demonstrated extensive thrombus within the sac with a large patent vascular structure along the inferior margin of the sac. Direct sac puncture was achieved using a combination of ultrasound and fluoroscopy. Aliquots containing 2 mL Onyx-18 and 1 mL Onyx-34 was administered percutaneously into the sac. Post-embolization ultrasound demonstrated no evidence of sac filling.



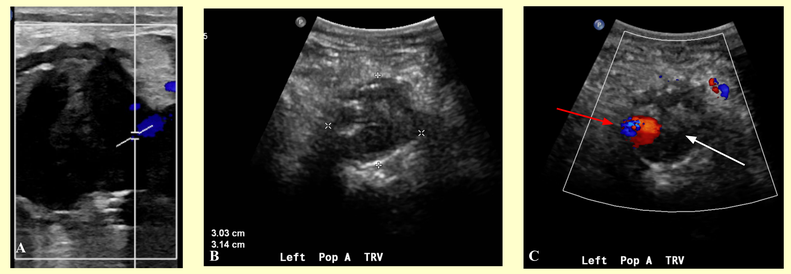
A. Pre-procedural doppler ultrasound of the left PAA demonstrated filling within the sac (white arrow).
B. Percutaneous sac puncture with a 21G spinal needle yielding brisk, bright red blood upon access.
C. DSA of the left PAA confirmed intra-sac needle placement with reflux into the afferent/efferent feeding branches (red arrows).
D. Post-embolization spot fluoroscopy with radioopaqe Onyx material seen throughout the sac (green).

*Not included: Immediate post-procedural doppler ultrasound of the left PAA without evidence of residual filling.

Results

One-month follow-up ultrasound demonstrated stability of the sac size with extensive thrombus and absent internal doppler flow.

One-year follow-up ultrasound demonstrated absent internal flow within the sac with substantial decrease in size measuring 3.2 cm, previously 4.5 cm in its greatest dimension.



A. 1-month doppler image of the left PAA without evidence of residual flow.
B. 1-year follow-up grayscale image of the left PAA measuring 3.0 x 3.1 cm.
C. 1-year follow-up doppler image of the left PAA with patency of the stent (red arrow). No doppler flow within the left PAA (white arrow).

Conclusions

Persistent type II endoleaks of PAA present a challenging clinical dilemma for the vascular interventionalist. The development of occult collateral feeding vessels into the aneurysm sac can be technically difficult to treat with traditional endovascular embolization. In patients with PAA complicated by type II endoleaks refractory to standard endovascular treatment, direct sac embolization may be considered.