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Interventional management of a patient with multiple stenoses: subclavian, jugular and innominate trunk with arteriovenous fistula dysfunction: A case report.

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Abstract

Introduction: Dysfunction of an arteriovenous fistula in the right upper extremity may be caused by subclavian vein injuries following catheter placement at the start of treatment, potentially leading to chronic stenosis sequelae that affect the development of primary access.

Clinical case: This is a 66-year-old patient with stage 5d chronic kidney disease who is undergoing hemodialysis. He presented with a dysfunctional arteriovenous fistula and significant edema in the right upper extremity, along with collateral circulation.

Diagnostic workshop: Interventional treatment revealed chronic stenosis in the right subclavian vein and innominate trunk.

Outcome: Interventional treatment using a stent graft and balloon angioplasty significantly improved access flow, reduced edema, and enabled continued hemodialysis sessions without complications.

Conclusions: In interventional surgery, stent-grafts offer an effective solution to extend the useful life of vascular accesses, enhancing the quality of life and decreasing the need for repeated interventions in patients with exhausted access.

Keywords:

Chronic kidney disease, vascular access, stent grafts.

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Loss of vascular access is life-threatening for patients requiring hemodialysis. Even access dysfunction, caused by stenosis of the central venous system, is detrimental to the health of the patient, triggering a series of symptoms and signs derived from infradialysis and substantially decreasing the survival of patients compared with those with functional access [1]. Stenosis of the subclavian vein is a sequel to its puncture at the time of the need to start replacement therapy for renal function in an emergent way [2], so the current recommendations are the use of access through the jugular vein with high punctures and early programming of access in the upper limbs, as well as completely excluding the use of catheters with programs for the creation of native vascular accesses before the start of the hemodialysis program (Fistula First) [3].

When stenosis of the right subclavian vein has occurred, the primary and early sign is edema of the right upper limb, where vascular access is located. The measurement of vascular access flow can predict vascular access stenosis [4]. In these cases, the possibility of rescuing access via the endovascular option with balloon angioplasty and the placement of a stent is an advanced alternative to ensure the continuity of the treatment and improve the quality of life of the patient [5].

Arteriovenous grafts have been established as effective alternatives for this group of patients, offering benefits such as a higher long-term success rate. The implementation of early and biological grafts, as well as the use of endovascular techniques such as thrombolysis and angioplasty, represents advances in managing vascular complications [6].

The KDOQI guidelines establish that high-pressure balloon angioplasty is a reasonable initial approach for treating hemodynamically significant stenotic lesions in arteriovenous fistulas and grafts, both clinically and angiographically [7].

This article presents a case report of a patient with central stenosis accompanied by a dysfunctional arteriovenous fistula and edema in the same affected arm. It highlights the complexity and challenges of managing compromised vascular access.

Clinical case

Clinical history

This is a 66-year-old man, originally from the province of Manabí, whose occupation is mechanical. His personal medical history included high blood pressure diagnosed 8 years ago, type 2 diabetes mellitus with an evolution of 37 years, chronic kidney disease in renal replacement therapy, and hemodialysis three times a week for the last 8 years.

His clinical history included previous use of multiple vascular access devices, including placement and repeated changes in catheters for hemodialysis. Similarly, he had a history of arteriovenous fistulas (AVFs) in both arms: a fistula in the left arm that is currently nonfunctional and another in the right arm with dysfunction.

Figure 1 . Physical examination of the patient's limb.

Arm edema with presence of collateral circulation at the level of the thorax.

Figure 2 . Physical examination of the neck area.

Collateral circulation and presence of hepatojugular reflux.

Physical examination

On physical examination, collateral circulation at the hemithorax level was observed. A right cephalic humerus arteriovenous fistula was observed, with a palpable thrill present. The edema in the limb and neck involvement was also evident; peripheral pulses were regular, and the capillary filling was 4 seconds. In the other limb, the patient has a humerus-cephalic arteriovenous fistula, which is not functional and lacks thrill (Figure 1 and Figure 2).

Diagnostic workshop

Angiographic studies of the upper limbs, such as fistulography, phlebography and cavography, were performed. Right arteriovenous fistulography demonstrated patency of the venous system without significant angiographic lesions. On phlebography, the right subclavian vein was observed with chronic occlusion, and obstruction was also observed in the right jugular vein and the right innominate trunk. On cavography, the superior vena cava was patent and without significant angiographic lesions. The patient was classified as having central vessel stenosis, which caused edema of the arm, dysfunction of the AVF, and, therefore, collateral circulation (Figure 3).

Treatment

Angiography was performed with peripheral angioplasty treatment in the areas of stenosis, with a double peripheral balloon technique in the right subclavian vein and right innominate trunk. A Covera ™ (Becton, Dickinson and Company, Tempe, AZ, USA)-mediated stent graft with antiproliferatives (sirolimus) was positioned in the stenosis of the subclavian vein. With pre- and postprocedure control of endoluminal ultrasound (IVUS/NIRS), correct positioning and adequate blood flow can be visualized (Figure 4 and Figure 5).

Evolution

After the procedure, acetylsalicylic acid + clopidogrel treatment was established in addition to anticoagulation during hospitalization. Clopidogrel 75 mg once a day, apixaban 2.5 mg every twelve hours and diosmin + hesperidin 500 mg every twelve hours were given upon discharge. Seven days after the intervention, the patient attended a medical check-up, in which a favorable evolution was observed. During the clinical evaluation, a significant decrease in edema in the affected arm is highlighted, reflecting an improvement in vascular access function. In addition, hemodialysis sessions without complications are reported, with adequate parameters and flows that ensure the effectiveness of the treatment.

Patient perspective

The patient manifested notable improvement in the clinical symptoms he previously presented, including a reduction in heaviness and discomfort associated with edema. Likewise, it refers to improving quality of life, with greater comfort during daily activities and a perception of general well-being.

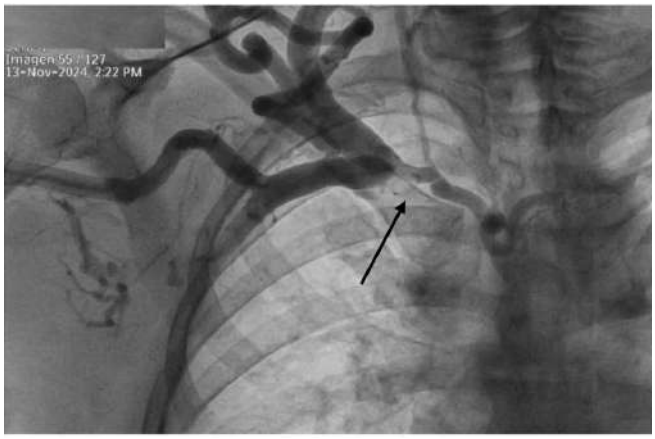
Discussion

The depletion of vascular access (VA) in patients with chronic kidney disease (CKD) is a significant challenge for the management of hemodialysis, significantly when previous access is compromised by stenosis, thrombosis or other complications. This phenomenon is common in patients with terminal CKD, who depend on these access points for their treatment, which underlines the importance of developing effective and sustainable solutions. The need to start surgery with humerus-cephalic accesses, as in this patient, implies that the radiocephalic accesses had a diameter of less than 3 mm, which prevented his surgery.

The case presented in this publication involves the treatment of double-balloon angioplasty and the use of a graft stent in the subclavian vein, and the right innominate trunk represents an advanced and promising therapeutic approach to managing central vessel stenosis. Endovascular revascularization of central veins through the placement of stents offers an effective solution for treating chronic stenosis. By restoring blood flow, symptoms associated with venous obstruction are alleviated, and the duration of vascular access is prolonged. This therapeutic strategy is particularly relevant in hemodialysis patients, where the loss of functional vascular access represents a frequent and limiting complication. This finding is consistent with the results obtained in the present clinical case, where intervention with a graft stent and the double balloon technique allowed the viability of vascular access to be maintained in a patient with multiple previous complications.

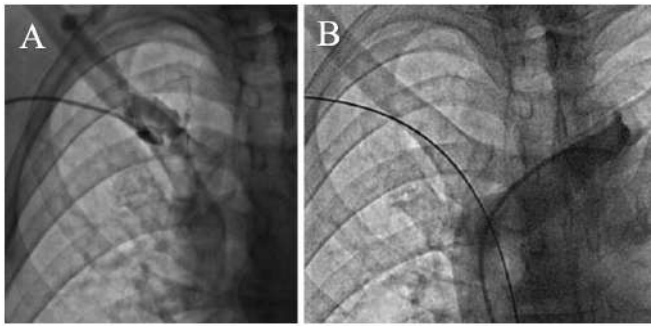
One of the most significant challenges of managing exhausted vascular access is thrombosis. This condition worsens the viability of traditional access and increases the risk of infection and access failure [8]. The success of the intervention carried out in the present clinical case highlights the effectiveness of stents as an option to treat and reduce complications associated with central vessel thrombosis and stenosis.

Figure 3 . Diagnostic Venography of the Subclavian Vein.



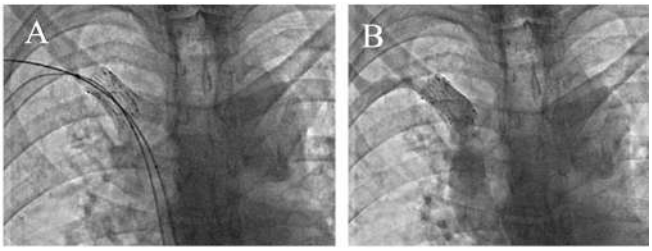
Right subclavian vein with chronic occlusion. Right jugular vein with chronic occlusion. Right innominate trunk with chronic occlusion.

Figure 4 . Stenosis dilation interventionism.



Interventional image: a cord is observed passing through areas of stenosis, prior to resolution with angioplasty.

Figure 5 . The results of interventionism.



A. Image showing the Stent Graft.
B. Resolution after angioplasty of the right subclavian vein and right innominate trunk.

One of the most relevant observations in our clinical case was the significant short-term improvement in the quality of life of the patient after the intervention. The decrease in edema and normalization of the hemodialysis sessions provided physical and psychological relief by allowing the patient to continue with their treatment regularly.

Improving quality of life is fundamental to CKD management, especially when patients face multiple vascular complications. This is consistent with the findings of the other studies reviewed, which highlight the importance of innovative solutions that extend the life of vascular accesses and improve comfort and general well-being.

The depletion of vascular access in patients with end-stage CKD is a complex problem that requires precise surgical intervention and the use of advanced techniques, such as stents and arteriovenous grafts.

The case presented, together with the reviewed studies, shows that when traditional options fail, alternatives such as endovascular revascularization and stent-grafts, in addition to balloon angioplasty, can provide practical solutions to restore the functionality of vascular access and improve the quality of life of patients.

Stent stenosis is a recurrent complication because inspiratory pulmonary pressure produces constant pressure on the stent and the first rib. One way to counteract this refractory event has been resectioning the first rib, followed by endovascular therapy to decrease the pressure on the stent and increase secondary patency, with a mean survival of 69.3 months [9]. This surgery has few complications and is generally well tolerated, so it should be part of managing subclavian vein stenosis as part of the infraclavicular approach for thoracic venous outlet syndrome [10]. In the present case, this surgery was not performed, and the patency of the stent was evaluated in the long term.

The use of covered stent grafts, such as the Covera ™, is a safe and effective option for treating stenosis in the venous anastomosis of access grafts for hemodialysis, with primary patency rates of 70.3% at 6 months and 36.9% at 24 months [11]; however, prospective studies are needed for evaluation at 1 year and 3rd year.

Conclusions

The present case shows the effectiveness of combined angioplasty (balloon and stent) in prolonging the useful life of vascular access, particularly relevant in this patient with chronic stenosis in the central vessels.

Abbreviations

AV: Vascular access.
AVF: arteriovenous fistula.
CKD: chronic kidney disease.

Supplementary information

The supplementary materials have not been declared.

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Does not apply.

Authors' contributions

Miryam Anabel León Tacuri: Conceptualization, methodology, research, Writing – Original draft.
Karen E. Hernandez: Conceptualization, methodology, research.
Juan P. Saltos Loor: Conceptualization, methodology, research.
Hector P. Ortega Tobar: Conceptualization, methodology, research Conceptualization, methodology, research.
Roberth V. Pazmiño Ruiz: Conceptualization, methodology, research.
Gustavo Hidalgo: Conceptualization, methodology, research.
Leonardo Solorzano: Conceptualization, Project Management, Supervision, Validation, Visualization, Writing – Revision and Editing.
Gregorio Hernández Castellanos: Conceptualization, Project Management, Supervision, Validation, Visualization, Writing – Revision and Editing.
All authors read and approved the final version of the manuscript.

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Availability of data or materials

Does not apply.

Declarations

Ethics committee approval and consent to participate

It does not apply to clinical cases.

Consent for publication

The authors have written permission from the patient.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Author information

Not declared.

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