



Case Report

The Experience of Using Plain Balloon Percutaneous Venoplasty in Central Vein Stenosis in Hemodialysis Patient: Insight for Better Development Strategy

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ABSTRACT

Background: Central vein stenosis is the most complication among hemodialysis patients. The proper management is still challenging because venoplasty is the main recommendation, but it has potential complications. The comparable data of plain vs. drug-coated balloons still exist. In particular, the plain balloon can be an alternative when the drug-coated balloon is not always available.

Objective: In this presentation, we will discuss using plain balloon venoplasty as an urgent strategy to relieve central vein stenosis in hemodialysis patients and its outcome after the procedure in our hospital.

Case Illustration: A female, 56 years old suffered from unilateral upper extremity edema. She had undergone routine hemodialysis and had a history of an AV shunt inserted three months ago. We suggested this patient with central vein stenosis. We performed venography that resulted in a stenosis of 95% at the brachiocephalic vein and underwent plain balloon percutaneous venoplasty. After the procedure, her right upper extremity was getting better. In the next three months, she complained that her right upper extremity had become swollen again. We performed re-venography, which resulted in restenosis of the brachiocephalic vein. She underwent percutaneous venoplasty again, and the evaluation was better. The diameter of her upper right extremity was smaller, and she could do her daily activity.

Conclusion: Central vein stenosis was one of the most complications after dialysis catheter insertion. We performed percutaneous venoplasty and observed the outcome of this patient. After three months, the symptom was recurrent, and we performed percutaneous venoplasty again.

1. Introduction

The treatment of central vein obstruction is challenging. Central vein stenosis frequently encountered problems among dialysis patients. Diagnosis criteria of central vein stenosis are defined as narrowing of vein diameter > 50% and were accidentally found in 42% of patients who undergo dialysis.⁷ Venoplasty is more assessable, but recoil dan restenosis is the most common issue after the venoplasty procedure.¹¹

Both plain and drug-coated balloons are available in percutaneous venoplasty despite the possibility of stent insertion. Both angioplasty and stenting showed poor patency. Stenting has a better primary patency rate in the first two years, although KDOQI recommended angioplasty first.^{1,7} The recommendation of percutaneous venoplasty before stent implantation has been performed.

The previous study showed that the drug-eluting balloon patency rate was higher than plain balloon¹¹, but the report data in our country was limited, and the drug-coated balloon was not ready. Hence, we present a case illustration of a hemodialysis woman who suffered from central vein occlusion and underwent a plain balloon venoplasty procedure.

2. Case Illustration

A year female 56 years old came to Saiful Anwar Hospital with a chief complaint of gradual right upper extremity swelling three months ago. She said that heavy to move her arm and disrupt her daily activity. No history of chest pain or shortness of breath. She had a history of chronic kidney disease in the last three months ago, inserted an AV shunt, routinely controlled with internal medicine,

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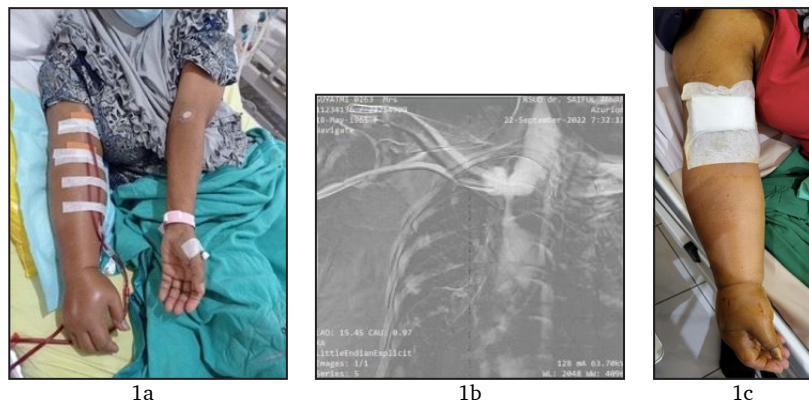


Figure 1. Clinical appearance of the patient at first admission (A), venography showed stenosis of right brachiocephalic vein with diameter stenosis 2.1 mm (B), and after first percutaneous plain balloon venoplasty on day-1 (C).

and underwent routine hemodialysis at RSSA. We got unilateral pitting edema from the right chest, neck, and arm to the fingers from the physical activity. The pulsation and peripheral oxygen saturation were normal. The motoric function was limited due to edema decrease of sensory function. We found an AV shunt at her right cubiti regio from duplex ultrasonography. We suspected this patient had central vein stenosis.

We performed venography, which resulted in stenosis in 95% of the brachiocephalic vein. The patient underwent percutaneous venoplasty with plain balloon Mustang 6F 8.0x8.0x135 mm inflated balloon 20 atm for 2 minutes and upsizing balloon with Mozec PTA 12x40x135 mm inflate balloon 20 atm for 2 minutes. The evaluation of final evaluation was reasonable. She was hospitalized for three days, and the edema was getting better (Figure 1).

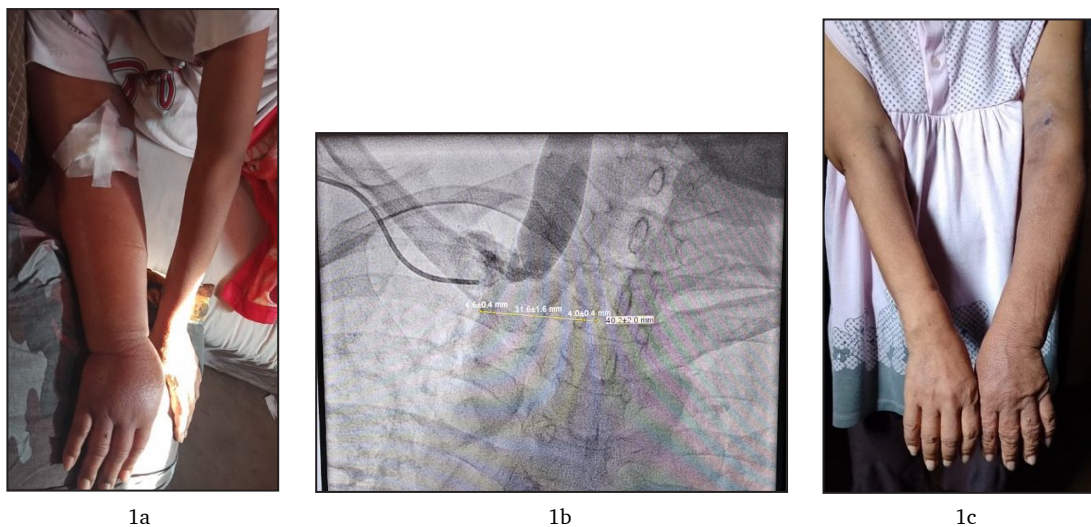


Figure 2. Recurrent upper right extremity is swollen after 3 months of venoplasty (A), venography with stenotic vessel diameter 4.6 mm (B), and one week after second percutaneous plain balloon venoplasty (2).

We observed this patient, but in the next three months after the procedure of percutaneous venoplasty, she complained that her right upper extremity was swollen. We suspected her re-stenosis of the central vein, and we performed venography, resulting in brachiocephalic vein stenosis. She underwent plain balloon percutaneous venoplasty, and the evaluation until now was better. The diameter of the upper right extremity became smaller (Figure 2).

3. Discussion

The term AV access dysfunction describes the three AV access complications. Narrowing luminal diameter until $> 50\%$ in the first 15 minutes of observation after the invasive procedure was the definition of elastic recoil¹¹, while technical failure was defined as $\geq 50\%$ restenosis within 30 days after the procedure.¹¹ Subclavian vein (SCV), brachiocephalic or innominate veins, and superior vena cava are the term of central vein.⁷ In this case presentation, the stenotic lesion was at the brachiocephalic vein.

One pathophysiology of central vein stenosis is because of an increase in pressure and blood flow. Increased collateral venous and lymphatic drainage induces ipsilateral vein dilatation at the upper arm, neck, and superior chest.¹² Another study described that turbulence could induce shear stress that developed into neointima hyperplasia. This neointimal hyperplasia caused endothelial injury and resulted in significant stenosis leading to disturbance of blood flow.¹⁰ The arteriovenous access flow dysfunction assessment is typically associated with underlying stenotic lesions and/or thrombosis. Morbidity is the most complication of progressive vascular access stenosis with subsequent vascular access failure. Venous hypertension, aneurysmal degeneration of the arteriovenous fistulas/grfts outflow tract. These effects impair dialysis, induce loss of renal replacement therapy, and cause ineffective arteriovenous fistulas/grfts.⁷ Clinical manifestations of central vein stenosis are ipsilateral edema, pain, and venous varicosities of the ipsilateral upper limb, which may extend to the neck and chest. The primary treatment for symptomatic central vein stenosis is endovascular therapy. KDOQI Clinical Practice Guideline for Vascular Access 2019 recommends using high-pressure balloon angioplasty as the immediate treatment of both clinically and angiographically significant central vein stenosis secondary to arterial venous fistula.⁷

Elastic recoil is the post-intervention complication that potentially happens within three months after the procedure.^{1,2} A study among dialysis patients compared the patency rate of central veins among plain balloon vs. paclitaxel drug-coated balloon population. They follow up in one, three, and six months. The median patency rate was significantly higher in the paclitaxel drug-coating balloon than in the plain balloon (109.0 days after the plain balloon and 238.5 days after the paclitaxel drug-coated balloon). No statistically significant difference between plain balloon venoplasty versus paclitaxel drug-coated balloon venoplasty in one-month patency ($p > 0.05$), and a statistically significant difference was found between 3- and 6-month patency rates ($p = 0.031$ and $p < 0.001$).⁴

Impression study, 2021, that observed the use of sirolimus versus plain balloon. This study described that a plain balloon might exacerbate intimal hyperplasia resulting in restenosis following interventions.¹⁰ Drug-coated balloons blunt the acceleration of intimal hyperplasia, so it has the potential benefit of reducing the re-intervention rate. The technical success rate of PTA with less than 30% residual stenosis was 78%. About 15.6% of patients showed narrowed vessels ($>50\%$) in 15 minutes and did not influence the primary access after PTA.¹¹

Frequent reinterventions procedure result in high patient morbidity. Stenting is an alternative to refractory or recurrent central venous stenosis. A systematic review of central vein intervention using venoplasty versus stenting in 456 central vein stenosis patients showed that the brachiocephalic vein was the most affected. The stenting patient has a superior primary patency compared with the patient undergoing venoplasty in the first two years, and the complication rate was low.⁸ The 12-month primary patency rate for both stenting and angioplasty is poor (less than 60%). Secondary patency rates for venoplasty and stenting were comparable, with a 12-month secondary patency rate for venoplasty ranging from 77.8% to 91.6% and 89.6% to 98.4% for stenting.¹ Percutaneous angioplasty (PTA) or surgical revision in AV fistula with $> 50\%$ stenosis in either venous outflow or arterial flow were recommended by KDOQI10.

The earlier investigation of the long-term result of primary stenting vs. angioplasty found that the 30-day rate was 76% for both groups, and the 12-month rate was 29% for PTA and 21% for both groups for PTS ($P=0.48$). Assisted primary patency was similarly comparable ($P=.08$), with the PTA group having a 30-day patency rate

of 81% and a 12-month rate of 73% compared to PTS-assisted patency rates of 84% at 30 days and 46% at 12 months. Paclitaxel-coated balloons improve patency rate in cases of early central venous restenosis with no procedure-related problems. The median primary patency period for paclitaxel-coated balloons was nine months, compared to 2.5 months for the last preceding treatment with ordinary balloons. ($p < 0.001$).⁶

4. Conslusions

Central vein stenosis can be treated with both percutaneous venoplasty. Both plain and drug-coated balloons are available, although the previous study showed that drug-coated balloons had a better outcome. In exceptional conditions where the drug-coated balloon is unavailable, the plain balloon may be used as an urgent strategy despite the risk of recurrent recoil. In this case, our report was a plain balloon percutaneous venoplasty in a hemodialysis woman with central vein stenosis.

5. Declarations

5.1. Ethics Approval and Consent to participate

This study was approved by local Institutional Review Board, and all participants have provided written informed consent prior to involvement in the study.

5.2. Consent for publication

Not applicable.

5.3. Availability of data and materials

Data used in our study were presented in the main text.

5.4. Competing interests

Not applicable.

5.5. Funding source

Not applicable.

5.6. Authors contributions

Idea/concept: DIS, SA. Design: DIS, SA. Control/supervision: SA, AR. Literature search: DIS, SA. Data extraction: DIS, SA. Statistical analysis: KAN SW. Results interpretation: SA, AR. Critical review/discussion: SA, AR. Writing the article: DIS, SA. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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