



Long-term patency of bypass to the right atrium as a last resort in two hemodialysis patients: case report

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Introduction: Central venous occlusion (CVO), which is caused by central venous catheters in haemodialysis patients, remains a challenge in vascular surgery.

Case presentation: The authors report data evaluating bypass graft patency and complications of two patients with CVO who have benefited from a subclavian artery to right atrium bypass using polytetrafluoroethylene. The first patient, underwent three times an angioplasty of the atrio prothetic anastomosis, finally the graft failed at 12 month. The second one, presented a steal syndrome with ischaemia of the right upper limb immediately postoperatively. Three months after the procedure, she underwent an angiographic control that showed a stenosis of the protheto atrial junction.

Clinical discussion: Central venous occlusion in patients with end-stage kidney disease is most often due to central venous catheters. Although the endovascular therapy is the first-line approach to the treatment of CVO, the surgical bypass to the right atrium is often the last resort to preserve adequate vascular access in haemodialysis patients, with CVO. The autologous vein and bovine arterial bypass remains better than polytetrafluoroethylene grafts in terms of long-term patency. Only few cases have been reported on the literature, besides no long-term outcome data has been previously reported.

Conclusion: Long-term secondary patency of bypass to the right atrium can be achieved, but requires strict follow-up, and multiple endovascular procedures to maintain the bypass access.

Keywords: central venous occlusion, haemodialysis, right atrium, steal syndrome

Introduction

Central venous occlusion (CVO) of the superior and inferior vena cava in patients with end-stage kidney disease that is caused by central venous catheters remains a serious challenge, since it is associated with diminished life expectancy^[1].

Endovascular treatment including angioplasty and stenting is the first-line of treatment, while an impossible recanalisation of the occlusion leads to surgical practice. The surgical bypass to the right atrium (RA) is often the last resort in patients with CVO. Only few cases have been reported in the literature.

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HIGHLIGHTS

- Central venous occlusion (CVO), which is caused by central venous catheters in haemodialysis patients, remains a challenge in vascular surgery.
- We report data evaluating bypass graft patency and complications of two patients with CVO who have benefited from a subclavian artery to right atrium bypass using polytetrafluoroethylene graft from June 2021 to September 2022.
- The surgical bypass to the right atrium is rarely performed, and remains the last resort to preserve adequate vascular access in haemodialysis patients, with CVO, nevertheless. Long-term secondary patency can be achieved but requires strict follow-up, and multiple endovascular procedures to maintain the bypass access.

We report the results of follow-up of two patients that underwent bypass to the right atrium. Our case report was written according to SCARE guidelines^[2].

Case presentation

We report data evaluating bypass graft patency and complications of two patients with CVO who have benefited from a subclavian artery to right atrium bypass using polytetrafluoroethylene (PTFE) graft from June 2021 to September 2022.

The two patients have thrombosed all the native and bypass graft approaches in the upper limb, besides one patient



Figure 1. Anastomosis using 5/0 prolene between the right atrium and the armed prosthesis.

thrombosed her native arteriovenous fistula of lower limb without possibility of thrombectomy. Given the difficulty of maintaining their vascular accesses. They benefited several times from central catheters.

The patients benefited from extremities venograms, which showed chronic occlusion of the superior and inferior vena cava and major tributaries. They had undergone attempted endovascular procedures that failed to cross the obstruction.

After a multidisciplinary staff with cardiac surgeons and nephrologist, we decided to perform a loop bypass between the right subclavian artery and the right atrium.

After approaching the right subclavian artery, a right anterior mini thoracotomy was performed at the level of the third intercostal space with ligation of the artery and the internal thoracic vein. lateral clamping of the right atrium and subclavian artery were performed, after pericardiotomy and exposure of the right atrium.

After systemic heparinization (50 UI/kg), we realized a first anastomosis between the right atrium and the armed prosthesis with 5/0 prolene (Fig. 1). After tunnelling of the prosthesis facing the third intercostal space jostling towards the right subclavian artery, a 2 cm longitudinal arteriotomy was made and a spatulated end-to-side anastomosis was completed with running 5-0 monofilament polypropylene suture (Prolene).

A strongly palpable thrill over the graft has been noticed after surgery.

In both patients, there were no intraoperative complications. The mean duration of the procedure was 230 min. they were

transferred after surgery to the ICU, and put on curative anticoagulation (low molecular weight heparin 0,6 UI /12 h), and on antiplatelet aggregation. They were pricked through their bypass, 2 weeks after surgery, without difficulty .

The surgical management of this case was performed by an experienced professor of vascular surgery with the aid of an attending and two junior residents.

Six months later, The first patient, which is a 56-year-old female was hospitalized for thrombosis of the subclavian atrial bypass, thus she underwent a thrombectomy using forty 5 French after approaching the proximal anastomosis. An angiographic control showed a stenosis of the protheto atrial junction with stagnation of the contrast product (Fig. 2). Indeed , the patient underwent a simple angioplasty at the distal anastomosis using a 6 mm balloon (Fig. 3). The scopic control image was satisfactory (Fig. 4).

The patient required another endovascular procedure to treat distal anastomosis stenosis 3 months later.

Another thrombectomy and angioplasty using 6 mm balloon was performed 3 months later. Finally, the graft failed at 12 month, then the patient is on peritoneal dialysis.

Concerning the second patient, which is a 39-year-old female. We discovered after approaching the right subclavian artery, a poor quality artery with little pulse.

Our patient presented a steal syndrome with ischaemia of the right upper limb immediately postoperatively. Our team faced a dilemma: either the ligation of the bypass and the salvage of the limb or the preservation of the bypass and the amputation of the upper limb after systematisation of the ischaemic lesions. After a multidisciplinary staff and of course after discussing the dilemma with the patient, we decided to preserve the bypass, since preserving the bypass is preserving the vital prognosis. Thereby, an amputation of the upper limb was performed 1 week later (Fig. 5). Three months after the procedure, she underwent an angiographic control that showed a stenosis of the protheto atrial junction.

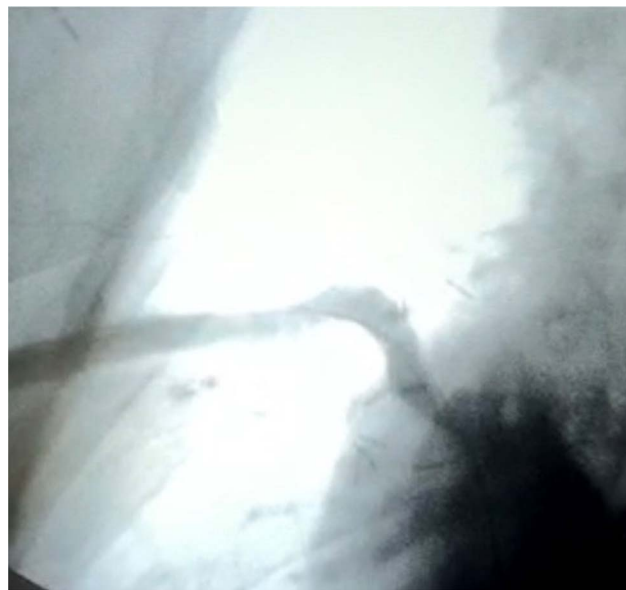


Figure 2. Angiographic control showing the stenosis of the protheto atrial junction.

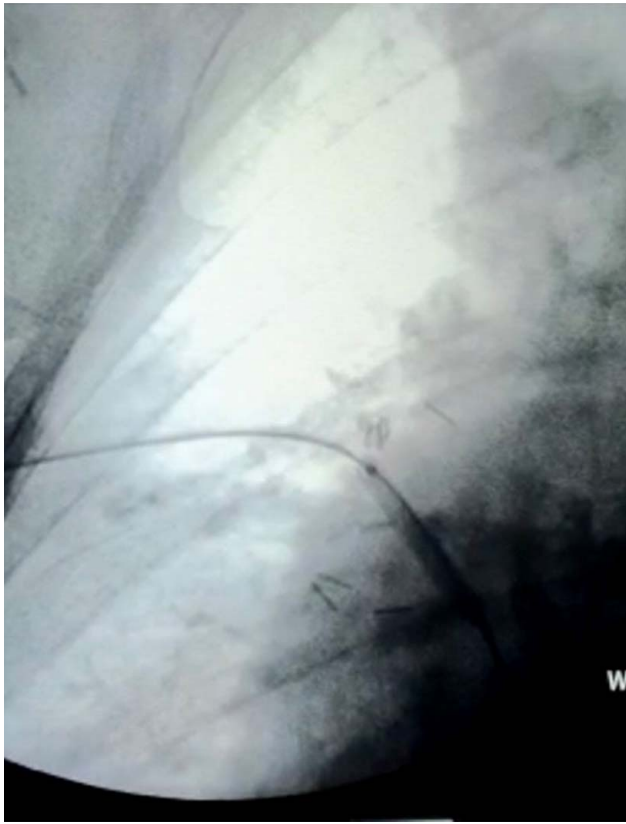


Figure 3. Angioplasty of the protheto atrial junction using 6mm balloon.

Discussion

Central venous occlusion in patients with end-stage kidney disease is not often due to central venous catheters. Central venous catheters lead to the formation of a thrombus and consequently a CVO by endothelial cell aggression^[3]. For this reason, Kidney Disease Outcome Quality Initiative (KDOQI) has widely recommended catheter last and fistula first for dialysis access.

Endovascular treatment including angioplasty and stenting is the first line of treatment, despite of a weak long-term patency. Moreover, the endovenous anatomy must be compatible with endovascular treatment. The atrial cavo junction is considered at high risk of auriculo cava tear, which can induce cardiac tamponade^[4].

All two patients have failed endovascular interventions, which is why they underwent surgical reconstruction using bypass to the RA, after a cardiac evaluation that was favourable for this surgery.

Anterior chest wall grafts for dialysis access were first described in the 1970s^[5], and it is often a last ditch resort to preserve adequate vascular access in haemodialysis patients. It is performed by a surgical bypass to the RA.

It should be emphasised that bypass to the RA is associated with good outcomes as it was reported by the department of vascular surgery at Houston Methodist hospital, who have used bovine carotid artery conduit^[6] and autologous femoropopliteal vein^[7]. However, no long-term outcome data have been previously reported.

Pablo and colleagues reported a retrospective review of five dialysis patients treated with bypass graft to the right atrium from

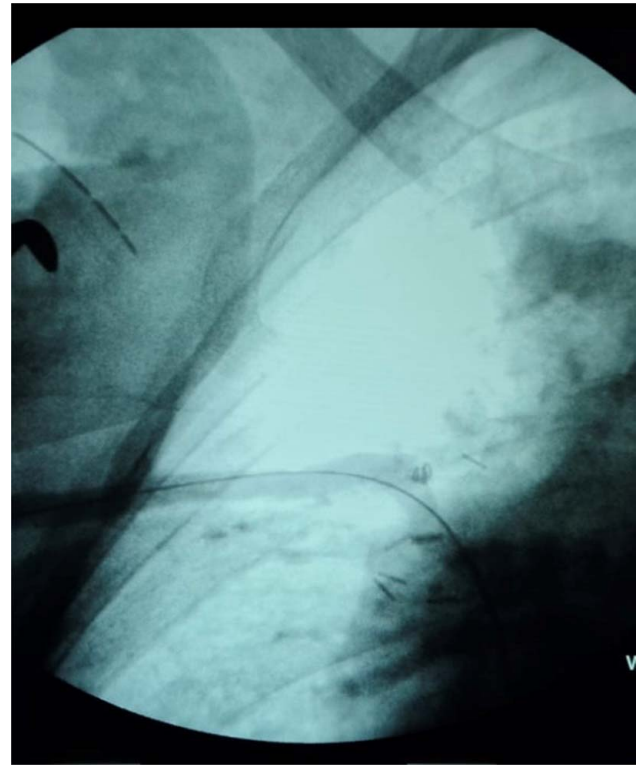


Figure 4. Satisfactory angiographic control.

2012 to 2014. One-year secondary patency rate of the bypass was 100%. One patient died of a leg sepsis and another one of a stroke within 14 months after the procedure. Another patient was admitted repeatedly 16 months after the procedure for thrombosis of the bypass, which was recovered by endovascular interventions, and ultimately the graft failed after 31 months despite multiple interventions. The bypass remained patent in two patients for 78 months, at the expense of four open access procedures, and 23 endovascular interventions.



Figure 5. Amputation of the right upper limb after systematisation of the ischaemic lesions.

Thereby, we can conclude that long-term secondary patency can be achieved but requires strict follow-up, and multiple endovascular procedures to maintain the bypass access^[8].

Since our two patients does not have an autologous vein for bypass surgery, which long-term patency is better than PTFE grafts^[9], we decided to perform a central venous bypass using PTFE graft, after a multidisciplinary staff with our cardiac surgeons and nephrologists colleagues.

It is of utmost importance to emphasize that biological grafts for instance bovine arterial bypass are doing better than PTFE grafts in patients with thrombophilia^[6]. Nevertheless, using PTFE grafts can be the only way available as a haemodialysis access in patients who do not have a suitable vein. Besides, it can be effective for short reconstructions in the mediastinum, moreover, we do not have the arterial bovine conduit available at our institute.

Multiple cases of axillary artery to RA bypass using PTFE graft have been reported in the literature^[10,11].

We performed this bypass to the RA using mini thoracotomy, which is an excellent substitute to median sternotomy.

Morsy *et al.*^[12] reported that anterior chest wall grafts have primary and secondary patency like other forms of autogenous or complex access. As well as the skin is thick in this part of body, the risk of infection is slow, besides, canulation is easy^[13].

The first patient underwent twice thrombectomy and endovascular procedure, Finally, the graft failed at 12 month. Then the patient is on peritoneal dialysis.

The second patient presented a steal syndrome with ischaemia of the right upper limb immediately postoperatively, and underwent limb amputation. Three months after the procedure, she underwent an angiographic control that showed a stenosis of the protheto atrial junction.

Conclusion

CVO can lead to serious consequences, leading the surgeon to face dilemmas. Therefore the best way to deal with these approaches for haemodialysis problems is to prevent CVO by minimising the use of central catheters, except for emergency situations. Nevertheless, bypass to the RA is a good alternative that requires close angiographic follow-up.

Ethical approval

Applicable.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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There is no financial support.

Author contribution

Y.B., S.B., H.E.M., A.R. and A.B.: conception, literature review, analysis, data collection, writing—review and editing. I.H., Y.B., E.M.M., A.B. and O.E.M.: conception, methodology, supervision.

Conflicts of interest disclosure

The authors declare that they have no conflicts of interest.

Research registration unique identifying number (UIN)

This is not an original research project involving human participants in an interventional or an observational study but a case report. This registration is not required.

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Provenance and peer review

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