Short-term results of angioplasty for management of central venous obstruction and stenosis in hemodialysis patients

Hany Abdelmawla Mohamed, Maher Abdelmoneim, Mohamed Sabry

Vascular Surgery Department, Faculty of Medicine, Cairo University, Cairo, Egypt

Correspondence to Hany Abdelmawla Mohamed, Vascular Surgery Department, Faculty of Medicine, Cairo University, Cairo, Egypt. Mob: 01003015118; e-mail: hanymawla26@gmail.com

Received 10 May 2019
Accepted 26 June 2019

The Egyptian Journal of Surgery 2019, 38:729–732

Introduction
Central venous obstruction and stenosis are common complications that lead to access dysfunction and morbidity in patients on dialysis.
Patients and methods
This is a prospective study that was conducted at a tertiary referral center, and 30 patients on regular dialysis who presented with venous hypertension in the upper limb were enrolled. Proper history and examination was done. All patients underwent angioplasty of the lesions, and follow-up was planned at 1, 3, 6, and 12 months. Assessment of primary and assisted primary patency rates were used as the main outcome of this study with assessment of short-term results of percutaneous transluminal angioplasty (PTA) of failed and failing arteriovenous fistula in hemodialysis patients.
Results
The study was conducted on 30 patients with end-stage renal disease, comprising 21 males and nine females. The mean age was 53.8±14.5 years. Technical success was achieved in 24 (80%) patients. The rest of the patients showed an improvement of their lesions but with a residual stenosis of 30–60%.
Conclusion
Endovascular management of central venous stenosis and occlusion is an effective and safe procedure in patients on regular hemodialysis with acceptable primary and assisted primary patency rates.

Keywords:
angioplasty, central vein, hemodialysis, occlusion

Egyptian J Surgery 38:729–732

1110-1121

Introduction

Central venous obstruction and stenosis commonly cause high significant morbidity with failure and access dysfunction in patients on regular hemodialysis [1]. Although open surgical management demonstrated more durability in the past, it was associated with high incidence of morbidity [2]. Endovascular interventional procedure for central venous occlusion is less invasive and safe but needs an experienced surgeon to achieve satisfactory results [3].

Patients and methods

A prospective study was conducted on 30 patients from February 2018 to March 2019 in Kasr Al Ainy and New Kasr Al Ainy Teaching Hospitals. Informed consent was applied to all patients before any intervention. The study included patients with end-stage renal disease (ESRD) on regular hemodialysis who presented with venous hypertension in upper limb. The study included patients with collateral veins over chest, limb swelling, and prolonged bleeding after hemodialysis. Pretreatment evaluation included history and examination. History included age, sex, cause of renal failure, presences of cardiovascular comorbidities, prior access sites, current access used for hemodialysis type, and location and duration of the failed or failing access. Every patient was evaluated for the presence of congestive heart failure, which could adversely affect arteriovenous fistula (AVF) hemodynamic.

The upper limb was examined for scars of previous operations, edema, and dilated veins on the chest wall and the shoulder, indicating central venous occlusion. Palpation of pulses was done at all levels, and Allen's test was performed to assess the relative contributions of radial and ulnar arteries to the hand circulation. The blood pressure of both upper limbs was measured and compared for differences, indicating more proximal arterial disease. The AVF was evaluated for quality and propagation of thrill over it, the presence of aneurysmal dilatation, status of the overlying skin,

 DOI: 10.4103/ejs.ejs_106_19

and the presence of external compression by hematoma.

All cases were done in the angio-suite. The field was sterilized, and the patients were monitored clinically and by pulse oximetry. The procedure was performed under local anesthesia of the puncture site (2% lidocaine hydrochloride) and light sedation during balloon inflation.

Accessing

An appropriate-sized sheath (usually 6 F) is advanced over a guide wire into the venous limb of the fistula. Long sheaths were used in some cases. The sheath was tested for free blood flow. Overall, 5000 IU of heparin was injected and then flushed, to prevent intravascular thrombosis. Diagnostic fistulogram was done through injection of the dye directly through the sheath if the endovascular access was close to the fistula site or was antegrade (with the flow), injection of the dye was directly through the sheath. Otherwise a vertebral guiding catheter was used as diagnostic catheter. The angiographic findings were evaluated for each patient to realize the problem and to put a plan for proper management.

Passing the guide wire

A guide wire is then passed through the sheath and advanced to the level of the central veins. Usually a 260-cm 0.035 angled hydrophilic guide wire (Terumo, Radifocus Terumo Guidewire, Germany) was inserted in the sheath over a 6- or 5-F selective Bern catheter under angiographic guidance. The wire and the catheter were then manipulated and advanced under imaging guidance until the anastomotic site was reached. The catheter was rotated until its tip faces and engages in the anastomotic site, and then the wire was advanced into the vein across the lesion supported by the catheter till secured in the central vein. The catheter was advanced passing the lesion, and then the wire was removed and the central vein was imaged for any stenosis or occlusion. The wire was then advanced through the catheter till it reached the heart. There was no difficulty in crossing the lesions except in the following circumstances:

(1) Tight lesion.
(2) Multiple tight lesions.
(3) Preceding aneurysmal dilatation.
(4) Flush occlusion.

For the tight lesion, a Terumo stiff wire was used to give pushability. For the multiple tight lesions difficulties, the first lesion was dilated first with a small balloon. The flush occlusion was challenging. We started by marking the position of the vein by feeling it clinically and marking its site by radio-opaque instrument to direct the Bern catheter tip toward it while digitally occluding the artery just above the anastomosis otherwise. We used the combined venous access approach.

Balloon dilatation

After crossing the lesions, balloon dilatation was used for dilatation of the lesion by appropriate balloon size (usually 12 mm) followed by completion angiography.

In all patients, primary patency and assisted primary patency rates were collected. Primary patency rate is defined as time between the initial intervention to the first reintervention in the form of percutaneous transluminal angioplasty (PTA) or PTA and stenting. Assisted primary patency rate is defined as the interval from initial intervention to permanent occlusion or intervention need stent placement.

Results

This study was conducted on 30 patients with ESRD. There were 21 males and nine females. The mean age was 53.8±14.5 years (range, 23–76 years). The causes of ESRD were hypertension in 35% of patients, diabetes in 25% of patients, glomerulonephritis in 5% of patients, systemic lupus in 5% of patients, and in 30% of patients, the causes of renal failure were unknown (Table 1). In two patients, the femoral vein was used as an access, and in another couple of patients, because of the degree of stenosis, it was not easy to overcome antegradely, so it was possibly to overcome retrogradely. In two patients, there was an occlusion, and the guide wire could not be passed. In the other 28 patients, balloon dilatation was done with marked improvement and resolution of the stenosis (Figs 1, 2). Our initial interventional success rate was approximately 90%. Anatomical technical success rate was made in 24 (80%) patients. The remaining four patients had marked improvement in their lesions, with

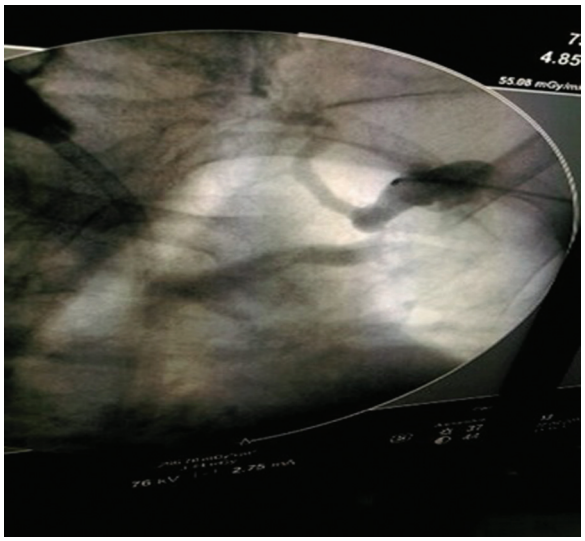
Table 1 Causes of end-stage renal disease and their percentages

Causes of ESRD	%
Hypertension	35
DM	25
SLE	5
Glomerulonephritis	5
Unknown	30

DM, diabetes mellitus; ESDR, end-stage renal disease; SLE, systemic lupus erythematosus.

a residual stenosis of approximately 30–60%. Clinically, the signs of success as appearance of a continuous palpable thrill over the vein, decreasing the extremity tension, and disappearance of collateral veins over chest wall were presented in all patients, but in two cases, the arteriovenous access was abandoned and a central venous catheter was placed. Table 2 shows primary patency and the assisted primary patency rates for the patients at 3, 6, 9, and 12 months. Primary patency is defined as time interval from the initial intervention to the first reintervention in the form of PTA or PTA and stenting; it was 88, 63, 31, and 16% at 3, 6, 9, and 12 months, respectively. Assisted patency rate is defined as the interval from initial intervention to permanent occlusion or intervention need stent placement, and it was 88, 76, 70, and 46% at 3, 6, 9, and 12 months, respectively.

Figure 1



Central venous tight lesion.

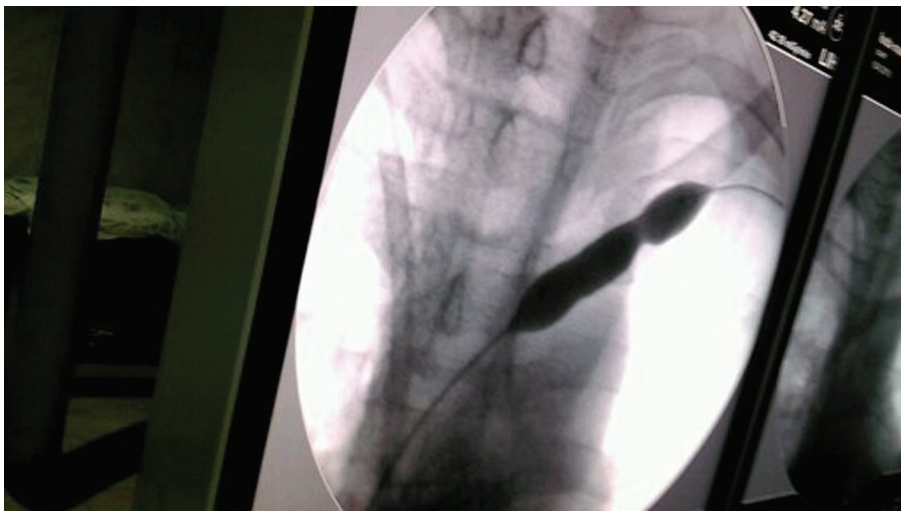
Discussion

Higher incidence of central venous stenosis (CVS) and occlusion has been associated with multiple central venous catheter insertions and longer catheter dwell times. Most of the authors showed that the placement of subclavian vein catheters induces a higher incidence of CVS than that occurs with internal jugular vein catheters. Moreover, there is an evidence that catheters placed in internal jugular vein produce more stenosis when inserted in the left side [4]. The pathophysiology is still not known, but there are many mechanisms that applied in the development of CVS such as trauma caused by catheters, causing intimal wall hyperplasia and inflammatory response within the wall of the vein, and increase in the blood flow turbulence. These inflammatory responses cause platelet deposition and thickening of venous wall [5]. Recently, endovascular interventions for CVS and occlusion have become the first-choice management. Studies that demonstrate angioplasty for CVS and occlusion are few and were retrospectively applied, although these studies reported a high technical and immediate success ranging from

Table 2 Primary patency and assisted primary patency rates for the patients

	3 months (%)	6 months (%)	9 months (%)	12 months (%)
Primary patency	88	63	31	16
Assisted primary patency	88	76	70	46

Figure 2



Balloon dilatation of central venous tight stenosis.

70 to 95%. One of the main causes of technical failure of angioplasty is the elastic properties present in some of these lesions, and some authors advise that stent deployment in these lesions is effective and more durable. A study done by Glanz *et al.* [6] reported approximately 30% primary patency rate at 1-year follow-up in 13 patients presented with subclavian vein stenosis. Another study done by Lumsden *et al.* [7] reported 17% primary patency rate at 1 year of follow-up after percutaneous angioplasty done on 25 patients with CVS. Another prospective study by Quinn *et al.* [5] reported 12% primary patency rate at 1-year and 100% at 1-year secondary patency rate for patients who underwent angioplasty only. Our results are comparable to the results present in literature that show 6-month primary and cumulative patency rates of 23–63% and 28–100%, respectively, and for 12-month primary patency rates of 12–50% and cumulative rates of 14 and 100%. In our study, primary patency and assisted primary patency rates at 6 months were 63 and 76% and primary patency rate and assisted primary patency rate at 12 months were 16 and 46%, respectively. Most authors demonstrated that in access stenosis, especially in CVS, the need for treatment should not depend only on anatomical criteria such as more than 50% reduction in intraluminal diameter. Clinical and physiological abnormalities should guide to which CVS and occlusion should be managed. The development of chest wall collateral veins may improve symptoms, so the conservative management is initially recommended. There is an evidence that angioplasty in asymptomatic CVS can accelerate the progression of stenosis and lead to its rapid recurrence so it is not indicated in these cases. In fact, one main problem of CVS is the restenosis after angioplasty, needing repeated angioplasty to preserve the venous access. Most studies encourage the use of stents and angioplasty with a drug-eluted balloons in case of recurrence or elastic recoil [8].

Conclusion

Angioplasty for CVS is an effective interventional procedure with protecting of an active venous access for patients on regular dialysis; however, in some cases, multiple PTA is needed owing to rapid recurrences and restenosis.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Bakke AM, Protack CD, Saad WE, Lee DE, Waldman DL, Davies MG. Long-term outcomes of primary angioplasty and primary stenting of central venous stenosis in haemodialysispatients. J Vasc Surg 2007; 45:776–783.

2 Vogel PM, Parise C. SMART stent for salvage of haemodialysis access grafts. J Vasc Interv Radiol 2004; 15:1051–1060.

3 Chemla ES, Korrakuti L, Makanjuola D, Chang AR. Vascular access in haemodiaysis patients with central venous obstruction or stenosis:one center experience. Ann Vasc Surg 2005; 19:692–698.

4 Lumsden AB, MacDonald MJ, Isiklar H, Martin LG, Kikeri D, Harker LA, *et al.* Central venous stenosis in the hemodialysis patient: incidence and efficacy of endovascular treatment. Cardiovasc Surg 1997; 5:504–509.

5 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. Cardiovasc Surg 1995; 6:851–855.

6 Glanz S, Gordon DH, Lipkowitz GS, Butt KMH, Hong J, Sclafani SJA. Axillary and subclavianstenosis: percutaneous angioplasty. Radiology 1988; 168:371–373.

7 Lumsden AB, McDonald MJ, Iisklar H, Martin LG, Kikeri D, Harker LA, *et al.* Central venous stenosis in the haemodialysis patients: Incidence and efficacy of endovascular treatment. Cardivasc Surg 1997; 5:504–509.

8 Levit RD, Cohen RM, Kwak A, Shlansky-Goldberg RD, Clark TW, Patel AA, *et al.* Asymptomatic central venous stenosis in hemodialysis patients. Radiology 2006; 238:1051–1056.