Endovascular treatment of a Right Internal Jugular Vein occlusion in a hemodialysis patient with severe neurological symptomatology

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Abstract

In the last decade, Internal Jugular Vein (IJV) obstructive disease has been gaining increasing attention due to different confounding symptoms that impair patients' quality of life and cannot be explained by other established causes. The most common clinical symptoms associated with IJV stenosis are tinnitus and sleep disturbances (60.5%), headache (48.8%), visual disturbances (39.5%), hearing disorders (39.5%) and anxiety or depression (37.5%). We report a complex case of a woman with a wide range of severe neurological inexplicable disorders. Using Duplex Ultrasound, an IJV occlusion was successfully diagnosed and the patient was then treated using endovascular techniques. IJVs occlusion and outflow alteration were detected by the means of Duplex Ultrasound (DUS) demonstrating the need of a carefully assessment of neck vessels in patients with drug-resistant neurological symptomatology as headache, tinnitus and sleep disturbances.

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Key words: Internal jugular vein occlusion, headache, phlebography.

Contributions: all the authors made a substantive intellectual contribution. All the authors have read and approved the final version of the manuscript and agreed to be held accountable for all aspects of the work.

Conflict of interest: the authors declare no potential conflict of interest.

Funding: none.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

Received: 29 November 2023.
Accepted: 1 December 2023.
Early view: 4 December 2023.

Licensee PAGEPress, Italy
Veins and Lymphatics 2023; 12:12145
doi:10.4081/vl.2023.12145

Introduction

In the last decade, Internal Jugular Vein (IJV) obstructive disease has been gaining increasing attention due to different confounding symptoms that impair patients' quality of life and cannot be explained by other established causes. The most common clinical symptoms associated with IJV stenosis are tinnitus and sleep disturbances (60.5%), headache (48.8%), visual disturbances (39.5%), hearing disorders (39.5%) and anxiety or depression (37.5%).[1] We report a complex case of a woman with a wide range of severe neurological inexplicable disorders. Using Duplex Ultrasound, an IJV occlusion was successfully diagnosed and the patient was then treated using endovascular techniques.[2]

IJVs occlusion and outflow alteration were detected by the means of Duplex Ultrasound (DUS) demonstrating the need of a carefully assessment of neck vessels in patients with drug-resistant neurological symptomatology as headache, tinnitus and sleep disturbances.

Case Report

A 60-years-old woman was admitted to our Transplant Centre Unit due to asthenia, nausea, headache, dizziness, tinnitus, hearing loss, and gait disturbances with inability to walk.

In 2001, the patient received a kidney transplant from living donor. Due to chronic rejection of the transplanted kidney, after 20 years she had to undergo hemodialysis via a Central Venous Catheter (CVC) positioned in Right Internal Jugular Vein (RIJV) in the meantime that a left radiocephalic arteriovenous fistula was created. Finally, the CVC in the right IJV was removed. The neurological symptoms led the patient to carry out multiple diagnostic investigations: A Positron Emission Tomography (PET) of the total body showed an area of inhomogeneous distribution of the tracer involving C4-C5 significant for initial discitis. She was treated with gentamicin and teicoplanin antibiotics. A Magnetic Resonance Imaging (MRI) of the brain documented an alteration of the intervertebral discs between the C4 and C7 vertebrae determining narrowing of the spinal canal and compression of the dural sac and medulla. Some hyper intense areas were noted in bilateral frontal subcortical arrangement to be referred to micro gliotic infarct. The neurological consultation suspected a posterior cord

syndrome, and the otolaryngologist documented a vestibulopathy of the right posterior canal and a peripheral vertigo syndrome.

Despite the therapies used, the patient did not experience any improvement in their symptoms. A duplex ultrasound of the neck vessels showed no stenosis of both carotid arteries, normal flow parameters of the left IJV, but documented the proximal right IJV occlusion and absence of flow. A collateral pathway by the External Jugular Vein (EJV) was also detected. Due to clinical symptoms and DUS findings a phlebography of RIJV was planned.

Technical notes

The procedure was performed through a percutaneous approach to the right common femoral vein under local anesthesia and DUS guidance. Initial attempts at retrograde recanalization of the RIJV were unsuccessful. Subsequently, the EJV was cannulated using the 0.035 hydrophilic nitinol guidewire "Aquatrack" and the angiographic catheter BER II (Cordis). By means of a standardized and operator-independent catheter venography protocol,[2] we clearly documented the distal occlusion of the right IJV and the collateral pathway (Figure 1A). Furthermore, there were no anomalies observed in the Left IJV. Using an antegrade method through the EJV, such as well described by Lupatelli *et al*.,[3] we successfully crossed the obstructed segment of the IJV. The guide wire was then captured by an En Snare System (Endovascular snare system) at the level of superior vena cava and a standard retrograde approach was achieved (Figure 1 B). Patency of the IJV lumen was restored through sequential venoplasty using balloons of increasing diameter, with the largest balloon being an Ultraverse dilatation catheter of 10 mm (BARD) (Figure 1C). Completion venography confirmed the correct vessel patency, with no visible EJV or collateral pathways, indicating successful restoration of flow in the target IJV (Figure 1D). The post procedural course was uneventful and patient immediately reported improvement in headache, dizziness, tinnitus and nausea. On the first post-operative day the patient was able to walk without external support. Six months post-procedure, Doppler ultrasound demonstrated patent right IJV without restenosis and normal antegrade flow. The patient reported progressive clinical improvement and a better quality of life.

Discussion

Hemodialysis via CVC is a critical point in patients affected by terminal renal failure because of complications including catheter-related infection, thrombosis, and at last but not least CVC-associated central vein stenosis. The exact mechanism of CVC associated venous stenosis remains undefined. However, the position of the foreign body against the walls of the vessels, as well as the uremic state and the subsequent inflammatory response, seems to be involved in the pathogenesis of stenosis. Moreover, turbulent flow causes platelet aggregation and deposition resulting in endothelial hyperplasia.[4] Schillinger *et al.* compared the incidence of venous stenosis in 100 dialysis patients respectively from subclavian vein catheters (50 patients) and IJV (50 patients). The study revealed vein stenosis in 42% of the subclavian group and 10% of the internal jugular group. However, according to a more recent study, in 57 patients analysed, 56% of cases reported peri-catheter sleeve, 28% reported thrombus formation and finally, there were no differences between patients with RIJV and right Subclavian Vein (SCV) catheters compared to the rates of peri-catheter sleeve formation, thrombus formation or stenosis.[4]

DUS of the neck vessels represents a non-invasive instrumental examination capable of diagnosing any potential obstructive diseases of IJV. Therefore, in patients who underwent hemodialysis by means of IJV catheter and experience neurological symptoms such as headache, dizziness, and movement disorders that cannot be explained by other established causes, DUS should be recommended.

IJV stenosis may contribute to alterations in cerebral blood flow and metabolism, which may account for its clinical manifestations.[1]

Headache, dizziness and gait disturbance are complex and multifactorial neurological symptoms which significantly reduces quality of life. There is strong evidence that headache is linked with obstruction of the cerebral venous drainage system. Several studies suggest that venous hypertension, caused by increased venous blood retention in the cortical vessels, might be an influential factor in the pathophysiology of headache. Particularly the elevated cerebral venous pressure can result in dilated cerebral veins and stimulate the pain-sensitive vessel structures.[5]

Recent evidence suggests a potential link between hearing symptoms such as tinnitus, vertigo attacks, fluctuating hearing loss and nausea, and the extracranial venous outflow alterations.[6]

IJV outflow alteration have been reported to contribute to the injury of the endothelial cells in the inner ear and several data support the hypothesis that compromised cochlear perfusion is a possible cause of Sudden Sensorineural Hearing Loss (SSNHL).[7]

Although Percutaneous Transluminal Angioplasty (PTA) has

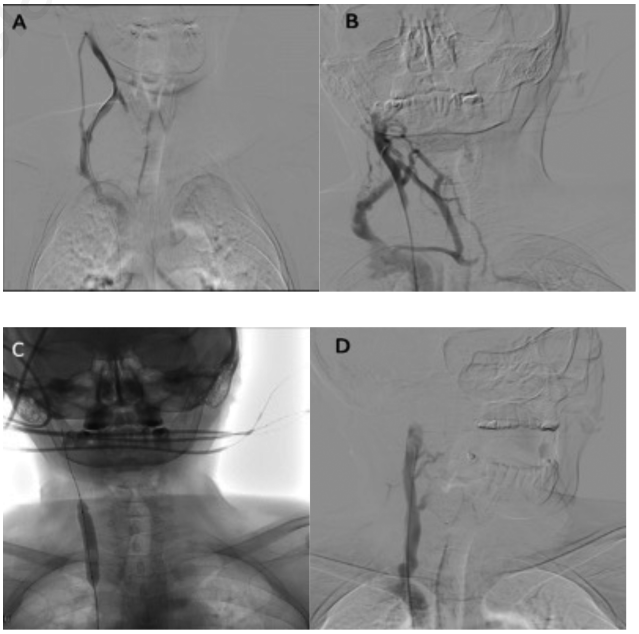

Figure 1. A) by means of a standardized and operator-independent catheter venography protocol, the distal occlusion of the right IJV and the collateral pathway were clearly documented; **B**) the guide wire was captured by an En Snare System (Endovascular Snare System) at the level of superior vena cava and a standard retrograde approach was achieved; **C**) patency of the IJV lumen was restored through sequential venoplasty using balloons of increasing diameter, with the largest balloon being an Ultraverse dilatation catheter of 10 mm (BARD); **D**) completion venography confirmed the correct vessel patency, with no visible EJV or collateral pathways, indicating successful restoration of flow in the target IJV.

been demonstrated as a safe procedure, several factors influencing and predicting the efficacy of PTA in the treatment IJV anomalies have been identified.[8] PTA intervention seems to increase the rate at which contrast agent is cleared from IJVs. Specifically, PTA appears to be more effective in younger individuals with transverse luminal defects and the absence of occlusion, compression or longitudinal luminal defects. The occlusion and excessive length and consequent longitudinal placement relative to the wall of the valve leaflets seem to be decisive factors in predicting a possible failure of PTA in about 75% of cases.[9] In our patient, neurological symptoms appear to improve immediately after better venous outflow was restored. Similarly, Bavera *et al.* demonstrated in a very large cohort of patients, Both IJVs DUS and clinical improvements were shown in patients treated with balloon venoplasty.[10]

Conclusions

This case highlights the potential correlation between neurological symptoms and disturbances in cerebral venous outflow. DUS of the neck vessels would be used in patients with neurological symptoms such as headache, dizziness, and movement disorders that cannot be explained by other established causes. Balloon venoplasty of the internal jugular vein emerges as a minimally invasive procedure beneficial for addressing neurological symptoms especially in patients resistant to optimal medical therapy.

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