CASE REPORT

A haemodialysis catheter misplaced due to central venous stenosis: A case report

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Abstract

Chronic kidney disease has become a significant global health issue, with some individuals progressing to end-stage renal disease (ESRD) and requiring renal replacement therapy. For ESRD patients undergoing haemodialysis, the first step is to establish vascular access. In emergency situations, inserting a haemodialysis catheter (HDC) into the central vein is often the most appropriate approach; the right internal jugular vein (IJV) is considered the optimal site for catheterisation. However, catheter placement in the right IJV can sometimes lead to inadvertent entry into an abnormal position. Herein, we present a unique case in which the tip of the HDC was noted to have misplaced into the left IJV due to the patient's multiple central venous stenosis (CVS). This case highlights the clinical manifestation of HDC misplacement, with CVS being the underlying cause. Therefore, healthcare providers should pay adequate attention to CVS.

Keywords: Chronic kidney disease, Haemodialysis, Internal jugular vein, Central venous stenosis.

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Introduction

Chronic kidney disease (CKD) is a pressing global public health issue, with an estimated prevalence rate of approximately 13.9%.[1] In China alone, there are approximately 120 million individuals affected by CKD, out of which approximately 2% will progress to end-stage renal disease (ESRD) and require either dialysis or a kidney transplantation.[2] The prevalence of ESRD continues to rise due to factors such as aging, diabetes, and hypertension.[3] As a result of these trends, a growing number of ESRD patients opt for central venous catheter (CVC) placement, rather than the preferred autogenous arteriovenous fistula, due to their own vascular conditions and limited life expectancy.[4] When it comes to establishing vascular access for haemodialysis, placement of a haemodialysis catheter (HDC) in the central vein is often deemed a suitable option. The right internal jugular vein (IJV) is typically the preferred site for catheterisation. However, it is important to note that insertion in the right IJV, can sometimes result in the catheter entering into an abnormal position.[5] Herein, we present an exceptional case in which the end of a HDC was inadvertently misplaced into the left IJV due to the patient's multiple central venous stenosis (CVS). Therefore, in the case of ectopic HDC, in addition to the common causes like abnormal vascular anatomy at the puncture site or operational technical issues, CVS should also be considered in patients, especially those with a previous history of multiple central venous catheter placements.

Case Report

A 79-year-old female patient was admitted to the Department of Nephrology of Baoding No.1 Central hospital, Baoding, Hebei071000, PR China, on September 12, 2019, with complaint of shortness of breath for one week. Her medical history was notable for type 2 diabetes and hypertension for 20 years. She was diagnosed with uraemia and received regular haemodialysis with a cuffed HDC via the right IJV (Figure 1-a) and a central venous catheter (CVC) was peripherally inserted for treatment through the left subclavian vein (SV) (Figure 1-b). After undergoing haemodialysis, her condition improved, and the patient ultimately opted for maintenance peritoneal dialysis. The HDC and CVC were then removed. However, her peritoneal ultrafiltration function became poor after two months. Her physical examination at admission displayed the following: blood pressure of 155/100 mmHg, anaemic appearance, heart rate of 98 beats/minute, and facial and bilateral lower limb oedema. Examinations on admission revealed moderate anaemia, moderately low albumin levels, significantly elevated brain natriuretic peptide (BNP) levels, and a slight decrease in ejection fraction shown on cardiac ultrasound. Ultrasound examination showed that both of her kidneys were shrunken with diffuse lesions. The main diagnoses for her at admission included chronic kidney disease (stage V) and renal anaemia, coronary heart disease, acute heart failure, type 2 diabetes, and hypertensive disease (grade 3, very high risk). The patient underwent comprehensive treatment to improve anaemia and heart function, as well

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as to control hypertension and diabetes, and other related conditions. She was inserted with a HDC via the right IJV for haemodialysis the day after admission. The puncturing process was conducted under ultrasound guidance as per normal routine. While the HDC was inserted into the right IJV, the operator noted that the dual lumen of the catheter could drain out blood poorly with a 20 mL syringe. So, a chest X-ray was conducted instantly which showed that the tip of the HDC was misplaced into the left IJV (Figure 1-c). The stenosis of the right innominate vein and the left subclavian vein (SV) was discovered under the guidance of digital subtraction angiography (DSA) (Figure 2). The HDC was directly removed, followed by mandatory oppression for 15 minutes and the patient experienced no complications. Then, a right femoral vein catheterisation with a temporal HDC was performed for haemodialysis. After regular haemodialysis for two weeks, the patient's condition significantly improved and she was discharged. One month later, she underwent endovascular treatment (ET) though DSA and a cuffed HDC was implanted via the right IJV at another hospital (Figure 1-d). During the one year of outpatient follow-up, the patient's haemodialysis proceeded smoothly, and her condition remained relatively stable.

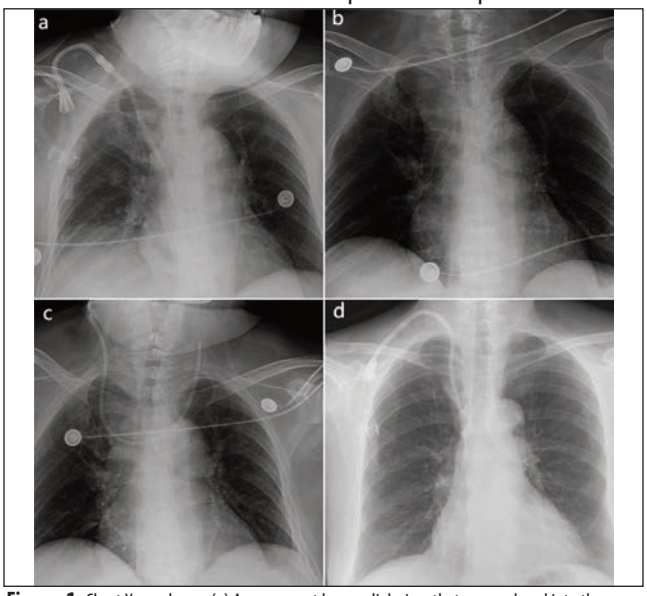

Figure-1: Chest X-ray shows: (a) A permanent haemodialysis catheter was placed into the superior vena cava via the right internal jugular vein; (b) A central venous catheter was peripherally inserted for treatment through the left subclavian vein; (c) A temporary haemodialysis catheter misplaced into the left internal jugular vein via the right internal jugular vein; (d) A cuffed haemodialysis catheter was placed into her right internal jugular vein after endovascular treatment.

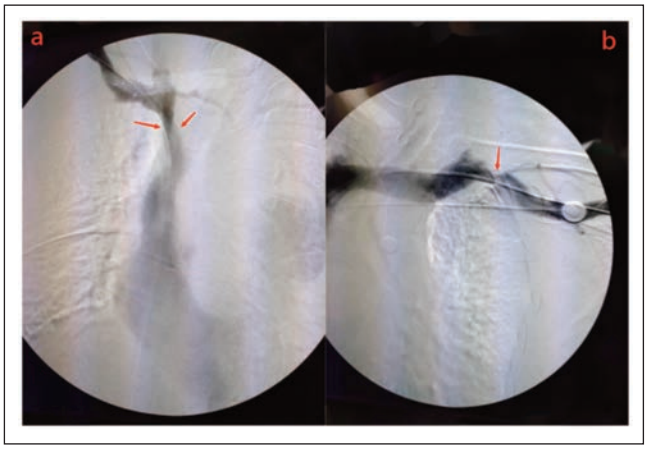

Figure-2: Digital subtraction angiography (DSA) showed: (a) the stenosis of the right innominate vein; (b) the stenosis of the left subclavian vein.

Discussion

There are numerous complications associated with the application of HDC, including infection, thrombosis, embolism, and CVS.[6] As the lifespan of haemodialysis patients increases, CVS is becoming a significant challenge that threatens the lives of those with CVC.[4] The prevalence of CVS is not well-documented due to the lack of symptoms in the early stages of the disease. However, as the condition progresses, CVS can lead to various clinical symptoms and even rare complications such as superior vena cava syndrome (SVCS), which poses a grave threat to haemodialysis patients with CVS.4 Different factors contribute to the development of CVS, including the placement of vascular devices, anatomical factors, and changes in haemodynamics. Among these factors, central venous catheter (CVC) is of utmost importance.[5] Despite ongoing research, the pathogenesis of CVS remains unclear.

Patients who have CVS and are undergoing haemodialysis often exhibit swelling in their arms, head, neck, or trunk, which can be on one or both sides of their body. Additionally, CVS may lead to neurological symptoms, pleural effusion, difficulty in breathing, and even SVCS.[5] This patient did not exhibit obvious swelling in the neck and upper limbs and there was no apparent jugular vein distention in the anterior chest. This might possibly be related to her central CVS not being severe. Although most haemodialysis patients do not experience any symptoms due to their CVS being below 50%, the guidelines from the Kidney Disease Outcomes Quality Initiative (KDOQI) do not recommend early intervention in asymptomatic cases.[5] However, treatment may be considered based on imaging techniques.[6] DSA is considered to be the gold standard for diagnostic imaging, but it is invasive. On the other hand, colour-doppler ultrasound, computed tomography angiography, and magnetic resonance angiography are non-invasive imaging methods for central venous imaging, although their use in this context is still a topic of controversy. The CVS in this patient was definitively diagnosed through DSA, providing the clinical imaging basis for subsequent cuffed HDC placement.

ET is commonly advised as the primary choice for treating symptomatic CVS, as it allows for the optimal utilisation of the patient's own vascular resources.[7] However, in cases where patients require multiple endovascular interventions to maintain vascular flow, surgical reconstruction of the access point becomes necessary, specifically in cases where both CVS and central venous occlusion are present. Yet, the long-term success rate of this procedure in terms of maintaining patency is still not well-established.[8] This patient lastly received ET by DSA at another hospital. During the procedure, a cuffed HDC was successfully inserted for her long-term haemodialysis.

In the case of this patient, on previous occasions of central venous insertion a stenosis in both the right innominate vein and the left SV was revealed. As a result, the guide-wire tip was obstructed and deviated abnormally to the left and upwards, ultimately leading to the misplacement of the catheter into the left IJV along the guide wire. This unique circumstance arose from the patient's several previous catheterisations, which may have caused CVS and resulted in the incorrect positioning of the HDC.[9] Hence, for patients with ectopic HDC, in addition to the anatomical abnormalities and the improper handling by the operator, CVS may also be one of the reasons. The specific causes can be identified by ultrasound and DSA.

There are some limitations for this case report. One is the lack of imaging data for the patient's ET, as the treatment was performed at another hospital. Additionally, it is important to note that the patient's follow-up time is relatively short, while it is advisable to continue tracking and monitoring the patient regularly and observe any recurrence of CVS.

Conclusion

CVS has emerged as a major cause of vascular access dysfunction in patients with ESRD. Early diagnosis and intervention of CVS are crucial in prolonging the lifespan of vascular access. However, CVS often presents initially without any symptoms, making it difficult to intervene in a timely manner. It is strongly recommended that catheterisation be carried out under the DSA guidance at times.[10] The collaboration of experts from various disciplines, such as endovascular intervention, vascular surgery, radiology, and nephrology, is highly advocated to improve and refine recanalisation technology for effectively treating CVS.

Disclaimer: This case was seen at Baoding No.1 Central Hospital, Baoding, Hebei071000, PR China.

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Ethics statement: The patient provided her written informed consent to participate in this study. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

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Author Contribution:
XJ: Writing, literature review and final approval.
XL: Case design, revision and final approval.