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A CVC Line Misadventure

"Doctor why do I have a humming sound in my ear?"

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Abstract

We report a 32-year-old female patient who was referred to a tertiary care hospital in Muscat, Oman, in 2021 with an iatrogenic arteriovenous fistula (AVF) that presented as a neck swelling which developed few weeks after an attempt of central venous catheterization through the right internal jugular vein (IJV). The fistula was corrected surgically at our institute with a successful outcome. AVF is an abnormal communication between an artery and vein which can occur as a congenital anomaly, after trauma or iatrogenic following central venous catheter (CVC) or endovenous thermal ablation.

Keywords: Arteriovenous fistula, Iatrogenic, central venous catheter, critically ill, ICU

Introduction

An arteriovenous fistula (AVF) is an abnormal communication between an artery and vein. It can occur as a congenital anomaly[1] or iatrogenic during any arterial or venous instrumentation, trauma, or endovenous thermal ablation[2]. One of the earliest cases of iatrogenic AVF was published by James and Myers in 1973.[3] The incidence of iatrogenic AVFs has previously been described to be

less than 0.6% of central line insertions.[4] However, the introduction of ultrasound guidance causes reduction in the incidence.[5] Our case report describes an iatrogenic AVF that presented as a neck swelling that developed several weeks after an attempt of central venous catheterization through the internal jugular vein (IJV). The fistula was corrected surgically at our institute with a successful outcome.

Case report

We report a 32-year-old female patient who presented to a tertiary care hospital in Muscat, Oman, in 2021. She was admitted earlier to the intensive care unit (ICU) with an impression of sepsis; hypotension with multiorgan failure and acute kidney injury (AKI). The patient was hemodynamically unstable at presentation to the center where she was managed, so a Central Venous Catheter (CVC) insertion was attempted through the right IJV for hemodialysis under ultrasound guidance. As the dilator was not traversing freely, the procedure was abandoned, pressure applied, and a Femoral Quinton line inserted. Several days after discharge, the patient developed a swelling on the right side of the neck associated with a humming sound in her right ear and a thrill, she didn't have coagulation abnormalities, so she was referred to us to rule out iatrogenic AVF and treat accordingly.

On examination, the patient had a pulsatile swelling that was 3 cm x 4 cm in size, with a thrill, and a bruit on the right side of the neck between sternal head of sternocleidomastoid, clavicular head of sternocleidomastoid and the clavicle. Neurological examination was normal, and pulses were intact. Duplex Ultrasound (US) was performed, a fistula was seen between the right IJV and the right common carotid artery (CCA), the IJV was pulsatile in the region of the fistula, and it showed a focal dilation. A Computed Tomography Angiography (CTA) was performed (Figure 1A & 1B), and it showed an arteriovenous fistulous communication between the right CCA and IJV.

The patient was taken for surgical closure of the iatrogenic AVF. An incision along the lateral border of the neck anterior to the sternocleidomastoid muscle was performed. A 4 mm mature neck between the right IJV and CCA was found, (Figure 2). The fistula was divided between vascular clamps (Figure 3) and repaired directly on the venous and arterial side with 6-0 prolene sutures

(Figures 4). CCA was not clamped during surgery, she had normal left CCA and intracranial circulation, therefore cerebrovascular monitoring was not considered.

Postoperatively, the patient was neurologically normal, the thrill and bruit on the neck disappeared. At follow up, 4 weeks post-operatively, she remained well.
Patient consent was obtained for publication.

Discussion

Catheterization of the IJV is commonly done for temporary hemodialysis, compared to subclavian and femoral access, as it is considered a safer option.[6] In the experience of the senior authors, an IJV access is the preferred route for a CVC insertion, as a Trendelenburg position is often used in hemodynamically unstable patients. However, femoral access has been used when access to the IJV is not possible - usually when another team airway control of cases of maxilla-facial surgery / trauma.

IJV catheterization can lead to several complications including venous perforation[7], puncture of the CCA, pneumothorax[8], cardiac tamponade[9], and Horner's syndrome[10]. Literature mentions that valve incompetence in the IJV could impair cerebral venous drainage.[11] Another rare complication of IJV catheterization is traumatic CCA- IJV Fistula (CJF).[2] Traumatic CJF has an incidence of 4-7% of all traumatic AVFs and it can be iatrogenic or due to penetrating injuries like gunshots or stab injuries.[2] Although it is considered a rare entity there are several cases reported and published where an iatrogenic AVF was created by central venous catheterization of the IJV.[2, 6, 12-13] If left untreated, it can lead to further serious life-threatening complications such as embolization, infection, and at later stages high-output cardiac failure.[2] Therefore, early detection and intervention is crucial to prevent such consequences.

Several techniques have been described to reduce the rate of complications during IJV cannulation which include: cannulation under ultrasound guidance, locating the vein using a needle with a smaller gauge, reducing head rotation to less than 40° as this reduces overlap between the vein and artery, and using an alternative access if there's difficulty during cannulation.[5 & 10]

There are various modalities that can be used to diagnose iatrogenic AVF, including duplex, Magnetic Resonance Angiography (MRA) and CTA. Duplex imaging in AVF shows an arterialized enlarged vein, high flow fistulous communication and a low resistance waveform of the artery involved.[11] It has an advantage of being fast. CTA and MRA provide a better anatomical view of the vascular injury, like the size, type, and region, which will aid in choosing the best treating modality.[14]

The options to consider while treating Iatrogenic AVFs are open surgery, endovascular stenting, or embolization. A complex AVF fistula has multiple draining vessels and a complex anatomy, therefore it is better treated with endovascular embolization or stent grafting.[11] Embolization of traumatic or iatrogenic AVF's can be offered if the communication is from side branches and not for end arteries.[16] Furthermore, it can be done with Coils, cyanoacrylate glue or Onyx (Covidien, Mansfield, MA).[11] In our patient the CJF was not complex, and it was superficial, hence an open surgical approach was preferred.

Conclusion

Iatrogenic AVF is a rare complication of central venous catheterization, but it can have serious outcomes. To prevent such outcomes, CVC insertion and other procedures should be carefully performed i.e., under ultrasound-guidance, by experienced personnel and/or skilled supervision. It is important to detect and treat iatrogenic AVF early to prevent more severe complications such as embolization, infection, atrial fibrillation and at later stages high-output cardiac failure. This case report is to sensitize the medical fraternity about avoiding iatrogenic CVC misadventures and how they can be managed.

Authors' Contributions

MAA, TAH, MAB, MAR, HAM – Manuscript, Literature Review

ES - Concept, Manuscript, Literature review, Final Approval

KAW - Manuscript, Final Approval

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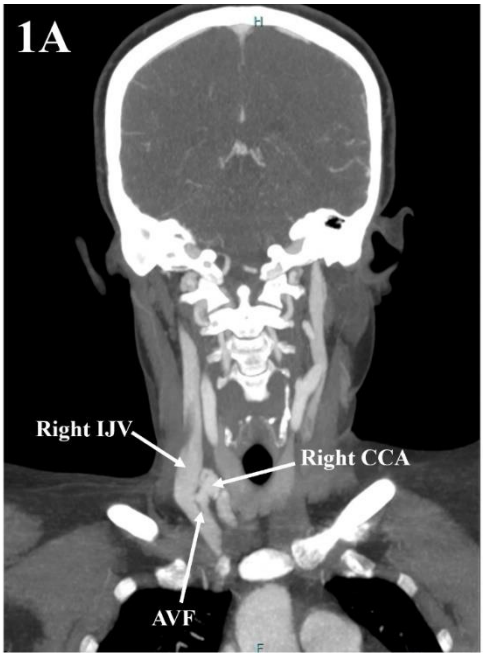

Figure 1A: Computed Tomography Angiography (CTA), coronal view, showing a right Internal Jugular Vein (IJV)-Common Carotid Artery (CCA) fistula

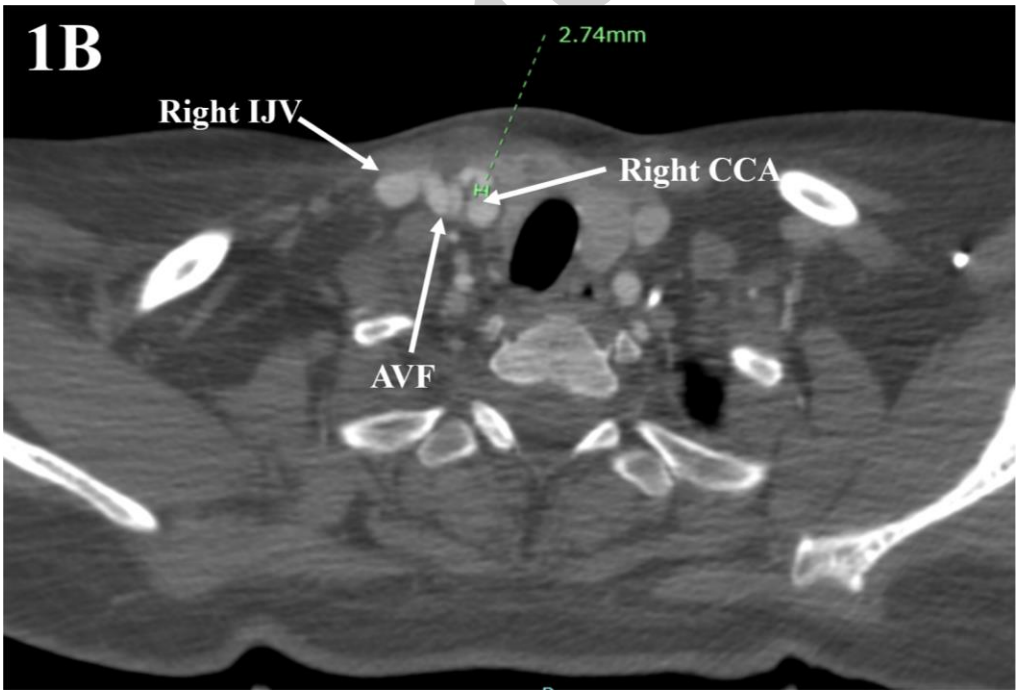

Figure 1B: CTA, axial view, showing a right IJV-CCA fistula

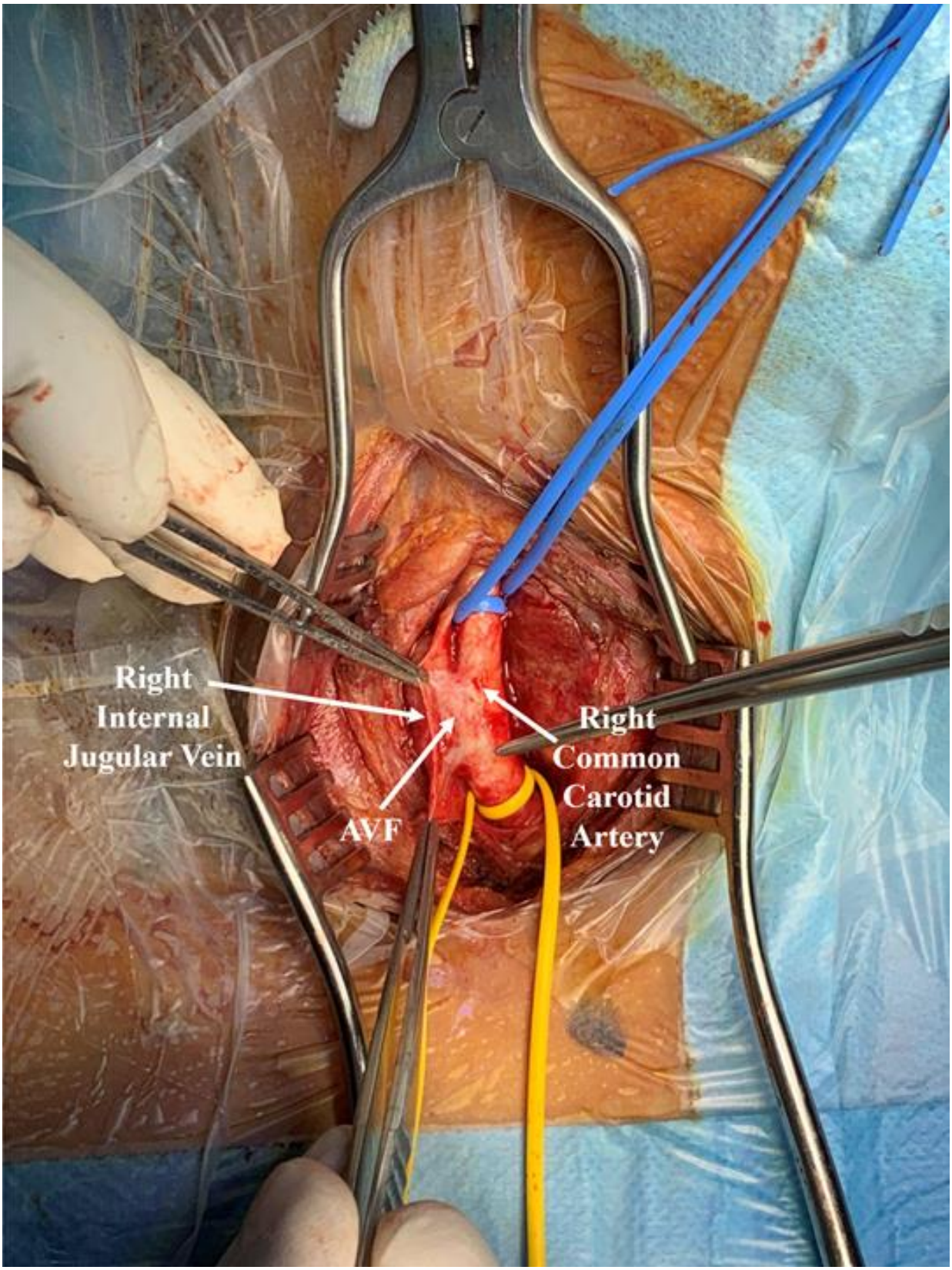

Figure 2: Identification of the IJV-CCA fistula intraoperatively

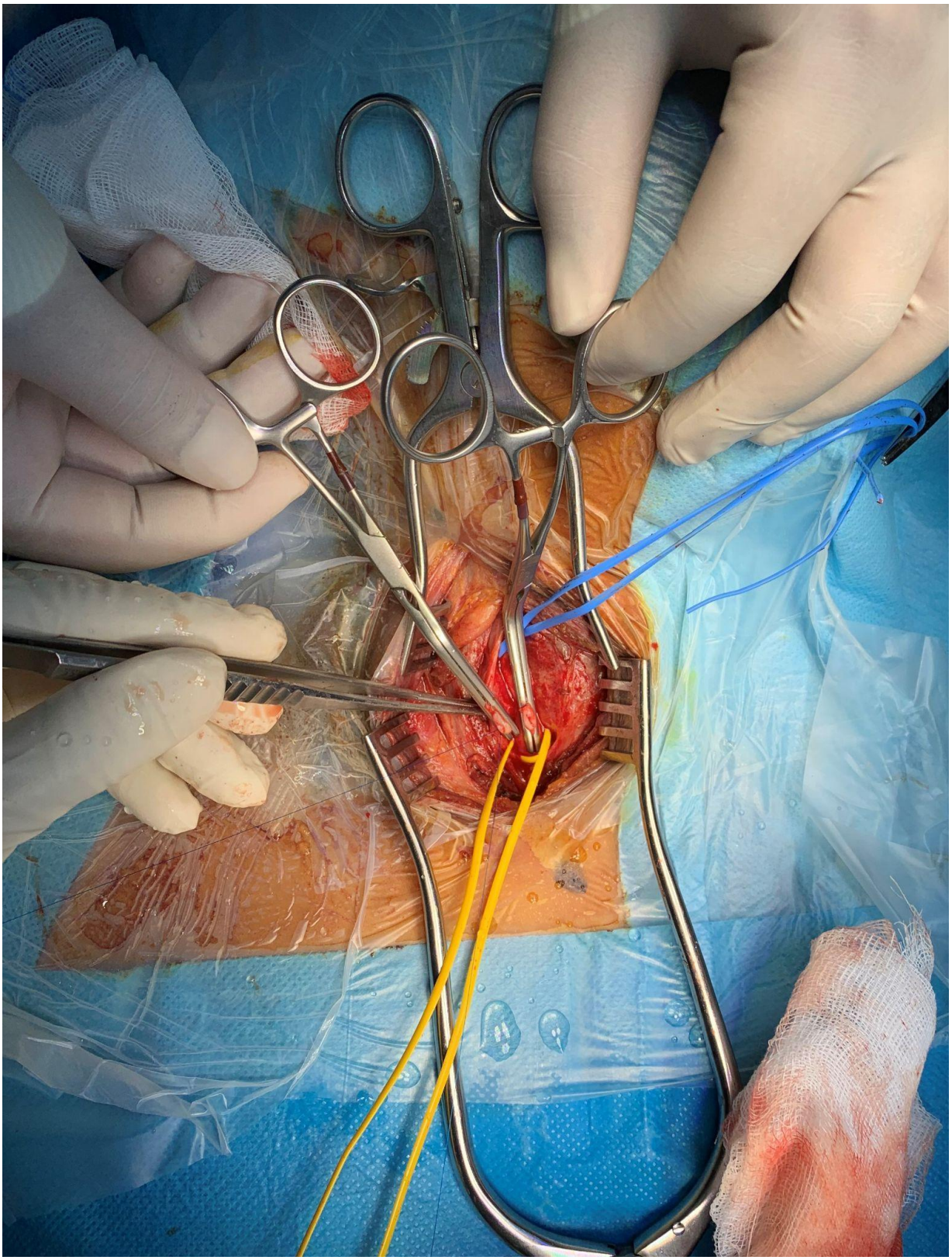

Figure 3: Division of the fistula

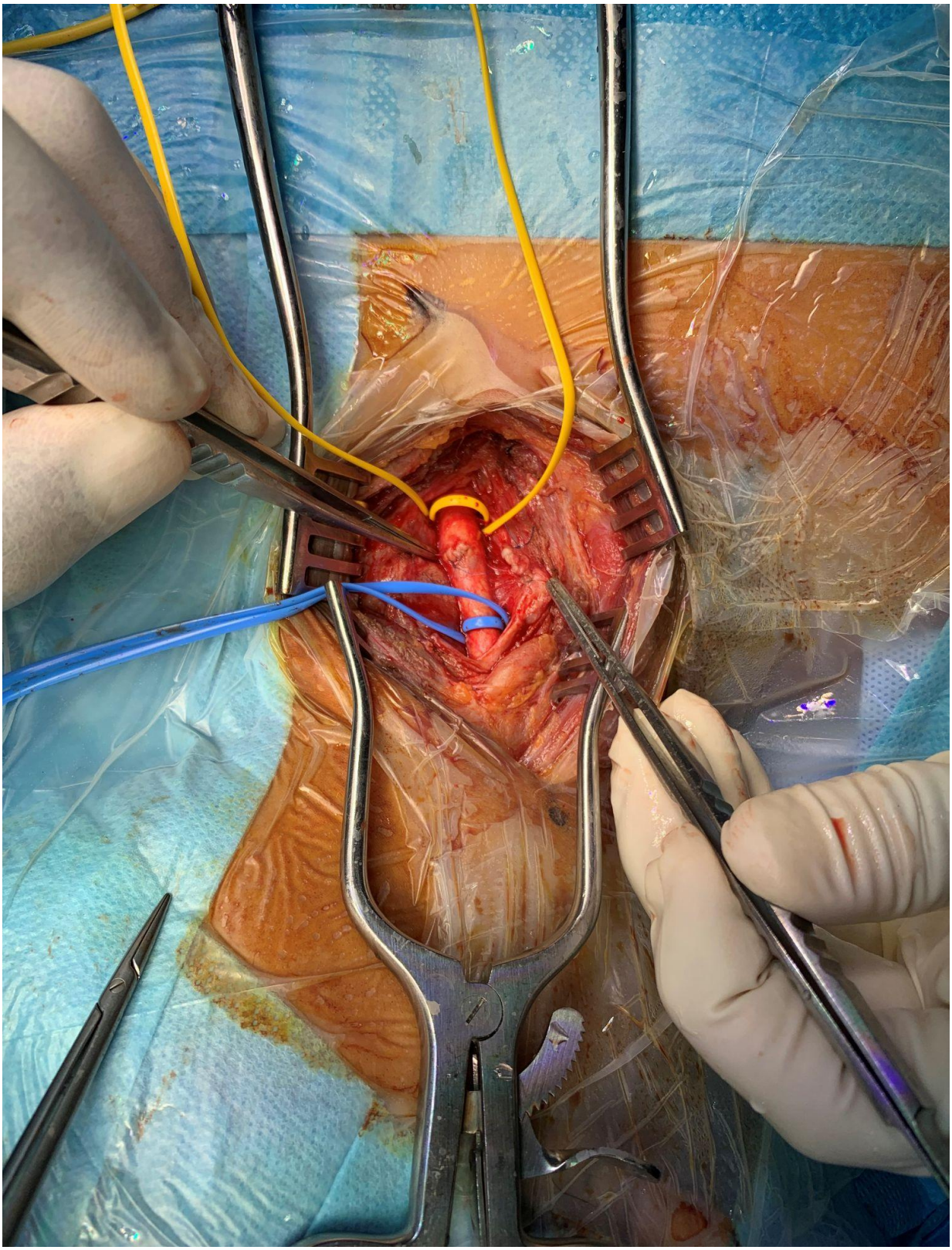

Figure 4: Post-repair of the fistula