

Case Report

Endovascular Radial Artery Sacrifice in an Unsalvageable Transradial Access Site Bleeding due to Cutting Balloon Angioplasty

Loy Liang Meng, MS Engineering¹ and Uei Pua, MBBS, MMed, FRCR, FAMS^{2,3}

The radial artery access site laceration is rare. We hereby described a case of radial artery access site laceration during retrieval of a cutting balloon. The bleeding site was not responsive to hemostatic maneuvers such as application of an external blood pressure cuff, balloon inflation, and an external compression bandage and was eventually coil embolized. Sacrifice using endovascular coiling averted surgical ligation which was the alternative.

Keywords: radial artery, laceration, cutting balloon

Introduction

The radial artery access site laceration is rare. We hereby described a case of radial artery access site laceration during retrieval of a cutting balloon and salvage with embolization.

Case Report

A 47-year-old woman was referred for a dysfunctional brachial–basilic arm fistula. Assessment of her left radial artery revealed a 2.1 mm caliber and a type A waveform on the modified Barbeau test. Our institution's protocol

is to use transradial access for tandem lesions in both the juxta-anastomotic and drainage vein so that all the lesions could be treated in a single retrograde fashion. Another advantage of transradial access is ease of hemostasis by manual compression over the puncture site. A 6F radial sheath (Glidesheath Slender, Terumo, Tokyo, Japan) was inserted into the artery at the distal radius. A short focal stenosis in the proximal basilic vein that was resistant to angioplasty via a Mustang high pressure balloon (Boston Scientific, Marlborough, MA, USA) was encountered (Fig. 1a), and a 6×20 mm cutting balloon (Boston Scientific, Natick, MA, USA) was then inflated to nominal pressure, successfully effacing the stenosis (Fig. 1b). The cutting balloon was completely deflated and retrieved.


After removal of the cutting balloon, blood was found to be spurting from around the vascular sheath (peri-sheath bleeding). Suspecting a lacerated sheath, a new 6F sheath was exchanged over the indwelling guidewire. Despite the new sheath in place, peri-sheath blood spurting persisted. A blood pressure cuff was then inflated (30 mmHg above the systolic pressure) over the proximal forearm for temporary hemostasis and a radial pressure bandage (STEPTY™, NICHIBAN Co., Ltd., Tokyo, Japan) was applied over the sheath entry site, which halted the hemorrhage. Inspection of the removed sheath revealed a full-length laceration of the sheath by the atherotome of the balloon. A 5F sheath was inserted

¹Duke-NUS Medical School, Singapore

²Department of Diagnostic Radiology, Tan Tock Seng Hospital, Singapore

³Yong Loo Lin School of Medicine, National University of Singapore, Singapore

Received: July 25, 2018; Accepted: February 11, 2019
Corresponding author: Uei Pua, MBBS, MMed, FRCR, FAMS.
Department of Diagnostic Radiology, Tan Tock Seng Hospital,
11 Jalan Tan Tock Seng, Singapore 308433
Tel: +65-8181-9490, Fax: +65-6759-9940
E-mail: druei@yahoo.com

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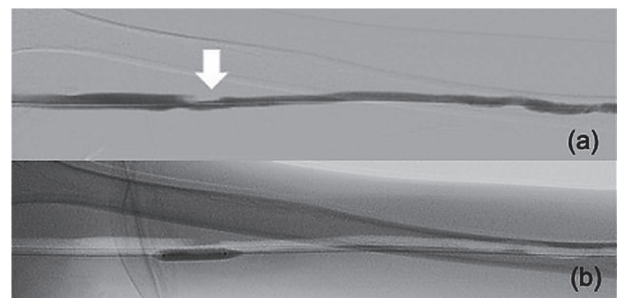


Fig. 1 (a) Post high pressure balloon venography showing significant residual focal stenosis despite balloon inflation to 24 atm. (b) A 6 mm×2 cm cutting balloon was used to successfully efface the stenosis.

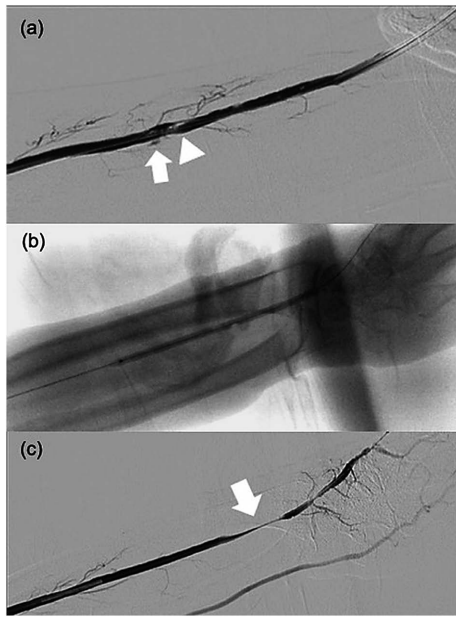


Fig. 2 (a) Angiography of the radial artery from a cranial access in the fistula with the replaced radial sheath in place and external wrist pressure applied. Focal radial artery perforation with extravasation (arrow) and dissection (arrowhead) was noted, beyond the tip of the radial sheath. (b) The distal radial artery was crossed, and a 3 mm balloon was inflated across the distal radial artery to tamponade the perforation and dissection, allowing the sheath to be removed. (c) Post balloon angiography with the radial pressure bandage still applied (arrow) showing resolution of the previously seen perforation and dissection.

into the basilic fistula as a second access and antegrade arteriography of the radial artery was obtained. Laceration with perforation of the radial artery was performed beyond the tip of the sheath (Fig. 2a). The radial artery was crossed using a V18 guidewire (Boston Scientific, Marlborough, MA, USA), the radial sheath was removed, and a 3 × 10 mm Sterling balloon (Boston Scientific) was inflated over the distal radial artery including at the entry site for 10 min (Fig. 2b). Simultaneous external pressure with the radial pressure bandage was re-applied. At the end of the balloon inflation, angiography (without releasing the radial pressure bandage) showed resolution of the previously demonstrated laceration (Fig. 2c). The radial pressure bandage was then left for the next three hours for complete hemostasis.

After three hours, on removal of the radial bandage, arterial spurting occurred again at the site of sheath entry. Once again, application of the forearm blood pressure cuff and reapplication of the radial pressure bandage was used to secure the hemostasis. At this time, the idea that the laceration of the radial artery was more extensive and severe than initially believed and likely beyond conventional endovascular salvage like stent grafting was thought. A

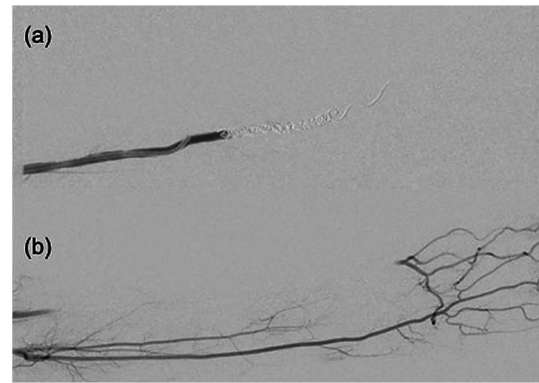


Fig. 3 (a) Angiography after embolization showing complete stasis over the distal radial artery, across the access site. (b) Completion arteriography after radial embolization showing good perfusion in the hand from the ulnar artery despite the embolized radial artery. Supplementary movies are available at the online article page on J-STAGE and PMC.

vascular surgical consult was made for surgical repair. Due to the distal radial location, radial artery ligation was the surgery of choice. As such, embolization of the radial artery was thought to be a reasonable and conceptually similar alternative. Through the basilic vein access, a 5F Ber catheter was used to deposit a total of three 4 mm × 7 cm Macro-Nester coils (Cook, Bloomington, IN, USA), extending across the puncture site from the distal to mid radial artery (Fig. 3a). Completion angiography confirmed successful embolization of the distal radial artery and good ulno-palmar collateral flow (Fig. 3b). Cessation of the puncture site hemorrhage was noted on removal of the radial bandage. The patient was discharged the next day and remained asymptomatic with a functioning fistula at a 6-month follow-up.

Discussion

The literature surrounding transradial dialysis access intervention is currently limited.^{1,2} The overall incidences of severe bleeding complications related to radial access are rare,¹⁻³ and unsalvageable access site bleeding is rarely described. The possibility exists that the retrieval of the cutting balloon through the shunt or the tortuous radial artery may have caused deformity of the blades, resulting in laceration of the artery. Researchers previously reported in literature that using a cutting balloon increased the risk of vascular injury during angioplasty of malfunctioning hemodialysis grafts and fistulas.⁴ Compared to other transradial peripheral intervention procedures (e.g., liver embolization), dialysis access intervention uses larger devices, which typically require 6–7F sheath access. In our case, the inner diameter of our 6F sheath was about 2 mm while the diameter of the radial artery was 2.1 mm, thus

predisposing the artery to injury. A spasm in the radial artery could also cause injury during retrieval of the cutting balloon. Following this incident, we have stopped using cutting balloons in angioplasties involving transradial access.

From our experience, sheath laceration by the atherotome of the cutting balloon during retrieval is not uncommon but does not result in arterial injury and usually only requires sheath replacement. From the angiographic finding of laceration beyond the position of the sheath tip (Fig. 2a) to the peri-sheath blood spurt despite a new sheath in-situ and the extensive slit on the radial sheath and rebleeding after initial hemostasis, we believe that the laceration to the distal segment of the radial artery was rather extensive. This was further supported by temporary cessation of the bleeding with balloon inflation and external bandage. Although an angiogram without any rescue maneuver would have confirmed our postulation of a long laceration, this possibility did not exist given the clinical scenario.

Surgical repair of distal radial laceration is known to have limited long term patency of around 50–77% and has the potential risk of associated iatrogenic nerve injury during repair.⁵⁾ To this end, simple artery ligation (radial artery sacrifice) is preferred in the presence of adequate palmar collateral circulation. This formed the basis of using coil embolization as an alternative to surgical ligation and has the advantage of being a percutaneous approach.

There are several lessons that could be learned. Firstly, pre-operative assessment of adequate collateral flow to the hand by the modified Barbeau test³⁾ allowed for safe execution of this bail-out alternative in the emergent situation. Pre-embolization documentation of adequacy of collateral flow is another alternative. Secondly, hemostatic maneuvers such as application of an external blood pressure cuff, balloon inflation, and an external compression bandage should be used as a first line approach to control the radial access bleed.

Conclusion

Coil embolization could be used as a last ditch percutaneous bail-out, should surgical ligation be considered in a severe radial access bleed where hemostatic maneuvers such as application of an external blood pressure cuff, balloon inflation, and an external compression bandage have failed.

Disclosure Statement

The authors declare no conflict of interest in the preparation of this manuscript.

Author Contributions

Study conception: UP

Data collection: all authors

Analysis: LLM

Investigation: all authors

Writing: all authors

Funding acquisition: nil

Critical review and revision: all authors

Final approval of the article: all authors

Accountability for all aspects of the work: all authors

References

- 1) Le L, Brooks A, Donovan M, et al. Transradial approach for percutaneous intervention of malfunctioning arteriovenous accesses. *J Vasc Surg* 2015; **61**: 747-53.
- 2) Chen SM, Hang CL, Yip HK, et al. Outcomes of interventions via a transradial approach for dysfunctional Brescia-Cimino fistulas. *Cardiovasc Intervent Radiol* 2009; **32**: 952-9.
- 3) Posham R, Biederman DM, Patel R, et al. Transradial approach for noncoronary interventions: a single-center review of safety and feasibility in the first 1,500 cases. *J Vasc Interv Radiol* 2016; **27**: 159-66.
- 4) Bittl JA. Venous rupture during percutaneous treatment of hemodialysis fistulas and grafts. *Catheter Cardiovasc Interv* 2009; **74**: 1097-101.
- 5) Thai JN, Pacheco JA, Margolis DS, et al. Evidence-based comprehensive approach to forearm arterial laceration. *West J Emerg Med* 2015; **16**: 1127-34.