CASE REPORT

An establishment of vascular access through superior vena cava for a patient with multiple central venous stenosis or occlusion

Yong-Shu Diao,[1] Yan-Huan Feng,[2] Chun-Cheng Liu,[3] Tian-Lei Cui,[4] Ping Fu[5]

Abstract

The patency of vascular access is of vital importance to dialysis patients. Access dysfunction is largely caused by vessel stenosis and thrombosis. Nephrologists usually find themselves helpless when all treatments fail and the vascular access seems to have exhausted. Here we report a successful establishment of vascular access through superior vena cava for a critical patient with multiple central venous stenosis or occlusion. To our knowledge, it is the first case ever reported on the successful establishment of vascular access through superior vena cava under such a complicated condition of vascular exhaustion.

Keywords: Vascular access, Dialysis, Multiple central venous or occlusion.

Introduction

What is central to patients' receiving dialysis is the patency of vascular access, the dysfunction of which is largely caused by stenosis and thrombosis. While the latter can be solved by re-canalisation or establishing a new vascular access, these available treatments lack clear evidence to support, especially in multiple central venous stenosis or occlusive patients. Here we report a successful establishment of vascular access through direct superior vena cava for a critical patient with multiple central venous stenosis or occlusion.

Case Report

A 75-year-old woman with end-stage renal disease (ESRD) due to diabetic nephropathy (DN) visited our medical centre for the occlusion of artificial graft for 2 days in July 2012. She had a history of diabetes mellitus (DM), hypertension (HT) and hyperlipidaemia under poor control. The patient had begun to receive peritoneal dialysis (PD) 5 years earlier, superseded afterward by haemodialysis (HD) because of obstruction of PD catheter. She had then received internal jugular vein and femoral vein catheterisation repeatedly for the low flow rate of arteriovenous fistulas. In the preceding one year the patient had received left upper limb's artificial graft replacement resulting from the occlusion of the right brachiocephalic vein and the left internal jugular vein.

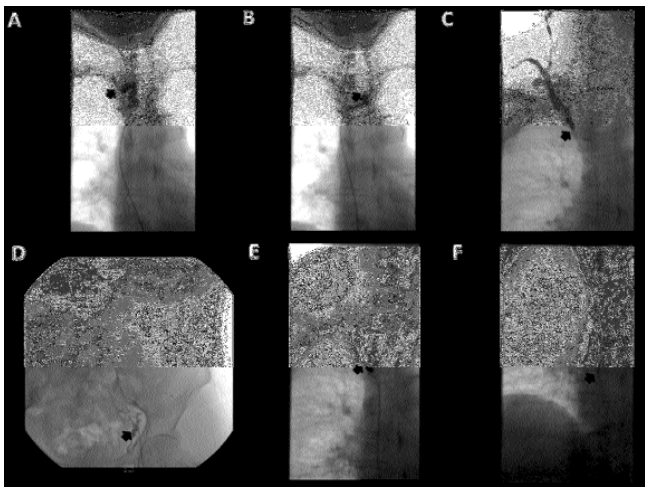

Figure: Digital Subtraction Angiography and Angioplasty (A and C): occluded right brachiocephalic vein, B) occluded left brachiocephalic vein, D) narrowed and twisted left femoral vein, E) the venous blood drainage was remarkably improved after vascular dilation, F) a cuffed catheter was successfully inserted into the joint of external jugular vein and sub-clavian vein, with the far end of the catheter located to the distal end of superior vena cava.

Primary associated symptoms were oliguria (urine output was less than 100 mL/d) and lower extremity oedema. No fever, jaundice, superficial lymph nodes or consciousness disorders were reported. Assessment of vital signs on presentation revealed temperature of 36.6°C, pulse of 66 beats per minute, and blood pressure of 145/97 mmHg. The upper limb colour ultrasound illustrated the full-length artificial blood vessel thrombosis and the median cubital vein thrombosis. Computed tomography angiography (CTA) showed that the bilateral brachiocephalic veins and the right internal jugular vein were all occlusive with the development of collateral circulation, and the bilateral femoral veins were extremely narrow, which was confirmed by subsequent digital subtraction angiography (Figure). Laboratory tests indicated normal haemoglobin levels (139g/L), normal

[1,2,4,5]Division of Nephrology, [3]Department of Ultrasonography, West China Hospital of Sichuan University, Chengdu, China.
Correspondence: Tian-Lei Cui. Email: tianleicui@163.com

platelet count (167×10^9g/L), high serum creatinine levels (925.3μmol/L), electrolyte disorders and normal coagulation function.

Because of the high calcium-phosphorus product, hyperphosphatemia and unstable haemodynamics, the patient received haemodialysis through direct puncture. However, dialyses for the patient 4 times per week could not correct electrolyte imbalances. We tried to insert deep veins of lower limb catheter and arteriovenous graft for haemodialysis was provided, but all treatment approaches took us nowhere.

The patient's condition got progressively worse, with her left arm swelling and signs of acute heart failure (New York Heart Association class II) appearing. We, therefore, performed re-canalisation and balloon dilation, and successfully inserted a long-term cuffed double-lumen catheter into the joint of external jugular vein and sub-clavian vein, with the far end of the catheter located to the distal end of superior vena cava. Despite tolerable soreness experienced during the operation, no obvious discomfort was reported. Haemodialysis through the cuff saw an improvement and the flow rate reached above 250ml/min.

Monthly follow-up showed that the patient was able to receive maintenance haemodialysis and the graft had been in a good condition. CTA done during the follow-up period of 2 years indicated no abnormal imaging results.

Discussion

It's a big challenge managing the central venous occlusive disease (CVD) and maintaining patency of vascular access among patients on haemodialysis. Exhaustion of vascular access causes add to dialysis-related complications and mortality. Yet the effective treatment of CVD and maintaining patency of vascular access, the so-called lifeline, remain major problems to overcome.

It's common for CVD in haemodialysis patients and the incidence may up to 27% with a history of previous central catherisation.[1]

Our patient had a history of repeated temporary catheterisation and fistulas, which is a high-risk factor of thrombosis.[2] A long history of DM, HT and hyperlipidaemia under poor control further suggested the possibility of multiple thrombosis or stenosis. We initially had the patient undergo vascular ultrasound and contrast angiography to attain a definitive diagnosis and to ascertain the accurate position of thrombosis and that of the narrow part of the blood vessel, if any. Results showed the patient had a very difficult problem of exhaustion of vascular access. To meet the requirement of haemodialysis, temporary catheterisation is still an option for keeping the life signs stable temporarily, provided the possibility still remains of re-canalisation of the blood vessels' stenosis. Unfortunately, first two attempts failed owing to the poor vascular condition and the thinness of orifice.

The fluctuation of blood pressure was no longer within the stable range, and the hyperkalaemia became more frequent, all of which implied that haemodialysis through direct puncture was no longer adequate and that there was an urgent need to build new vascular access during the treatment. Our effort to rebuild the prosthetic graft was unsuccessful, which may be ascribed to the degeneration of the primary graft that increased the possibility of failure by having gradually injured the blood vessels and the vascular wall, and thus making anastomotic extremely vulnerable.[2,3]

When the CVD in HD patients occur, endovascular intervention includes percutaneous transluminal angioplasty (PTA), and placement of bar-mental stents (BMS) is the primary treatment. The technical success rate about PTA ranged from 70-90% and the primary patency rates at 6 months and 12 months ranged 23-55% and under 50% respectively.[4-10] The BMS's technical success rate is also very high, but the primary patency rates are as low as 14% at 12 months.[6-18] It also lacked enough data to determine the effectiveness, especially in multiple central venous stenosis or occlusive patients.

Data on patients with multiple central venous stenosis or occlusion is very rare. Matsuura J et al. reported 3 cases of patients with central venous stenosis or occlusion, to all of whom PTA had been employed to perform central venous catheterisation.[19] Meanwhile, confronted with the same cases, Kapoor B et al. succeeded in application of stents.[20] Zmani N et al. reported a case of a middle-aged female patient with exhausted upper extremity access sites, whose life was successfully saved by surgically creating an arteriovenous graft in from the left common iliac artery to the inferior vena cava.[21] Taking a closer look at the reported cases, we found the follow-up care and prognosis unsatisfactory which could be maintained for no more than 4 months.

Our patient was in a critical condition and because of the failure of the temporary catheterisation and rebuilding the prosthetic graft, we performed re-canalisation and balloon dilation and successfully inserted a long-term cuffed double-lumen catheter into the joint of external jugular vein and sub-clavian vein, with the far end of the catheter located to the distal end of superior vena cava.

And after the complete monitoring mechanism for our patient, over a follow-up period of 2 years, the patient remained in a stable condition, outperforming cases reported in literature.[19-21]

Conclusion

Exhaustion of vascular access in HD patient is rare yet fatal, and will become increasingly common as the population of HD patients continues to climb. To our knowledge, it is the first case ever reported on the successful establishment of vascular access through superior vena cava under such a complicated condition of vascular exhaustion. The case reveals that what is central to successful treatment is whether or not it is able to overcome the problems of stenosis and thrombosis and to establish new vascular access.

Acknowledgments

The work was part of the National Key Technology R&D Programme and the Sichuan Province Health Department Scientific Research Programme.

Disclosure of grants or other Funding: This work was part of the Program on the National Key Technology R&D Program (No. 2011BAI10B08) and the Program on the Sichuan Province Health Department Scientific Research Program (No.140063).

References

1. Agarwal AK, Patel BM, Farhan NJ. Central venous stenosis in hemodialysis patients is a common complication of ipsilateral central vein catheterization. J Am Soc Nephrol 2004;15: 368A-9A.
2. Roy-Chaudhury P, Sukhatme VP, Cheung AK. Hemodialysis vascular access dysfunction: a cellular and molecular viewpoint. J Am Soc Nephrol 2006; 17: 1112-27.
3. Roy-Chaudhury P, Kelly BS, Miller MA, Reaves A, Armstrong J, Nanayakkara N, et al. Venous neointimal hyperplasia in polytetrafluoroethylene dialysis grafts. Kidney Int 2001; 59: 2325-34.
4. Glanz S, Gordon DH, Lipkowitz GS, Butt KM, Hong J, Sclafani SJ. Axillary and subclavian vein stenosis: percuta- neous angioplasty. Radiology 1988;168: 371-3
5. Beathard GA. Percutaneous transvenous angioplasty in the treatment of vascular access stenosis. Kidney Int 1992; 42: 1390-7
6. Kovalik EC, Newman GE, Suhocki P, Knelson M, Schwab SJ. Correction of central venous stenoses: use of angioplasty and vascular Wallstents. Kidney Int 1994; 45: 1177-81
7. Quinn SF, Schuman ES, Demlow TA, Standage BA, Ragsdale JW, Green GS, et al. Percutaneous transluminal angioplasty versus endovascular stent placement in the treatment of venous stenoses in patients undergoing hemodialysis: intermediate results. J Vasc Interv Radiol 1995; 6: 851-5
8. Dammers R, de Haan MW, Planken NR, van der Sande FM, Tordoir JH. Central vein obstruction in hemodialysis patients: results of radiological and surgical intervention. Eur J Vasc Endovasc Surg 2003; 26: 317-21
9. Surowiec SM, Fegley AJ, Tanski WJ, Sivamurthy N, Illig KA, Lee DE, et al. Endovascular management of central venous stenoses in the hemodialysis patient: results of percutaneous therapy. Vasc Endovascular Surg 2004; 38: 349-54
10. Bakken AM, Protack CD, Saad WE, Lee DE, Waldman DL, Davies MG. Long-term outcomes of primary angio- plasty and primary stenting of central venous stenosis in hemodialysis patients. J Vasc Surg 2007; 45: 776-83
11. Gray RJ, Horton KM, Dolmatch BL, Rundback JH, Anaise D, Aquino AO, et al. Use of Wallstents for hemodialysis access-related venous stenoses and occlusions untreatable with balloon angioplasty. Radiology 1995; 195: 479-84
12. Vorwerk D, Guenther RW, Mann H, Bohndorf K, Keulers P, Alzen G, et al. Venous stenosis and occlusion in hemodialysis shunts: follow-up results of stent placement in 65 patients. Radiology 1995; 195: 140-6
13. Vesely TM, Hovsepian DM, Pilgram TK, Coyne DW, Shenoy S. Upper extremity central venous obstruction in hemodialysis patients: treatment with Wallstents. Radiology 1997; 204: 343-8
14. Haage P, Vorwerk D, PirothW,Schuermann K, Guenther RW. Treatment of hemodialysis-related central venous stenosis or occlusion: results of primary Wallstent placement and follow-up in 50 patients. Radiology 1999; 212: 175-80
15. Oderich GS, Treiman GS, Schneider P,Bhirangi K. Stent placement for treatment of central and peripheral venous obstruction: a long-term multi-institutional experience. J Vasc Surg 2000; 32: 760-9
16. Chen CY, Liang HL, Pan HB, Chung HM, Chen WL, Fang HC, et al. Metallic stenting for treatment of central venous obstruction in hemodialysis patients. J Chin Med Assoc 2003; 66:166-72.
17. Vogel PM, Parise CP. SMART stent for salvage of hemodialysis access grafts. J Vasc Interv Radiol 2004; 15: 1051-60
18. Aytekin C, Boyvat F, Yag ?murdur MC, Moray G, Haberal M. Endovascular stent placement in the treatment of upper extremity central venous obstruction in hemodialysis patients. Eur J Radiol 2004; 49: 81-5
19. Matsuura J, Dietrich A, Steuben S, Ricker J, Barkema K, Kuhl T. Mediastinal approach to the placement of tunneledhemodialysis catheters in patients with central vein occlusion in an outpatient access center. J Vasc Access 2011; 12: 258-61.
20. Kapoor B, Lockhart M, Sharma D, Maya ID. Brachiocephalic vein stent fracture: case series and literature review. Semin Dial 2010; 23: 110-3.
21. Zamani N, Anaya-Ayala JE, Ismail N, Peden EK. Left common iliac artery to inferior vena cava abdominal wall arteriovenous graft for hemodialysis access. J Vasc Surg 2012; 56: 489-91.