# Assessment of Technical Success and Primary Patency of the Central Veins after PTA Alone Or With Stenting To Treat Patients Having Upper Limb Venous Hypertension after Creation of an Arterio-Venous Access

***Sherif Essam Tawfik MD, Mohamed Abd El-Monem Abd El-Salam Rizk MD, Abd elrahman Mohamed MD***
Vascular Surgery Department, Ain Shams University

## ABSTRACT

***Aim:*** *To assess the primary patency of the central veins of the upper limb after percutaneous transluminal balloon angioplasty (PTA) with or without stenting, and to determine if there is a difference between early and late intervention as regard technical success, also to assess the effect of lesion character on technical success.* ***Patients & Methods:*** *Twenty seven (27) patients having venous hypertension of the upper limb on regular hemodialysis at Ain Shams University Hospitals dialysis units from January 2014 till July 2014, were included in the study. Patients underwent balloon dilatation of stenotic or completely occluded central veins with or without stenting and the primary patency of this procedure was assessed through a period of a year.* ***Results:*** *The technical success rate was 85.2% (n=23), 1ry stenting was done in 63% (n=17) of cases. The patency rate in 6 months was 47.8%, and in one year was 37%. Success rate in early cases were 94.4% /n=17, while in late cases were 66.7% /n=6. 1ry stenting was 64.7%/n=11 in early cases while in late cases it was 100%/n=6.* ***Conclusion:*** *Percutaneous transluminal angioplasty alone or with stentning carry a high technical success rate especially if done in the first 6 months from the occurrence of symptoms.*
***Key words:*** *Venous hypertension, PTA for central viens, primary stenting of central veins*

## INTRODUCTION

Venous Hypertension is a significant problem for patients on regular haemodialysis that result in disabling upper extremity edema and impairment of arteriovenous access function. This problem seems to be increasing in clinical importance as the ability for medical care for patients on haemodialysis continues to improve, resulting in patients living longer. This may be due to an actual increase in incidence of the problem, or a greater awareness and recognition of the problem.[1]

Venous hypertension after access construction is due to central venous stenosis or occlusion or valvular incompetence in the more peripheral arm veins with retrograde flow. The exact incidence of central venous lesions in the haemodialysis population is unknown. It is estimated that between 5% and 20% of haemodialysis patients develop central venous stenosis. The incidence of significant (>50%) central venous stenosis following subclavian vein catheter placement is 42% to 50%, while it is 10% in patients with internal jugular catheters.[2]

Several factors have an impact on the development of central venous lesions, including longer catheter indwelling times, multiple catheterizations, and longer functioning ipsilateral arterio-venous access after ipsilateral catheter placement.[2]

Loss of the central draining vein may eventually cause the ipsilateral upper extremity to be abandoned for any access interventions, including access to the central veins using catheters. Therefore, prevention and early recognition and treatment of this situation are crucial.[2]

Endovascular treatment of central lesions offers the potential to address a difficult anatomic problem with little morbidity and often in an outpatient setting. The preferred treatment for central venous stenosis is percutaneous transluminal angioplasty.[3]

## PATIENTS AND METHODS

This study was conducted upon patients on regular haemodialysis at dialysis units of Ain Shams University hospitals (Demerdash & Ain

Shams University Specialized Hospital [ASUSH]).

This is a cohort study in which the sample was collected in the period from January 2014 till July 2014, and having venous hypertension of the upper limb.

**The inclusion criteria of these patients were:**

1. All patients were having haemodialysis sessions for more than 6 months.
2. Increase of venous pressure resistance during haemodialysis (measured by the dialysis machine pressure transducer at the beginning of hemodialysis using 15 gauge needles at a blood flow of 200 ml/min, measurements > 150 mmHg are considered abnormal).
3. Persistent or progressing entire limb swelling after creation of arterio-venous access.
4. Appearance of dilated chest veins after creation of arterio-venous access.
5. Venous ulcers in the upper limbs due to venous hypertension.
6. Patient's approval to be included in the study.

**The exclusion criteria were:**

1. Patients on haemodialysis for less than 6 months.
2. History of previous Upper limb DVT prior to AV access creation.
3. Presence of non central venous lesions as anastomotic or puncture site stenotic lesions.
4. Non Functioning arterio-venous access.

**Every patient was subjected to:**

1. History taking with especial attention to previous central venous catheterization.
2. Clinical examination with recording of the upper limb size (circumference)
3. Duplex Scanning and CT angiography, and in case these tests were inconclusive, intraoperative direct angiography was done

**Procedure:**

1. The procedure was done under local infiltration anesthesia with puncture of the arterialized vein or PTFE graft of the affected site while the patient is in the supine position**.**
2. Seldinger technique was used with introduction of a 8 -10 F (Prelude®, MeritMedical or Cordis®) sheath, Diagnostic angiogram was done to visualize the lesion for intervention using non ionic contrast media.
3. A 0.035 angled tip guide wire (Terumo®, Terumo corporation) was manipulated to cross the lesion as much as possible distal to the lesion, this negotiation with the lesion was done by a combination of a support catheter 5F angiographic catheter (Performa®, MeritMedical) .
4. After crossing the lesion, large diameter balloons (XXL™ Balloon Dilatation Catheter, Boston Scientific Corporation) of 12-16 mm diameter with length of 40 mm were used for dilatation. The balloon catheter was advanced into position over the guide wire using fluoroscopy. The balloon was slowly inflated by diluted contrast solution under fluoroscopy, using an inflation device.
5. Completion angiography was done for evaluation of angioplasty results. Technical success was defined as improvement of luminal diameter of more than 50% of normal vein diameter as judged by pre stenotic vein diameter or the presence of less than 30% residual stenosis.
6. A stent 14-18 mm with different lengths was placed over the lesion in case of residual stenosis ≥ 50%, or rapid recoil after balloon dilatation.
7. Manual compression of the puncture site: immediately after removal of the sheath for 15 to 20 minutes (it was done immediately after the procedure).
8. Follow up was done at 3, 6, and 12 months postoperatively.

## RESULTS

This study was conducted on 27 patients undergoing regular haemodialysis sessions at Ain Shams University Hospitals dialysis units (Demerdash unit 1,2 & ASUSH ).

The patients included in the study were 16 males versus 11 females with a percentage of 59.2 % and 40.8% respectively. The mean age of patients was 52.59±12.6 years (ranging from 30 to 72 years)

Of the studied group, only two patients had no previous history of central venous catheterization representing 7.4%, while the other 25 patients (92.6%) had previous history of central venous catheterization.

The following table shows patients' symptoms and the duration of their symptomatology.

**Table (1):** Description of the studied patients with venous hypertension

| | | N | % |
|---|---|---|---|
| **Duration of venous hypertension** | <6mns | 18 | 66.7% |
| | >6mns | 9 | 33.3% |
| **Side** | Rt | 17 | 63.0% |
| | Lt | 10 | 37.0% |
| **Edema** | Negative | 1 | 3.7% |
| | Positive | 26 | 96.3% |
| **Dilated Chest Veins** | Negative | 7 | 25.9% |
| | Positive | 20 | 74.1% |
| **Increasing Venous pr. During hemodialysis** | Negative | 0 | .0% |
| | Positive | 27 | 100.0% |
| **Venous ulcer** | Negative | 26 | 96.3% |

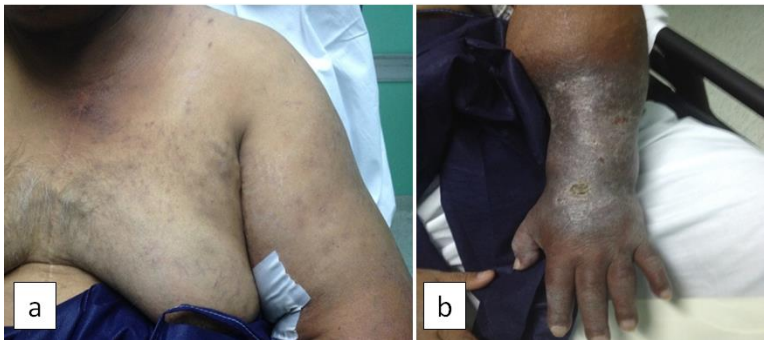


**Fig. (1):** Patient with dilated veins over the chest (a). Patient with venous ulcer and edema of the left upper limb (b).

All patients were subjected to either duplex examination, CT venography or intaraoperative venogram to determine the location and degree of the lesion. Twenty one patients (77.8%) had a sublavian lesion, while 16 patients (59.3%) had an innominate lesion. As for the degree of occlusion, 10 (37%) patients had total occlusion while 17 (63%) patients had significant stenotic segment.

Twenty three patients has had a successful intervention for their stenotic or occluded central venous system segments, of which 17 were stented.

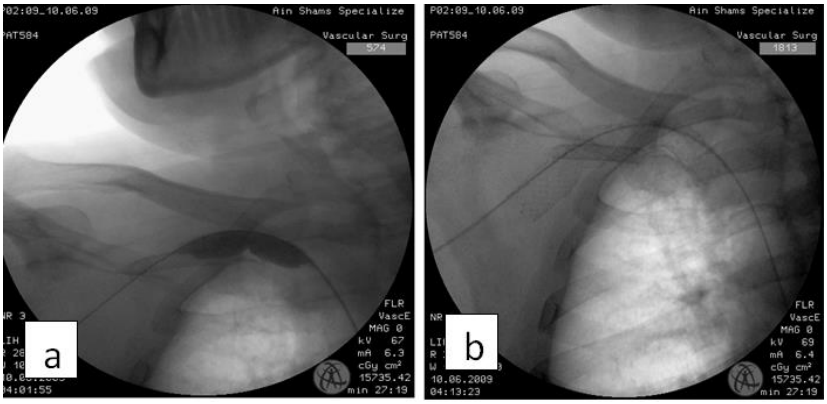


**Fig. (2):** (a,b) A case of venous hypertension with right subclavian vein stenosis and underwent subclavian vein balloon dilatation and stenting.

Follow up of these patients was done depending upon recurrence of symptoms including recurrence of upper limb swelling, presence of veins on anterior chest wall, and/or follow up duplex. Patency rates were found to be 52%, 47.8%, 37% for 3 months, 6 months and 1 year respectively.

We compared the success rate in patients who has had venous hypertension for less than 6 months period and those who had it for more than 6 months. We found the results to be insignificant inspite that 33.3% of patients with venous hypertension for more than 6 months had an unsuccessful procedure, as regard technical success rate in relation to lesion character, we found that the rate of total occlusion success was 60% while stenotic lesions was 100%, and the following table showed these results.

**Table (2):** The success rate in relation to lesion character and the duration of venous hypertension.

| **Duration of venous hypertension** | | | | | **P value** |
|---|---|---|---|---|---|
| **<6mns** | | **>6mns** | | | |
| **N.** | **%** | **N.** | **%** | | |
| 17/18 | 94.4% | 6/9 | 66.7% | | |
| **Degree of occlusion** | | | | | |
| **Total occlusion** | | **Stenosis** | | Fisher's exact | 0.09 |
| 6/10 | 60.0% | 17/17 | 100.0% | | 0.01 |

## DISCUSSION

In our study, 27 patients diagnosed of having venous hypertension of the upper limb underwent endovascular intervention, with technical success rate 85.2% (n=23), 1ry stenting was done in 63% (n=17)of cases. The patency rate in 6 months was 47.8%, and in 1 year was 37%.

In 2006, the National Kidney Foundation (NKF) Disease Outcomes Initiative (KDOQI) guidelines recommended percutaneous transluminal angioplasty (PTA), with or without stent placement, as the preferred intervention.[4]

Stent placement is recommended only for elastic recoil of the vein (>50% stenosis) after angioplasty or for recurrent stenosis within 3 months.[3]

Initial success rates for angioplasty alone in multiple series range from 70% to 100%. However, 6-month patency drop to between 13% and 86%. In a study using endovascular ultrasound, approximately 64% of patients had significant elastic recoil of the venous lesion after angioplasty alone. In patients treated solely with angioplasty, only 36% obtained primary symptomatic relief at 1 year, but this number increased to 86% with repeated treatments.[2]

Past studies have suggested that PTA combined with bare-metal stents (BMS) for central venous lesions improves the success with better long-term patency[5]; however, this improvement has not been confirmed. Still, BMSs for central venous occlusive disease in the setting of refractory stenosis are being used. Until now, no literature has demonstrated the superiority of BMS over PTA.[5]

In a study by Haage et al which included 50 patients in whom 50 Wallstents (Boston Scientific, Natick, Mass) were placed, with a reported 12-month patency rate of 56%.[6]

Glanz et al., reported a 30% primary patency rate at 1-year follow-up in 13 subclavian vein lesions among 19 patients with 29 axillary and subclavian vein dilations.[7]

Lumsden et al., similarly reported a 17% 1-year primary patency rate after percutaneous treatment of 25 central venous stenoses.[8]

Quinn et al., in their prospective randomized trial of PTA vs PTA with stenting, reported a 1-year primary patency of 12%.[9]

Bakken et al, in the study comparing PTA alone or PTA with primary stenting, stated that the initial treatment of central venous stenosis was technically successful in 82% of the PTA group and 96% of the PTA and stenting group.[10]

In the study by El-Sabrout and Duncan the recommended PTA as a first line of management in case of central venous occlusion as it is associated with less morbidity and mortality in comparison to the surgical option.[11]

In our study we divided the study group into patients having venous hypertension for less than 6 months and those having venous hypertension for more than 6 months. We found that technical success rate in early cases were 94.4% /n=17, while in late cases 66.7% /n=6. 1ry stenting was 64.7%/n=11 in early cases while in late cases it was 100%/n=6

Regarding technical success rate in relation to lesion character, we found that the rate of total occlusion success was 60% while stenotic lesions was 100%.

## CONCLUSION

Venous hypertension of the upper limb is a serious complication to the creation of arterio-venous access, that occurs due to central venous stenosis or complete occlusion. Central venous stenosis or occlusion may occur due to the use of central venous catheters.

Venous hypertension may lead to upper limb swelling, the appearance of dilated veins over the chest, venous ulceration, and above all inability to perform adequate dialysis from this access.

Percutaneous transluminal angioplasty alone or with stentning carry a high technical success rate especially if done in the first 6 months from the occurrence of symptoms.

As regard the 1ry patency in the first year, it is acceptable as more than one third of cases remain symptom free with efficient dialysis from the access. Yet PTA is reproducible.

## REFERENCES

1. Elseviers MM, Van Waeleghem JP: Identifying vascular access complications among ESRD patients in Europe. A prospective, multicenter study. Nephrol News Issues 2003; 17:61-64.66-68.
2. Dosluoglu HH, Harris LM: Haemodialysis Access: Nonthrombotic Complications, chapter 75, Section 10, Rutherford's Vascular Surgery, 7th edition Cronenwett JL, Johnston KW (eds.), 2010: 1137-1154.
3. 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; 32:760-769.
4. Quinn SF, Kim J, Sheley RC. Transluminally placed endovascular grafts for venous lesions in patients on hemodialysis. Cardiovasc Intervent Radiol 2003;26:365-9
5. Kundu S. Review of central venous disease in hemodialysis patients. J Vasc Interv Radiol 2010;21:963-8.
6. Haage P, Vorwerk D, Piroth W, 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;212:175-180
7. Glanz S, Gordon DH, Lipkowitz GS, Butt KMH, Hong J, Sclafani SJA. Axillary and subclavian vein stenosis: percutaneous angioplasty. Radiology1988;168:371-373.
8. 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.
9. Mickley V, Gorich J, Rilinger N, Storck M, Abendroth D. Stenting of central venous stenoses in hemodialysis patients: long-term results.Kidney Int 1997;51:277-280.
10. Bakken 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 hemodialysis patients. J Vasc Surg 2007;45:776-783
11. El-Sabrout RA, Duncan M. Right atrial bypass grafting for central venous obstruction associated with dialysis access: another treatment option. J Vasc Surg 1999; 29: 472-478.