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Non-surgical Treatment of Central Venous Occlusion in Haemodialysis Patients

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ABSTRACT

Background: Central venous stenosis (CVS) is often found in patients on hemodialysis. Prior ipsilateral central venous catheterization and cardiac rhythm insertion are major risk factors, however the lack of this history may potentially lead to CVS. Chronic CVS may lead to thrombosis at the point of stenosis with partial or total blockage of the central vein. Objective: To assess in patency, complication rate and death rates the impact of the endovascular repair of central vein blockage following arteriovenous fistula formation. Methods and patients: This potential non-randomized research will be carried out at the Nasr Insurance hospitals vascular chirurgy department. The trial will involve 20 individuals with chronic renal disease and limb edoema after the development of fistula. In accordance with the inclusion criteria listed below, the Ethical Committee shall receive permission. Results: Only 11 patients had balloon angioplasty. There were no immediate difficulties. Six patients with restenosis. One in six patients with PTA with stenting had restenosis. One patient developed recurrence in the stent on diagnostic venography (stenosis). All recurring patients had repeat PTA. Conclusion: Endovascular therapy in individuals who are hemodialysed is an effective and safe approach for the treatment of CVD. Without severe morbidity or death, there is a high technical success rate. Multiple re-interventions for the treatment of restenosis are nonetheless necessary.

Keywords: Arteriovenous fistula, brachiobasilic transposition.

1. Introduction

As advised in 2006, arteriovenous fistula (AVF) is preferable than both arteriovenous grease and central venous catheter for those individuals needing long-term hemodialysis [36[.

The idea for selecting where an AVF should be located in general is to initially try the non-dominant hand before moving on to the dominant hand; from a distal to proximal; from radiocephalic (RC) to brachiocephalic (BC) to brachiobasic transposing (BBT) [8].

Fistulas are nonetheless at an increased risk of early failure at a rate of 38 to 60%. Thus, a failure to mature is the greatest weakness of this sort of vascular access. Improvements in strategies for salvaging fistula non-maturation play a significant role in enabling the dialysis community to accomplish the Fistula First Initiative objectives. By recovering >95% of the over 60% of AVFs which do not develop [10].

Central venous stenosis and blockage is an important problem in individuals who undergo extended hemodialysis that causes substantial morbidity with site dysfunction. Central venous (CVD) illness has been described as 50% or more of the stenosis of the inner jugular, subclavic or axillary veins [20]. Central venous stenosis incidence is 25-40% [21]. The main causes of central venous stenosis in individuals suffering from hemodialysis are extended centre venous catheterization and high-flow status in the arteriovenous fistula or graft generating venous intimate hyperplasia and stenosis (Schwab et al., 1988). Central venous stenosis occurs clinically, ipsilateral swelling of the arm or neck, high venous pressure during hemodialysis and hemodialysis failure. The goal of the therapy is to offer the patients with symptomatic relief while maintaining AVF [37].

Surgical and endovascular therapies for central venous stenosis are available. The appropriate therapy has to be identified, though. Although the main patent rate was high (80-90% for 1 year) with an open-surgical repair of the central veins, [25] the patent rate is high. Endovascular intervention is commonly regarded as the method of treating central venous stenosis [2]. Percutaneous transluminal angioplasty (PTA), bare metal stent and covered stent implantation are endovascular therapy options. The ideal endovascular therapy remains still uncertain, with no evident benefit in contrast to angioplastic primary stent placement [15]. The Quality Initiative Guidelines for the National Kidney Foundation Outcomes [5] have suggested angioplastics as preferable therapy for CVD with or without stent insertion. In this research, we will examine the results in central venous stenosis or occlusion in patients receiving hemodialysis of balloon angioplasties or stenting.

2. Aim of the Work

To evaluate the effect of endovascular repair of central venous occlusion after arteriovenous fistula creation regarding to patency rate, complication rate and mortality rate.

3. Patients and Methods

3.1. Patients

This prospective non randomized study will be conducted in the vascular surgery department at Nasr Insurance hospitals. The study will include 20 patients suffering from chronic kidney disease and limb edema after fistula creation. Satisfying all the inclusion criteria mentioned below, after the clearance from the ethical committee will be obtained.

3.2. Inclusion criteria

Patients with age between 12 - 75 years. Chronic renal failure with dialysis access. Duplex confirmed central venous occlusion or stenosis. Limb edema. Patients giving consent for either types of operations.

3.3. Exclusion criteria

Working or functioning access. Absence of consent to be involved in the study.

2.4. Methods

Non-randomized forward-looking study with 20 patients.

All patients are clinically examined and investigated in depth.

Duplex US assessments of the fistula itself and the proximal outflow and central veins must precede the decision to carry out endovascular repairs.

The vascular diameter, premorbidity and co-morbidity and anaesthetic hazards were clinical contributors to decision-making. Endovascular repair patients will be examined throughout the follow-up period at the post-intervention clinic.

Patients are gathered and examined for demographic and clinical data, AVF features, and outcome data. The study includes demographic and clinical data such as body mass index (BMI), co-morbidity and anti-platelet treatment.

The facts of the AVF will be gathered, including surgery, complications, cancellation tests, salvage and date (include fistuloplasty, thrombolysis, thrombectomy or surgical ligation / revisions). By agreement in the literature, the definitions of patentability are as follows:

Primary patentability

This is the period from the moment of formation of AVF to: I any intervention to preserve or restore patenting; (ii) AVF thrombosis; or (iii).

Primary patent assisted

This is the time period from generation of AVF to: I thrombosis to AVF or (ii) the time of measurement of patentability. The supported primary patent interval involves intermediary operations to ensure the functioning of a patent access (surgical or endovascular intervention).

Secondary patentability

This is the period between the moment of formation of the AVF until I abandonment of the AVF or (ii) measurement time. The secondary patentability interval covers all interventional manipulations (surgical or endovascular procedures) meant to retain a patent access functionality and restore the functioning of thrombozyme AVF.

2.5. Statistical analysis

Categorical data will be described as numbers, ratios, and percentages, whereas numerical data will be described as mean, range, and standard deviation (SD). Categorical data will be compared using Fisher exact/Chi-square test, whereas numerical data were compared using t-test. Statistical significance was set at $p<0.05$. Primary, assisted primary, and secondary patency rates at 1, 3 and 6 months will be calculated using Kaplan–Meier survival analysis. The statistical analyses will be performed using IBM SPSS v.25.

4. Results

A total of 20 patients underwent 20 interventions for endovascular treatment of CVD. The study included 8 men and 12 women with a mean age of 49 years (range, 35-61 years).

Clinical and radiologic findings

11 patients had right-sided venous occlusion and nine patients of the left side. More than one segment was involved in three patients. A total of 14 veins were identified with complete occlusion and stenosis in 6 segments.

Diseased veins were identified as the following, 6 in axillary veins, 5 in subclavian vein, and 9 in innominate vein.

Procedural details

Average number of interventions performed on each diseased venous segment was 1.82. The length of the stenotic segment was 1-3 cm in 13 patients and 3-5 cm in 5 patients. Two patients had long segment involvement of >5 cm.

Table (1) Age.

	Mean ± SD	**Range**
Age	49 ± 11.7	35-61

Table (2) Side affected and type of lesion.

Side Affected	**N**	**%**
Right	11	55%
Left	9	45%
Type of lesion		
Stenosis	6	30%
Occlusion	14	70%

Table 3: Side Affected.

Side Affected	**N**	**%**
Axillary vein	6	30%
Subclavian vein	5	25%
Innominate vein	9	45%

Table (4) Length of affected segment.

Length of affected segment	N	%
1-3 cm	13	65%
3-5 cm	5	25%
>5 cm	2	10%

Table (5) Endovascular Interventions.

Endovascular Interventions	N (%)	Restenosis at one month
Balloon angioplasty	11 (55%)	6 (35.29%)
Balloon angioplasty + stenting	6 (30%)	1 (5.88%)
Failed intervention	3 (15%)	

Table (6) Complications.

Complications	N (%)
Localized extravasation	2 (10%)
Restenosis	6 (30%)
In Stent restenosis	1 (5%)
Dialysis access site failure	4 (20%)

Success rate

Technical success was achieved in 85% cases (17/20). In two patients, the occluded segment could not be passed. Perforation occurred in one patient with no need for further intervention.

In the remaining 17 cases, only balloon angioplasty was done in 11 cases (45%). In 6 cases (55%), balloon angioplasty with stenting was done in the same setting. Symptomatic improvement was reported in all the patients with no major peri-procedural morbidity or mortality.

Complication and re-intervention rate

In two instances, early problems were local extravasation (following which the procedure was abandoned). Late consequences were: in-stent stenosis.

Three patients died at 5, 7 and 12 months after the procedure correspondingly during follow-up.

The percentage of restenosis among effective procedures was 41.18%. 6/11 (54.55 percent) restenosis in individuals treated with PTA alone (at 1 month after the first intervention).

All recurring patients had repeat PTA. Stenting in three individuals was followed by angioplasty. In the case of 1 (25.76 percent) of six patients suffering from stenting PTA, re-intervention was necessary.

On the repeated angiographical examination, a patient was treated with repeated angioplastic balloon in-stent stenosis.

Failure of the site of dialysis was documented in 4 individuals (20 percent). The failure was related to AVF thrombosis in two instances. The other two patients had low speed fistula and aneurysms with puncture site.

Localized extravasation was immediately complicated during challenging handling of the guidewire (two patients). Restenosis (n = 7) was delayed complications.

Patency rate

Primary patency rate at one year was 7/20 (35%), secondary patency was 70%.

5. Discussion

Complications associated with dialysis access have developed substantially in recent years because to the rising number of patients with renal end-stage illness and their longer longevity. CVD is a common problem among hemodialysis patients. Two key aspects involved in the development of CVD are venous trauma owing to central venous cancellation and secondary to high-flow hemodynamic stress related to the AVF site (13; 28).

Central vein location cancellation determines central vein occlusion. Venous stenosis has been found in up to 50% of patients having subclavian vein catheterization (22; 17). On the other hand, the lowest prevalence of CVD was related with internal jugular vein cannulation (34). The DOQI recommendations on dialysis outcomes and quality initiatives urged avoiding the catheterization of subclave veins in patients suffering from chronic renal failure to get temporary access (29).

The development of central venous stenosis increases arteriovenous pressure at the location of dialysis access. The resulting venous hypertension produces considerable local morbidity due to swelling of the end, neck and chest. The first treatment techniques included either the operational ligation of the fistula and the abandonment of the dialysis area, or the open operational repair of the central veins. Although the main patent was high for one year (80-86 percent), surgical procedures showed substantial morbidity (42). In the 1980s, investigation of several approaches for the treatment of central venous stenosis was initiated (12).

Endovascular therapy is now the preferred therapy for CVD. The several endovascular procedures employed include angioplastic ballooning, stenting and, more recently, angioplastic cutting. The ideal management

approach remains unclear. Some supported primary stenting in the treatment of CVD, (15; 30) while others recommended ballon angioplasty as the main therapy, reserving stenting for failure to treat or restenosis (14; 31; 38).

With this research, we documented our early experience in central venous lesions endovascular.

In our case series, the first technical success rate was 85%. In the event of technical failure, the guideline in the subclavian vein could not be passed through the fully blocked venous section. For PTA, the literature showed a technical success rate of 70 to 90 percent (6; 19; 9; 40). Very high percentages of technical success in bare metallic stenting were reported in literature ranging from 90 to 100% (41. 39; 3).

We only conducted angioplastic balloon in 11 individuals. There were no immediate difficulties. Six patients with restenosis.

At one year, our main patent rate reached 35%. Elastic recurrence is believed to be the reason of early recurrence in PTA patients (31). Primary patenting rates for PTA in earlier trials varied from 23 percent to 55 percent at 6 months, and 12 to 50 percent at 12 months. Cumulative patent rates ranging from 29 percent to 100 percent and from 13 to 100 percent correspondingly at 6 and 12 months (19; 9; 38).

PTA with stenting was done in the remaining six cases. We employed the self-extended stent of nitinol. While nitinol stents are known to give higher flexibility and resistance to kinking, no significant difference between wallstents and nitinol-based stents has been reported in two earlier investigations (23; 24). In another trial, however, nitinol stents were more effective than wallstents (33). Recently, coated stents were also used for central venous stenosis therapy. The little known research on the effectiveness of covered stents has revealed a high technical success rate with positive results (32; 26; 1). Covered stents thus seem to be a viable alternative for endovascular therapy. Their costs nonetheless remain the limited component and the cost/benefit analysis should be taken into account.

One in six patients with PTA with stenting had restenosis. One patient developed recurrence in stent with diagnostic venography (stenosis). All recurring patients had repeat PTA.

Hemodynamic stress and turbulence caused by increased AVF blood flow caused intimate hyperplasia, resulting to stent restenosis (11). Primary patency rates of 63-100 percent at 3 months, 42-89 percent at 6 months and 14-73 percent at 12 months were reported with bare metalic stenting. The cumulative patentability rates vary from 72% to 100% between 55% and 100%, and 31% to 97%, respectively, at 3, 6 and 12 months (3; 5).

There were certain limitations to our investigation. It was a non-randomized research, first of all. Secondly, there was a fairly small number of patients.

6. Conclusion

Endovascular therapy is an efficient and safe way of treating CVD in individuals who receive hemodialysis. It has a high rate of technical success without considerable morbidity or death. Multiple re-interventions for restenosis therapy are, nevertheless, necessary.

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