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A Case Report of Arteriovenous Fistula Penetrating into the Ascending Aorta Due to Right Internal Jugular Vein Placement

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ABSTRACT

Internal jugular vein placement is frequently utilized in clinical practice for rapid infusion, intraoperative monitoring, peritoneal dialysis, and access for interventions. Additionally, the process may lead to complications like hematoma, infection, misdirection of the artery, pneumothorax, and arteriovenous fistula. In the case described in this report, all vascular ruptures effectively were repaired because when internal jugular vein placement was adopted, a dialysis catheter would go through the right internal jugular vein into the subclavian artery, then the ascending aorta via the cephalic trunk, and finally the ectopic catheter would be surgically removed. The patient was released from the hospital on the seventh postoperative day after maintaining stable vital signs throughout the procedure.

CASE PRESENTATION

The patient was a 51-year-old female, who was admitted to the hospital on August 20, 2020, due to “three days of arteriovenous fistula after internal jugular vein placement.” The patient had a history of hypertension, and "renal failure" diagnosed in 2015 led to her regular peritoneal dialysis. A right internal jugular vein-right subclavian artery fistula was seen on surgical exploration, but the vein fistula was not repaired due to the deep anatomical level, surgical environment, and instrumentation limitations. She was transferred to our department on August 20, 2020. To clarify the location of the catheter, preoperative CTA of the head and carotid artery showed a right internal jugular vein-right subclavian artery fistula. (Figure 1) CTA of the whole aorta showed a cannulation shadow in the right subclavian artery and ascending aorta (Figure 2); cardiac ultrasound showed tubular strong echogenicity in the ascending aorta, aortic regurgitation (mild), and pericardial effusion (little to moderate) (Figure 3). (Figure 2) (Figure 3) The patient also was suggested a regular peritoneal dialysis, and femoral vein placement with a double-lumen dialysis catheter was performed on August 23, 2020.

On August 26, 2020, the patient through a right neck incision underwent a right internal jugular vein-right subclavian artery fistula repair, during which at the free broad jugular muscle and sternocleidomastoid muscle, the dialysis catheter was seen to go through the right internal jugular vein into the subclavian artery, and then the ascending aorta via the cephalic trunk. (Figure 4) The catheter being cut and pulled out, the rupture in the anterior and posterior walls of the right internal jugular vein was repaired. Then, two wraps of 5-0 and 4-0 PROLENE sutures were placed along the dialysis catheter penetrating the right subclavian artery, respectively.

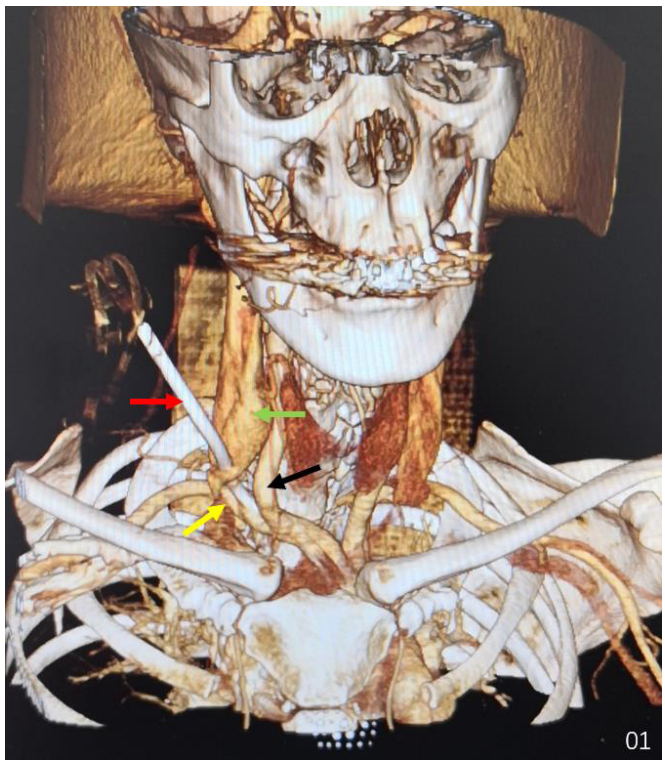

Figure 1. Dialysis catheter (red arrow in figure) penetrates the right internal jugular vein (green arrow in figure) into the subclavian artery (yellow arrow in figure); the internal jugular vein is medial to the right common carotid artery (black arrow in figure).

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The patient recovered well after the operation, and nothing abnormal was detected through the chest X-ray and ultrasound. The patient was discharged on the 7th day after the operation.

DISCUSSION

Successful peritoneal dialysis often requires reliable intravenous access or long-term indwelling dialysis catheters and serves as the most effective treatment for acute and chronic renal failure, and a protection for resuscitation. The internal jugular vein and femoral vein are the two commonly chosen veins, among which the internal jugular vein is the best choice because of its good location and least significant impact on the patient's activity and life after placement. The overall incidence of complications, such as hematoma, infection, misdiagnosed artery, pneumothorax, and arteriovenous fistula is reported to be 15% [Soni 2016], and the incidence of arteriovenous fistula formation through the peripheral artery is about 0.1%-0.8%. The vast majority of these reported cases were right internal jugular vein-right common carotid artery fistulas [Kornbau 2015]. The sequela of these complications is hematoma that may cause airway obstruction, pseudoaneurysm, arteriovenous fistula and stroke secondary to thromboembolism [Tan 2020]. All in all, it is the use of clinical criteria and the clinician's skill that will decide the ways to access the internal jugular vein.

In this case, the catheter penetrated through the right internal jugular vein into the subclavian artery and then the ascending aorta via the cephalic trunk, which is rare due to the anatomic structure of the head and neck vessels. Generally speaking, arteriovenous fistulas often occur due to the operator's clinical inexperience, poor technique, or the patient's own vascular anatomic variation. The risk of developing an arteriovenous fistula is much greater than that of other complications and may lead to further pseudoaneurysms, thrombosis, or even sudden death. Once these complications are possible, the operation should be stopped and the catheter should be secured. From our literature review, the safest method for removal is via endovascular and open surgical removal. Direct removal with compression is not recommended, due to the high risk for stroke, bleeding, and hematoma formation. After intraoperative exploration, it was found that the catheter penetrated the internal jugular vein at a deeper anatomic location, then the case was further diagnosed as a right internal jugular vein-right subclavian artery fistula. So, the patient was then transferred to the hospital for a complete CTA examination on the whole aorta. Cardiac ultrasonography was completed to determine whether the catheter entered the ascending aorta was in relation to the

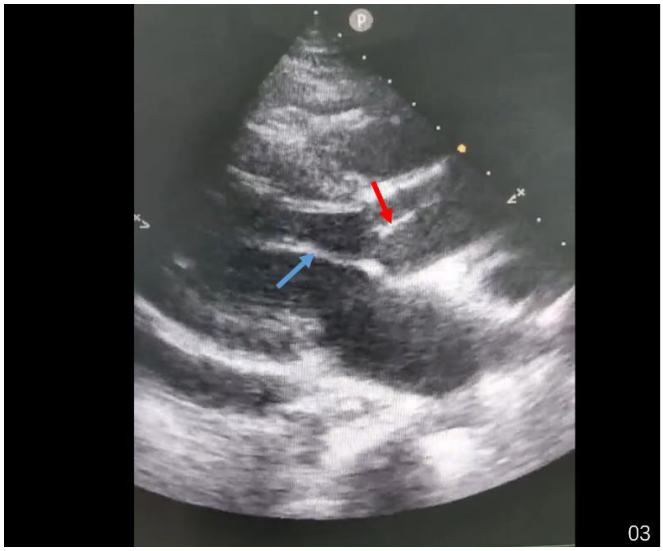

Figure 3. Dialysis catheter (red arrow in the figure) in the ascending aorta in relation to the aortic valve (blue arrow in the figure).

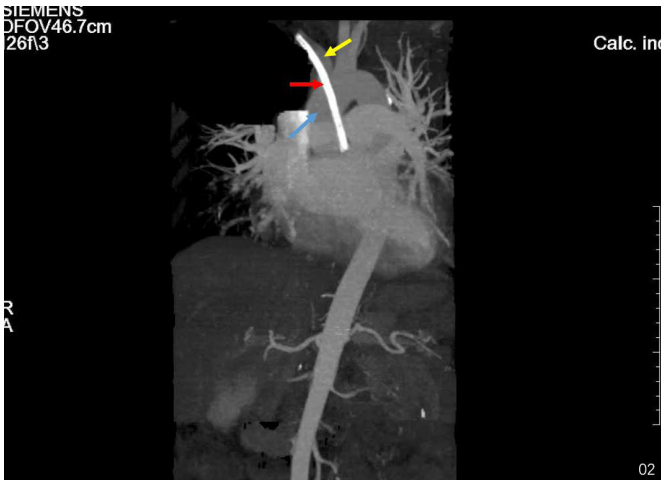

Figure 2. The dialysis catheter (red arrow in the figure) enters the ascending aorta (blue arrow in the figure) via the cephalic-arm trunk (yellow arrow in the figure).

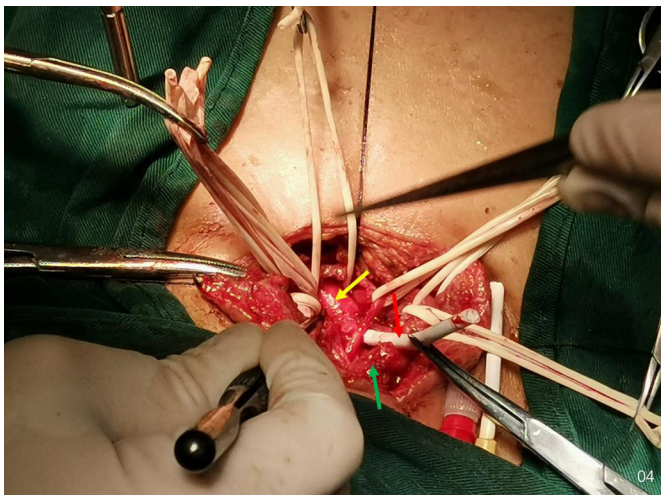

Figure 4. Intraoperative anatomical relationships: dialysis catheter (red arrow in the figure) penetrating the subclavian artery (yellow arrow in the figure); sutured internal jugular vein (green arrow in the figure).

aortic sinus and aortic valve to finalize the complete surgical plan. In this case, minimally invasive treatment with the Perclose ProGlide vascular closure device was considered during the preoperative discussion. But given the severity of the patient's underlying disease, an efficient and prudent surgical approach was chosen, and ultimately a right internal jugular vein-right subclavian artery fistula repair was performed under general anesthesia, with catheter removal and repair of the right internal jugular vein and right subclavian artery rupture. A thorough assessment of the patient's condition before and after the cannulation procedure was necessary to effectively avoid serious complications.

A clear understanding of the anatomy surrounding the internal jugular vein and the patient's condition should be obtained prior to the procedure. If the patient has a short neck, a thick fat layer, or lesions in the thyroid and other surrounding organs, ultrasound guidance during subclavian cannulation is highly recommended to minimize these complications, because it directly reveals the anatomy as the needle passes through the vessel [Alon 2021]. At the same time, the operation process should be standardized. If the operation process encountered resistance or back pumping for arterial blood, the operation should immediately be stopped, and physicians should not continue placement without considering the above-mentioned conditions. At the same time after the placement of the catheter, X-ray examination should be performed as soon as possible to clarify the position of the catheter.

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