kidney and dialysis

MDPI

Case Report

A Case of Brachial Artery Thrombosis Caused by Massage of an Occluded Arteriovenous Graft

Taisuke Matsue, Yoshikazu Kuroki *, Toshihide Naganuma, Yoshiaki Takemoto and Junji Uchida

Department of Urology, Osaka City University Graduate School of Medicine, 1-4-3, Asahi-machi, Abeno-ku, Osaka 545-8585, Japan; d18mb048@eb.osaka-cu.ac.jp (T.M.); m9643361@msic.med.osaka-cu.ac.jp (T.N.); ytakemoto@msic.med.osaka-cu.ac.jp (Y.T.); uchida@msic.med.osaka-cu.ac.jp (J.U.)

* Correspondence: fuv89934@osaka-cu.ac.jp

Abstract: Background: Acute upper limb ischemia (AULI) is a potential complication associated with massages of occluded vascular accesses in patients undergoing hemodialysis. Pharmacological thrombolysis, endovascular intervention and surgical intervention are possible treatment options. Deciding the appropriate treatment strategy is still a controversial issue. Case Presentation: The patient was a 43-year-old woman with renal failure who underwent hemodialysis and peritoneal dialysis. She was found to have an arteriovenous graft (AVG) thrombosis at the start of a hemodialysis session. She underwent massage of the vascular access, and immediately after the massage, she reported pain and cyanosis in her right-hand fingers and was referred to our hospital. Duplex ultrasonography revealed a large number of thrombi in the brachial, radial and ulnar arteries. AULI due to brachial artery thrombosis was diagnosed and surgical intervention was performed on the same day. The vascular wall of the forearm artery was incised vertically against the running vessel, and thrombi around the bifurcation of the radial and ulnar arteries were removed. Angiography guided-surgical intervention was performed and improvement in blood flow was achieved. The patient was discharged on the second day after the operation. Conclusion: Surgical intervention has been reported as an effective treatment of AULI due to brachial artery thrombosis after massage of an occluded vascular access.

Keywords: vascular access; hemodialysis; acute limb ischemia; thrombosis; thrombectomy

Citation: Matsue, T.; Kuroki, Y.; Naganuma, T.; Takemoto, Y.; Uchida, J. A Case of Brachial Artery Thrombosis Caused by Massage of an Occluded Arteriovenous Graft. *Kidney Dial.* **2021**, *1*, 74–78. https://doi.org/10.3390/kidneydial1010011

Academic Editor: Vladimir Tesar

Received: 11 August 2021
Accepted: 7 September 2021
Published: 18 September 2021

1. Introduction

Vascular access in hemodialysis patients can cause a thrombotic occlusion due to blood pressure reduction, dehydration and venous stenosis [1]. In these cases, both endovascular intervention and surgical intervention may be employed as therapeutic procedures [2]. As an early treatment option, massage of the occluded vascular access may be performed to break thrombi and to disperse them. However, if a coarse thrombus disperses to a central or peripheral site, secondary complications may occur [3]. Furthermore, there is scant evidence for the safety and efficacy of massages. Treatment strategies for AULI, one of the possible massage complications, include thrombolytic therapy, endovascular intervention and surgical intervention [4], but many aspects of the treatment planning and decision making are determined by the practical capabilities and local availability of each facility [5]. Here, we report a case of successful surgical intervention for AULI occurred after massage of an occluded vascular access for dialysis.

2. Case Report

The patient was a 42-year-old woman with lupus nephritis who started hemodialysis after renal failure occurred in 2011. During the hemodialysis treatment, she experienced repeated thrombotic occlusions and consequently underwent several endovascular interventions, surgical interventions and revascularization. In 2017, peritoneal dialysis

combined with weekly hemodialysis was started, and in 2018 an expanded polytetrafluoroethylene (ePTFE) graft between the brachial artery and basilic vein was inserted into the right forearm; however, thrombotic occlusions recurred. Blood tests showed no abnormalities in anti-phospholipid antibody profile or in the coagulation system. In 2019, at routine control pre-hemodialysis, arterio venous graft (AVG) flow was not detected: consequently an AVG occlusion was suspected. Despite the administration of urokinase (60,000 units), following which a vascular massage was performed, reperfusion was not achieved. Immediately after the massage, the patient suffered from pain and exhibited cyanotic discoloration in the right distal forearm and was referred to our hospital for examination and treatment. Vital signs were preserved at the first visit. The patient's right hand fingers, 2nd to 4th, exhibited a violet coloration of the distal phalange and were cold to touch, and painful (Figure 1). No sensory or motor deficit was observed at this level. Pulse was absent in the radial artery and feeble in the ulnar artery at palpation. B-mode ultrasonography revealed extensive luminal thrombi, ranging from the arterial anastomotic site to the arteries of the forearm, involving some traits of the ulnar artery and distally in the radial artery. Duplex ultrasonography confirmed the absence of blood flow in the forearm arteries. The patient was diagnosed with AULI due to thrombotic reflux and underwent surgical intervention on the same day.

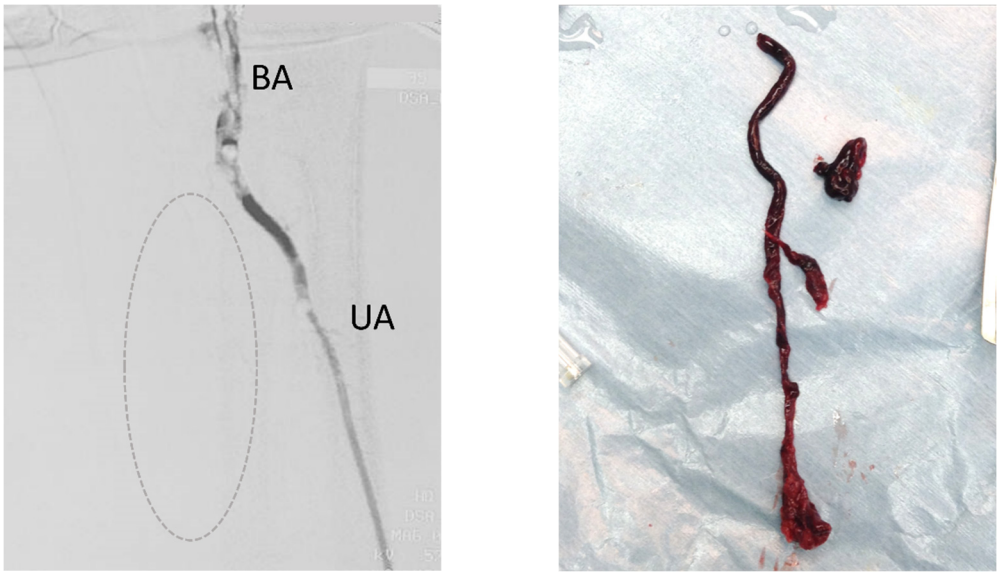
Figure 1. The patient's right hand. The area of the distal phalange of the second to fourth fingers was purple.

A skin incision was made just above the arteriovenous anastomosis, parallel to the blood vessel, in the area of the brachial artery thrombus (Figure 2). The vascular wall was incised vertically along the vessel direction by hooking the central artery with a bulldog clamp; bleeding did not occur. Arterial thrombi near the incised sites were removed using a 3-Fr Fogarty catheter, mosquito forceps and tweezers. Angiography performed during surgery failed to detect blood flow in the radial artery, therefore we hypothesized that thrombi might have involved the peripheral radial artery (Figure 3a). Therefore, additional thrombectomy was performed in the radial artery and a long single thrombus was removed (Figure 3b). Angiography was re-performed, showing improved blood flow in the radial artery. The surgery was completed after radial and ulnar pulses were found to be detectable at the wrist. The full procedure took 1 h and 12 min.

Immediately after surgery, the color of the fingers improved. Heparin at 500 unit/hour was infused intravenously after surgery. Hemodialysis resumed on the first day after surgery and no thrombus was found in intravascular spaces two days after surgery by

duplex ultrasonography. The patient was discharged from hospital on the same day of the procedure.

Figure 2. Operative site, just above the brachial artery thrombus: BA, brachial artery; RA, radial artery; UA, ulnar artery.



(**a**) (**b**)

Figure 3. (**a**) Angiography performed during surgery; imaging of the radial artery was deficient. (**b**) Thrombi removed by surgery; the long thrombus on the left side was located in the radial artery.

3. Discussion

Endovascular and surgical interventions are recommended as treatments for the occlusion of vascular accesses [6,7]. On the other hand, none of the guidelines recommend nor oppose massage as an immediate treatment for vascular access thrombosis. In clinical practice, a shunt massage is a procedure aimed to break thrombi by external physical stimulation and disperse them to a central area [3]. A strength of this procedure is that it can be performed immediately after a thrombotic occlusion is clinically evident. At the same time, a risk associated with the procedure is that the dispersion of a coarse thrombus may lead to the development of pulmonary embolism [8], whereas thrombi dispersing to the periphery represent a risk of brachial, ulnar and radial artery occlusion, as seen in the present case. Shunt massaging is a helpful technique that does not require any equipment. However, there are currently no studies nor reports that have quantitatively compared the benefits and risks of massages. Therefore, we believe that caution is mandatory. Although

it was not performed in this case, we suggest performing ultrasonography, when possible, in order to determine beforehand the size and location of the thrombus.

The patient was diagnosed with AULI, which differs from common vascular access occlusions. Only 5% of acute limb ischemia occurs in the upper limb [9], and the primary cause is an atrial-fibrillation-based embolic event [10]. Additionally, there are some previous reports of AULI occurring after a shunt massage for acute thrombotic occlusions of vascular access, similar to this case [3,11]. The main therapies for acute limb ischemia are pharmacological thrombolysis using urokinase or a plasminogen activator, endovascular intervention using a thrombus aspiration catheter and finally surgical intervention using a Fogarty catheter [12]. Many historical case reports of AULI have used the same techniques [3,10].

In order to guarantee a full recovery, AULI requires treatment within a 6 h period [5]. If there is a prolonged ischemia, in 10–20% of cases an amputation is deemed necessary [13,14]. Patients with upper extremity artery occlusion can develop a compensatory collateral circulation through the interosseous arteries [15], and consequently are less likely to have complete ischemia than those with a lower extremity artery occlusion. However, collateral circulation was unable to develop in the present case considering the acute onset of occlusion. In addition, ischemia was likely to progress because the patient had severe arteriosclerosis due to long-term hemodialysis [16].

In case of AULI, it is important to evaluate progression risk of ischemia. The "five Ps" (pulseless, pallor, pain, paresthesia, and palsy) are used as clinical symptoms to diagnose ischemic lesions [17]. The patient met three of these criteria (pulseless, pallor, and pain), which suggested a clinical diagnosis of limb ischemia. Blood tests, duplex ultrasonography and CT angiography may aid the clinician [4]. In cases of advanced ischemia, a rapid transition from time-consuming examinations and conservative treatments to endovascular or surgical intervention is required; intraoperative angiography is also useful to reduce the procedural time.

In the present case, we performed surgical intervention promptly after diagnosis for two main reasons. Firstly, there was a large number of thrombi and a conservative approach such as pharmacological thrombolysis was unlikely to be resolutive, insoluble microthrombi may also have occluded the peripheral digital arteries [4]. Peripheral arteries, including digital arteries, are extremely narrow, which makes it difficult to reach thrombi using a catheter, and this situation could be fatal. Thus, surgical intervention was preferred to ensure reliable removal, since the thrombi were visible during the procedure. Secondly, thrombi were positioned in a complex manner in the brachial, radial and ulnar arteries, presenting with an overriding pattern. We anticipated that the removal of these thrombi would be difficult using a catheter alone, thus we performed an open insertion of a Fogarty catheter after an incision directly above the brachial artery , greatly improving reaching the thrombotic site. Consequently, almost all thrombi were removed. After surgery blood flow improved and hemodialysis could be resumed promptly, combining anticoagulant therapy.

4. Conclusions

We successfully treated a patient who developed brachial artery thrombosis after a massage for an AVG occlusion. Prompt treatment and thrombectomy are required for patients with AULI, and surgical intervention has been an effective procedure in this case.

Author Contributions: T.M. writing—original draft preparation; Y.K., T.N., Y.T. and J.U. writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study as per our Institutional Review Board, due to the nature of our research as a case report.

Informed Consent Statement: Informed consent was obtained from the subjects involved in the study to publish this paper.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. MacRae, J.M.; Dipchand, C.; Oliver, M.; Moist, L.; Lok, C.; Clark, E.; Hiremath, S.; Kappel, J.; Kiaii, M.; Luscombe, R.; et al. Arteriovenous Access Failure, Stenosis, and Thrombosis. *Can. J. Kidney Health Dis.* **2016**, *3*, 2054358116669126. [CrossRef] [PubMed]
2. Kuhan, G.; Antoniou, G.A.; Nikam, M.; Mitra, S.; Farquharson, F.; Brittenden, J.; Chalmers, N. A Meta-analysis of Randomized Trials Comparing Surgery versus Endovascular Therapy for Thrombosed Arteriovenous Fistulas and Grafts in Hemodialysis. *Cardiovasc. Interv. Radiol.* **2013**, *36*, 699–705. [CrossRef] [PubMed]
3. Shrestha, B. Massaging Thrombosed PTFE Hemodialysis Access Graft—Recipe for Disaster. *J. Vasc. Access* **2007**, *8*, 120–122. [CrossRef] [PubMed]
4. Wong, V.W.; Major, M.R.; Higgins, J.P. Nonoperative Management of Acute Upper Limb Ischemia. *Hand* **2016**, *11*, 131–143. [CrossRef] [PubMed]
5. Gerhard-Herman, M.D.; Gornik, H.L.; Barrett, C.; Barshes, N.R.; Corriere, M.A.; Drachman, D.E.; Fleisher, L.A.; Fowkes, F.G.R.; Hamburg, N.; Kinlay, S.; et al. 2016 AHA/ACC Guideline on the Management of Patients with Lower Extremity Peripheral Artery Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation* **2017**, *135*, e686–e725. [CrossRef] [PubMed]
6. Gallieni, M.; Hollenbeck, M.; Inston, N.; Kumwenda, M.; Powell, S.; Tordoir, J.; Al Shakarchi, J.; Berger, P.; Bolignano, D.; Cassidy, D.; et al. Clinical practice guideline on peri- and postoperative care of arteriovenous fistulas and grafts for haemodialysis in adults. *Nephrol. Dial. Transplant.* **2019**, *34*, ii1–ii42. [CrossRef] [PubMed]
7. Schmidli, J.; Widmer, M.K.; Basile, C.; de Donato, G.; Gallieni, M.; Gibbons, C.P.; Haage, P.; Hamilton, G.; Hedin, U.; Kamper, L.; et al. Editor's Choice—Vascular Access: 2018 Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS). *Eur. J. Vasc. Endovasc. Surg.* **2018**, *55*, 757–818. [CrossRef] [PubMed]
8. Sharif-Hassanabadi, M. Fatal pulmonary embolism after hemodialysis vascular access declotting. *Am. J. Case Rep.* **2014**, *15*, 172–175. [CrossRef] [PubMed]
9. McCarthy, W.J.; Flinn, W.R.; Yao, J.S.; Williams, L.R.; Bergan, J.J. Result of bypass grafting for upper limb ischemia. *J. Vasc. Surg.* **1986**, *3*, 741–746. [CrossRef]
10. Bae, M.; Chung, S.W.; Lee, C.W.; Choi, J.; Song, S.; Kim, A.S.-P. Upper Limb Ischemia: Clinical Experiences of Acute and Chronic Upper Limb Ischemia in a Single Center. *Korean J. Thorac. Cardiovasc. Surg.* **2015**, *48*, 246–251. [CrossRef]
11. Córdova, M.D. Acute ischaemia as a consequence of arteriovenous fistula massage in haemodialysis. *Nefrología* **2009**, *29*, 367–368. [CrossRef]
12. Comerota, A.J.; Weaver, F.A.; Hosking, J.D.; Froehlich, J.; Folander, H.; Sussman, B.; Rosenfield, K. Results of a prospective, randomized trial of surgery versus thrombolysis for occluded lower extremity bypass grafts. *Am. J. Surg.* **1996**, *172*, 105–112. [CrossRef]
13. Ravn, H.; Björck, M. Popliteal Artery Aneurysm with Acute Ischemia in 229 Patients. Outcome after Thrombolytic and Surgical Therapy. *Eur. J. Vasc. Endovasc. Surg.* **2007**, *33*, 690–695. [CrossRef] [PubMed]
14. Olinic, D.-M.; Stanek, A.; Tătaru, D.-A.; Homorodean, C.; Olinic, M. Acute Limb Ischemia: An Update on Diagnosis and Management. *J. Clin. Med.* **2019**, *8*, 1215. [CrossRef] [PubMed]
15. Rodriguez-Niedenfuhr, M.; Vazquez, T.; Nearn, L.; Ferreira, B.; Parkin, I.; Sanudo, J.R. Variations of the arterial pattern in the upper limb revisited: A morphological and statistical study, with a review of the literature. *J. Anat.* **2001**, *199*, 547–566. [CrossRef] [PubMed]
16. Daenen, K.; Andries, A.; Mekahli, D.; Van Schepdael, A.; Jouret, F.; Bammens, B. Oxidative stress in chronic kidney disease. *Pediatr. Nephrol.* **2018**, *34*, 975–991. [CrossRef] [PubMed]
17. Norgren, L.; Hiatt, W.; Dormandy, J.; Nehler, M.; Harris, K.; Fowkes, F. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *J. Vasc. Surg.* **2007**, *45*, S5–S67. [CrossRef]