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Case Report

A Case Report of Combined Endovascular Bypass with Endovascular Fistula Repair in a Previously Perforated Artificial Vessel

Ma Si Chao[1], Feng Guan Yu[2] and Chang Ming Xin[3]*

[1]Nephrology Department, Affiliated Hospital of Changchun University of Chinese Medicine, Changchun City, 130000, China

[2]Changchun University of Chinese Medicine, Changchun City, 130000, China

[3]The Affiliated Hospital of Changchun University of Chinese Medicine, No. 1478, Gongnong Dadao, Changchun City, Jilin Province, China

Abstract

This case utilizes the characteristics of both penetrating prostheses to skillfully repair and bypass a dialysis endovascular stenosis and a tumor-like dilatation with thrombus, not only sparing the patient the transition period of long-term tube placement, but also providing a new surgical mindset for similar situations.

The patient's vascular resources were depleted after multiple endovascular fistula reconstructions in the left upper extremity, and vascular ultrasound of the right upper extremity suggested the formation of a large appendage thrombus in the lumen of this site, resulting in a significantly smaller effective vessel lumen; The downstream vein was markedly tortuous; consecutive bilateral stenosis was seen near the elbow, with a stenosis rate of 78%, and the elbow was succeeded by a noble vein of the upper arm with a diameter of about 6 mm. suggestive of an artificial arteriovenous fistula luminal verrucous dilatation with infection. The patient expressed a desire to avoid prolonged tube confinement during the transition to dialysis. Additionally, the patient requested excision of the infected endocardial fistula vascular segment and concurrent repair of the dilated segment of the endocardial fistula, which constituted the articulation of both penetrating artificial blood vessels. The patient was successfully dialyzed via artificial vascular puncture at the three-day postoperative mark. The appropriate cutting and repair of the articulation, coupled with the utilisation of the distinctive attributes of both-penetrated artificial blood vessels, can facilitate the expeditious transition of the patient into a routine dialysis regimen. This approach preserves the patient's vascular resources and circumvents the risk of infection.

More Information

***Address for correspondence:** Chang Ming Xin, The Affiliated Hospital of Changchun University of Chinese Medicine, No. 1478, Gongnong Dadao, Changchun City, Jilin Province, China, Email: cmxxking@163.com

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Synopsis

As the duration of dialysis increases, the arteriovenous endovascular fistulae often develop various complications, including stenosis, thrombosis, and verrucous dilatation of the vessels. Influential factors include the patient's vascular status, underlying disease, dialysis catheters, and more. Repeated endovascular reconstruction procedures progressively reduce the patient's vascular resources. The patient underwent endovascularization with no areas requiring puncture, except for those affected by infection, thrombosis, or the location of stenosis. Re-doing the endovascular fistula bypass in its vessel would also have the advantage of not increasing the patient's puncture area. Furthermore, the management of the tumor-like dilated portion of the patient's infection would also have to be considered. This case study demonstrates the advantages of both penetration-type artificial blood vessels. These vessels are designed to avoid infection in the tumor-like expansion part while simultaneously repairing the expansion part of the blood vessels for articulation. This allows the patient to undergo puncture after 48 hours for dialysis, thereby avoiding the transition of the central venous cannula.

Additionally, the artificial blood vessels facilitate the creation of an endocardial fistula puncture. In the urethral area, the artificial blood vessel maximizes the endovascular puncture area, shares the frequency of injury from the internal fistula vein puncture, diverts the blood flow from the internal fistula vein, and reduces the rate of progression of the internal fistula vein expansion.

The patient was a 47-year-old woman with a history of lupus nephritis for 20 years, hemodialysis for 16 years, hypertension for 16 years, and multiple endovascular fistula reconstructions in the left upper extremity, resulting in depleted vascular resources. The autologous internal fistula of the right upper limb exhibited multiple verrucous expansions, accompanied by localised erythema and oedema in the region of the puncture site of the larger tumour in the forearm. Ultrasound results: A substantial thrombus formation within the lumen at this site resulted in a notable reduction in the effective vessel lumen. Suggests aneurysmal dilatation of the lumen of an artificial arteriovenous fistula and infection. Pre-operative physical examination: The patient exhibited a short internal fistula vein, with approximately 15 cm of the infra-elbow vein of the forearm remaining. And the effective penetration area is extremely limited. The outflow tract is stenotic at the elbow level. This resulted in a notable elevation in venous pressure within the endovascular vein. The hemostasis time in the puncture area was markedly prolonged following dialysis, with a mean duration of approximately two hours. Positive arm-raising test; Localised erythema and oedema were observed in the puncture area of a large forearm tumour, indicating a localised infection.

Surgical procedure

The patient is placed in the supine position with the right upper limb abducted, and general anaesthesia is administered. The usual disinfection and sterile sheets are employed. In the mid-section of the forearm, an internal fistula vein tumour-like dilated segment (vessel internal diameter of approximately 3.0 cm) is observed, accompanied by skin redness and swelling of the oblique incision of the skin, measuring approximately 10 cm in length. This is to facilitate the complete removal of the aforementioned tumour-like dilated venous vessels. Non-invasive vascular blocking forceps were used to block the proximal and distal vessels of the segment of tumor-like dilated vessels. Incision of the vessel wall along the skin edge of the remaining segment of the vessel's anterior wall showed irregular old thrombus adhering to the vessel's anterior wall. The skin, the anterior wall of the vessel, and the thrombus attached to the wall were excised together, and the remaining vessel wall was trimmed. A 6-0 vascular suture was used to continuously suture the vessel wall, and the internal diameter of the vessel was approximately 1.0 cm after suturing; The skin of the ulnar side at the level of the elbow is incised in the shape of an 'S' from distal to proximal, from outside to inside, with a length of approximately 7.0 cm. The internal fistula vein was sufficiently freed to reveal a tortuous vascular course and two stenotic segments of the vessel. Non-invasive vascular blocking forceps were employed to block the proximal and distal vessels of the segment, resect the stenotic segment of the vessel, anastomose the severed end of the vessel end-to-end with a 5-0 vascular suture, and subsequently open the blocking forceps, thus ensuring the smooth autologous internal fistula vascular blood flow. A new sterile sheet was applied, and a longitudinal incision was made on the ulnar side of the upper mid-upper arm, approximately 5 cm in length. The subincisional noble vein was then freed from its tonic. From the subcutaneous tissue of the vein downstream of the distal forearm incision fistula to the subcutaneous tissue at the midpoint of the free vital vein in the middle and upper part of the upper arm, subcutaneous tunnelling was completed with the FLIXENE Artificial Blood Vessel Tunneler, and the FLXENE Immediate Penetrating Artificial Blood Vessel with a diameter of 6mm and a length of 50cm was inserted. The ulnar side vascular blocking forceps blocked both ends of the vein, incised the wall of the vein, about 1.5 cm long, cut the artificial blood vessel obliquely, and then anastomosed the artificial blood vessel-vein end-to-end with a 7-0 vascular suture. The open vascular clamps were opened, and heparin saline was injected in pulses from the distal opening of the artificial vessel, thereby restoring blood flow. Vasovagal tremor of the downstream vital vein was palpated, followed by re-blocking of the vital vein and blocking of the vascular sheaths at both ends of the superior cephalic vein of the forearm fistula, incising the anterolateral wall of this segment of the vessel for a length of approximately 1.5 cm. The artificial vessel was incised at an oblique angle, and subsequently an end-to-side anastomosis was performed between the artificial vessel and the superior cephalic vein. This was achieved using a 7-0 vascular suture, an open vascular clamp, and the restoration of blood flow. Artificial blood vessel touches tremor throughout. Furthermore, tremor was observed in conjunction with autologous internal arteriovenous fistulae. The subcutaneous tissues and skin were closed with 4-0 absorbable sutures, and following the surgical procedure and recovery from anaesthesia, the patient was transferred back to the ward.

Follow-up and outcomes

Two days after the operation, the patient's limb on the side of the endocardial fistula exhibited no evident swelling, and was dialyzed using a ready-to-wear artificial blood vessel, with blood priming in the mid-forearm and return of blood from the artificial blood vessel at the level of the upper elbow, with a dialysis flow of 200 ml/min. Color ultrasound showed that the head vein of the fistula was smooth after repair, and the inner diameter of the head vein of the forearm segment was about 8 ± 1 mm; the longer diameter of the oral vein and artificial blood vessel anastomosis of the near-autogenous arteriovenous fistula was about 6.5 mm, and the longer diameter of the anastomosis of the artificial blood vessel and the noble vein of the upper arm was about 7.1 mm, and the downstream noble vein of the fistula did not have any obvious stenotic segment of the blood vessel; and the flow rate of the brachial artery was about 1,482 ml/min.

The surgical incision healed well 15 days postoperatively, and the stitches were removed. During that time, the patient was dialyzed regularly using artificial vascular rope ladder puncture with dialysis flow gradually increasing from 200 ml/min to 240 ml/min. Color ultrasound showed that the head vein of the fistula was smooth after repair, and the inner diameter of the head vein of the forearm segment was about 8±1mm; the longer diameter of the oral vein and artificial blood vessel anastomosis of the near-autogenous arteriovenous fistula was about 6.4mm, and the longer diameter of the anastomosis of the artificial blood vessel and the noble vein of the upper arm was about 7.2mm, and the downstream noble vein of the fistula did not have any obvious stenotic segment of the blood vessel; and the flow rate of the brachial artery was about 1524 ml/min.

From 15 to 30 days after the operation, the patient was still dialyzed regularly by rope ladder puncture using an artificial blood vessel, with a dialysis flow rate of 250 ± 10 ml/min. Ultrasound showed that the head vein of autologous arteriovenous fistula was smooth after repair, and the inner diameter of the head vein of the forearm section was about increased, with the inner diameter of about 9 ± 1 mm; the oral vein of the proximal autologous arteriovenous fistula and the anastomotic port of the artificial blood vessel were longer with a diameter of about 6.4 mm, the anastomotic port of the artificial blood vessel and the noble vein of upper arm was longer with a diameter of about 7.0 mm; there was no obvious stenotic segment of the vessel downstream; the flow of brachial artery was about 1662 ml/min. The long diameter of the anastomosis between the artificial blood vessel and the upper arm vein was about 7.0 mm, and the downstream vein did not have any obvious stenosis; the flow rate of the brachial artery was about 1,662 ml/min.

At 58 days postoperatively, the patient's iatrogenic artificial vessel puncture did not elicit blood flow, and the autologous arteriovenous endovascular fistula trembled well. Color ultrasound suggests that the immediate penetration of artificial blood vessels throughout the thrombus, near the autologous arteriovenous fistula oral vein and artificial blood vessel anastomosis longer diameter of about 5.8 mm, artificial blood vessels and upper arm vein anastomosis longer diameter of about 7.0 mm, its downstream upper arm vein did not see obvious stenosis; autologous endovascular fistula cephalic vein fluent, cephalic section of the forearm inner diameter of about 10 ± 1 mm, its downstream median cephalic vein to the upper arm vein. There was no obvious stenosis. Ultrasound-guided endoluminal intervention was performed to deal with the thrombus of the penetrating artificial vessel, 500,000 units of urokinase thrombolysis, and 6 mm and 7 mm high-pressure balloon dilatation of the artificial vessel. After opening the artificial blood vessel, ultrasound showed that the oral vein and artificial blood vessel anastomosis of the near autologous arteriovenous fistula was about 6.2 mm in diameter, and the artificial blood vessel anastomosis of the artificial blood vessel and the upper arm vein was about 7.0 mm in diameter. However, the color blood flow of the artificial blood vessel was darker, and it was considered that the blood flow within the artificial blood vessel was lower, while the blood flow of the autologous fistula was brighter in color, and it was considered that the blood flow within the autologous blood vessel was higher. External pressure reduces the diameter of the vein of the autologous endovascular fistula, artificially increases the blood flow in the artificial blood vessel, and reduces the incidence of rethrombosis in the artificial blood vessel. The patient was instructed to temporarily elastic bandage pressure bandage the middle and upper forearms, which does not affect the artificial blood vessel rope ladder puncture regular dialysis.

Three months after the operation, the patient was still using the artificial blood vessel, rope ladder puncture, regular dialysis, dialysis flow 250 ± 10 ml/min. Color ultrasound suggests that the artificial blood vessel color blood flow and autologous endovascular fistula vein consistent; after the repair of the autologous endovascular fistula head vein fluent, the forearm section of the head vein internal diameter is about to increase, the inner diameter of the head vein is about 10 ± 1 mm; near autologous arterial fistula oral vein and the artificial blood vessel anastomosis is longer diameter of about 6.5 mm, the artificial blood vessel and upper arm VIP vein anastomosis is about 7.0 mm. The longer diameter of the anastomosis between the artificial blood vessel and the upper arm vital vein was about 7.0 mm, and no obvious stenosis was seen in the downstream vital vein; the flow rate of the brachial artery was about 1,650 ml/min.

Discussion

Commonly used vascular accesses for hemodialysis are AVF, AVG, and central venous catheter [1]. Among the three modalities, neither AVF nor conventional AVG can be used immediately after surgery, and they need to wait for "maturation". Only hemodialysis catheters can be used immediately after surgery, but they bring complications such as infection, central venous stenosis, occlusion, etc. Especially, central venous lesions may eventually lead to the inability to establish any hemodialysis access. In recent years, the application of ready-to-wear artificial blood vessels has been a major advancement in the field of artificial vascular materials for hemodialysis. Unlike the traditional expanded polytetrafluoroethylene (ePTFE) artificial blood vessels, the ready-to-puncture artificial blood vessels can reduce the risk of bleeding from the puncture eye through the special structural design of the wall, and can be punctured for dialysis immediately after the surgery without waiting for the 2 weeks for the fibers of the artificial blood vessels to heal with the subcutaneous tissue, which is of the greatest significance in reducing the transition period of hemodialysis, especially in the case of central venous lesions. The greatest significance is to reduce the use of hemodialysis catheters in the transition period, thus protecting patients' central venous resources [2]. The Chinese Expert Consensus on Vascular Access for Hemodialysis (2nd edition) suggests that "for patients with pre-existing central venous disease, whose residual central venous resources are very precious, it is recommended to use ready-to-wear artificial blood vessels if graft arteriovenous fistulae need to be established to avoid central venous catheterization during the transitional period" [1].

This patient in the surgical design that utilizes both wear-type artificial blood vessels can be early puncture advantages, but also to solve the autologous endovascular fistula limitation of infection lesions and thrombus, so that the tumor-like expansion lesion remodeling, outflow tract stenosis repair, at the same time the patient's autologous endovascular fistula due to surgical trauma need to be gradually recovered after surgery can be reused. Prolonged the length and usability of the patient's vascular access. 48 h after puncture, namely penetration type artificial vascular dialysis, to avoid the transition of central venous catheterization.

In the past, most of the patients with ready-to-puncture artificial blood vessels were similar to ordinary artificial blood vessels, "U"-shaped collaterals placement surgery, if the patient to do the ordinary artificial blood vessels need to be under the long-term catheter, the first to remove the autologous endocardial fistula, and then implanted with an artificial blood vessel, but also have a period of recovery, cannot be used right away, the operation is cumbersome, the cycle is long, and have to go through a few surgeries, as well as There is a waiting time for the fistula to mature, the surgery is more traumatic, and the patient relies on the artificial blood vessel for all future punctures. In this case, the patient's original autologous endovascular fistula was reshaped, the artificial blood vessel was used to build a bridge and connected to the autologous endovascular fistula, the vein downstream of the fistula was selected, and in the upstream of the repaired blood vessel segment, the appropriate location of the end-side anastomosis (the end of the artificial blood vessel - the side of the vein of autologous endovascular fistula), the artificial blood vessel was transferred across the radial side of the forearm to the radial side of the elbow, and the artificial blood vessel was obliquely directed inward to the ulnar side of the lower 1/3 upper arm, and the end-side anastomosis was performed on the noble vein of the upper arm (the anastomosis was located in the original endovascular fistula). (The anastomosis is located downstream of the original intracorporeal fistula). Compared with the "U"-shaped collaterals, this procedure preserves more of the vascular portion of the fistula, increases the perforation area of the artificial vessel, and shortens the waiting time for perforation, whereas the perforation of the both-penetrated artificial vessel transitions the waiting time for perforation of the fistula and increases the perforation area in the patient's future dialysis process.

Patient's perspective

The patient had multiple endovascular recanalization and secondary endovascular procedures during his previous 16 years of dialysis, resulting in depletion of vascular resources, and this procedure not only reduced the pain of waiting and transitioning for placement, but also increased the area of puncture and The patient was very satisfied with the procedure.

Conclusion

In conclusion, both perforated artificial vessel bypass combined with endovascular fistula repair can increase the postoperative perforation area and shorten the waiting time for patients to have their vessels perforated.

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