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Letter to the Editor: New Observation

Complication Following Chemoport Insertion – Role of Endovascular Intervention

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Central venous catheter (CVC) placement stands as one of the most frequently performed procedures by skilled medical professionals in critically ill patients. Incorrect insertion can result in complications, encompassing arterial injuries (up to 8%), hemorrhage, pneumothorax, pericardial effusion, and thrombosis.[1] Despite the rarity of vertebral artery injuries (VAIs) arising from CVC insertion, they pose a potential life-threatening risk that demands swift intervention.[2] While a few instances of VAI managed through endovascular techniques are detailed in existing literature, no reports have surfaced regarding acute ischemic stroke arising from VAI post-CVC insertion and its subsequent management through endovascular treatment (EVT). This study presents a unique case wherein an erroneously positioned chemo port induced VAI, resulting in a complicated posterior circulation stroke, ultimately addressed with successful EVT management.

A 52-year-old woman diagnosed with breast carcinoma underwent chemo port insertion in the right internal jugular vein (IJV). Subsequently, she reported symptoms of dysarthria, dizziness, and vomiting and eventually became unresponsive. Magnetic resonance imaging (MRI) of her brain unveiled acute infarcts in the left inferior cerebellar vermis and the left hemipons. Additionally, computed tomography (CT) angiography revealed a thrombotic occlusion at the apex of the basilar artery (BA) and within the P1 segment of the posterior cerebral artery (PCA) (Fig. 1a). The distal intradural (V4) segment of the left vertebral artery (VA) exhibited a reduced caliber, alongside a dominant right VA (Fig. 1a). The chemo port was observed to traverse through the right IJV, causing luminal irregularity and partial thrombosis of the proximal V1 segment of the right VA at the C7 level (Fig. 1b,c), extending up to the right hemithorax.

Retrograde access to the right common femoral artery (CFA) was established. The VA angiogram revealed a lack of opacification at the apex of the BA and in the bilateral PCA (Fig. 2a). A low-pressure right VA angiogram exhibited a filling defect within the V1 segment, aligned with the chemo port's level, displaying distal opacification and no active extravasation. The left VA was cannulated using a Ballast 088 long sheath (Balt) and AXS Catalyst 5 distal access catheter (DAC) from Stryker Neurovascular. Thrombus within the BA was navigated using the Rebar-18 microcatheter from ev3 Neurovascular (Medtronic) and a 0.014-inch Synchro microwire from Stryker Neurovascular in tandem, positioned in the left PCA. Subsequently, the Solitaire X revascularization device from Medtronic was deployed across the thrombus. Utilizing the Penumbra aspiration system (Penumbra Inc.), aspiration was performed through the DAC, leading to the retrieval of the thrombus (Fig. 2b). The first-pass Solumbra technique confirmed complete recanalization, as verified by angiography (Fig. 2c).

The affected portion of the right vertebral artery was isolated by deploying detachable coils proximal and distal to the site of injury. In the V3 segment of the left VA, the AXS Catalyst 5 DAC was positioned. Employing the headway duo microcatheter from Microvention (Terumo) and a 0.014-inch Synchro microwire, the right VA's V3 segment was accessed retrogradely. This maneuver was executed using the crossover technique via the vertebrobasilar junction, navigating it in proximity to the injury site. A process of distal coiling ensued (Fig. 2d). In an antegrade approach, the right VA was accessed and cannulated via the right radial artery. An Excelsior SL10 microcatheter from Stryker Neurovascular and a 0.014-inch Synchro microwire were employed for this purpose, followed by coiling from the proximal aspect (Fig. 2d). A post-coiling angiography exhibited the near-complete occlusion of the right VA.

After the procedure, she experienced mild weakness on her left side, which was confirmed by a CT brain scan revealing a small left occipital hemorrhage. The chemo port was successfully repositioned the following day without any complications. During a follow-up after a span of 2 months, her condition showed slight remaining weakness in the left upper limb, and there were no signs of new neurological deficits, as indicated by a modified Rankin Scale (mRS1) assessment.

Complications related to CVC insertion can be classified into two categories: early (<30 days) and delayed (>30 days). Early complications encompass venous malpositioning, arterial injury, pneumothorax, hemothorax, thoracic duct injury, and cardiac tamponade. Delayed complications include infection, vessel thrombosis, stenosis, catheter fracture with extravasation, migration, and distal embolization.[3] Catheter-related cervicothoracic arterial injuries can give rise to various serious consequences. These range from airway obstruction due to cervical hematoma and hemothorax leading to shock, to stroke arising from arterial thrombosis or cerebral emboli. Additionally, complications such as

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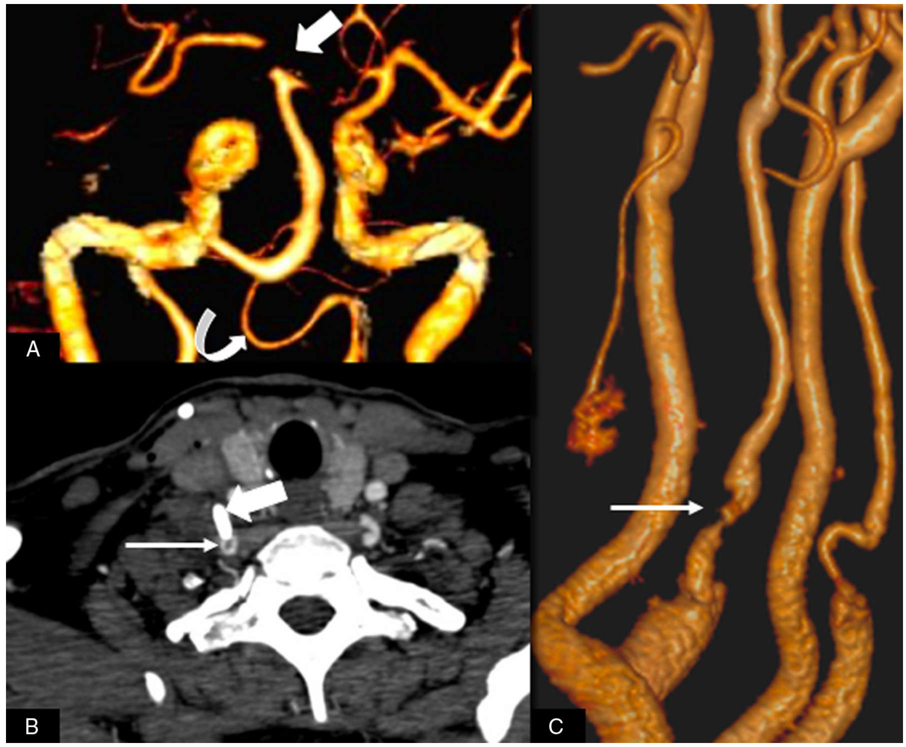

Figure 1: 3D images of CT angiography in oblique coronal view showing basilar top and left posterior cerebral artery occlusion (solid white arrow) with a small caliber V4 segment of left vertebral artery (curved white arrow) (1***a***). Axial sections of CT angiography at C7 level showing the chemoport (solid white arrow) in close contact with V1 segment of the right vertebral artery and a filling defect in the artery at this level suggestive of thrombus (thin white arrow) (1***b***). 3D images of CT angiography in coronal oblique view showing luminal irregularity and filling defect in V1 segment of the right vertebral artery (thin white arrow (1***c***).

pseudoaneurysm and arteriovenous fistula can also result from these injuries.[4] It is important to note that even a penetrating injury leading to vertebral artery (VA) cannulation can remain asymptomatic in up to 74% of patients. However, if left undiagnosed, it has the potential to lead to fatal outcomes.

VAI can be managed conservatively using the pull/pressure technique or actively through surgical or EVT, all aimed at preserving VA patency as the desired therapeutic outcome across treatment approaches.[5] However, it is important to note that pull/pressure techniques come with potential complications, including stroke (5.6%), hematoma, airway compression, and pseudoaneurysm. Notably, these complications are associated with significantly higher morbidity compared to surgical or EVT interventions.[2]

Surgical management may encompass microsurgical repair aimed at restoring arterial patency and minimizing ischemic complications, or it may involve VA ligation. Immediate surgery is indicated in cases of failed endovascular intervention, expanding hematoma, airway obstruction, or uncontrolled active bleeding leading to hemodynamic instability.[5] Unilateral VA ligation is generally well tolerated in the majority of cases. However, it is important to consider potential complications, which can include brainstem and cerebellar infarcts, cranial nerve palsies, and hemiplegia. These complications are more likely to arise when the contralateral VA is hypoplastic or stenotic, with inadequate collateralization of the posterior circulation.[6] In a study involving 101 patients who had sustained penetrating injuries to the VA and underwent open surgical repair, a retrospective review by Mwipatayi et al. reported a mortality rate of 6.93%.[7] Furthermore, Shintani and Zervas recorded a mortality rate of 12% following unilateral VA ligation.[8]

EVT offers a less invasive approach and is linked to a reduced risk of neurological complications, shorter hospital stays, lower morbidity and recurrence rates, and favorable outcomes, achieving a success rate of 85%–89%.[5] EVT encompasses both deconstructive techniques, such as parent artery occlusion and coil trapping, and reconstructive techniques involving covered stent or stent graft placement.[6] It can also complement open surgery, aiming to minimize intra- and postoperative hemorrhage.[5] In cases of dominant VA injury, a stent graft is the preferred method to avoid complications. Deconstructive techniques find preference in extensive arterial injuries, particularly when collateralization through the circle of Willis is inadequate.[9] Mechanical thrombectomy (MT) has garnered increasing interest in managing BA occlusion. The recent prospective multicenter ATTENTION trial has documented a higher rate of favorable outcomes (mRS score of 0–3) at 90 days, accompanied by reduced mortality in MT-treated patients compared to those under best medical management.[10] Similarly, the BAOCHE trial demonstrated that patients who underwent thrombectomy within 6 to 24 hours after symptom onset achieved better functional status at 90 days in comparison with those who received medical therapy, despite complications linked to the procedure and cerebral hemorrhages.[11]

In our particular case, we opted for EVT given the associated ischemic stroke. We proceeded with MT through the left VA, despite encountering challenges stemming from the small caliber of the V4 segment, the tortuous nature of the V1 segment, and the fenestrated V3 segment of the left VA (Fig. 2a). We deliberated on the possibility of stent graft placement in the right VA. However, this approach necessitates navigating a wire across the injured segment, which could lead to additional thromboembolic

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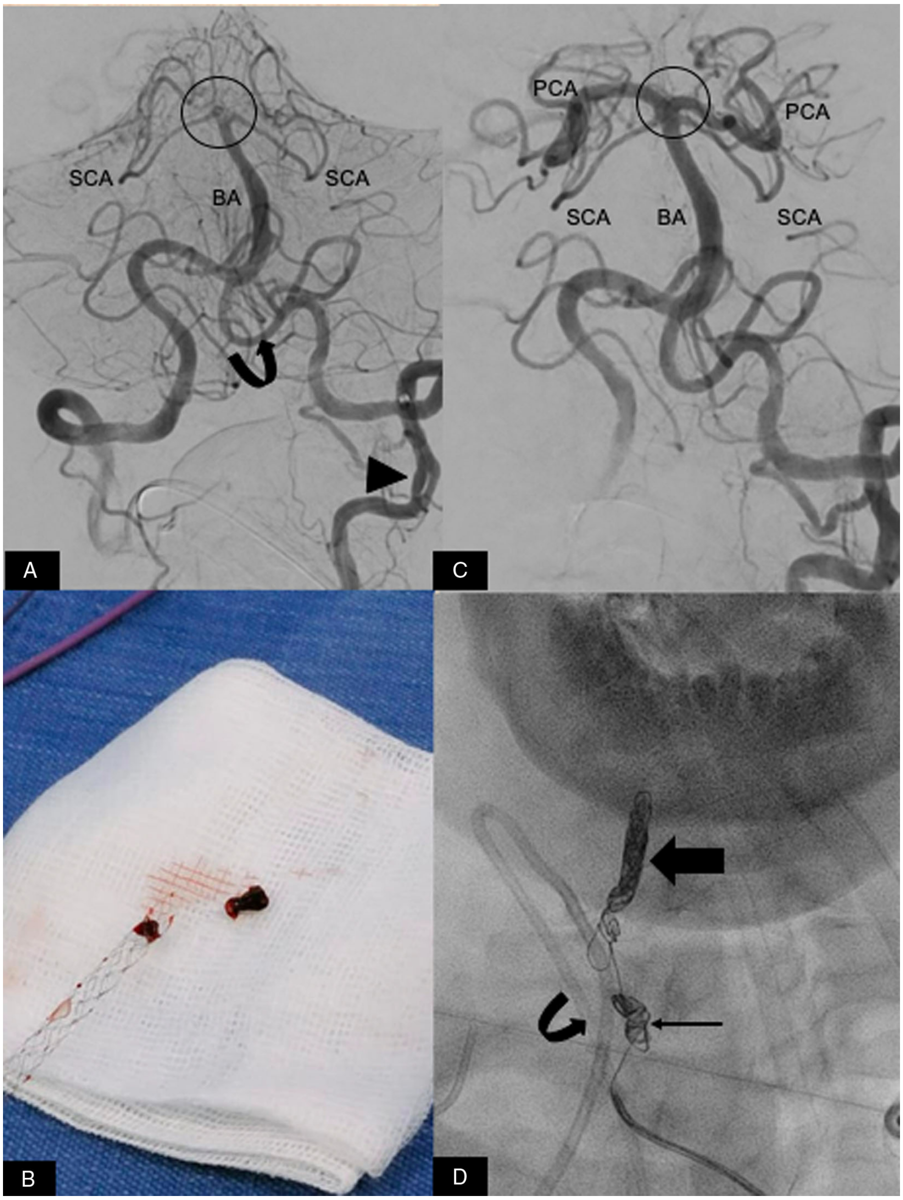

Figure 2: Pre-thrombectomy left vertebral artery angiogram showing filling defect in basilar top (within the circle outlined in black) and non-opacification of bilateral PCA. Small caliber V4 segment (curved black arrow) and fenestration in V3 segment (black arrow head) of left vertebral artery are also noted (2***a***). Thrombus retrieved from the basilar top with Solitaire X revascularization device (2***b***). Post-thrombectomy left vertebral artery angiogram showing filling of basilar top (within the circle outlined in black) and both PCA (2***c***). Fluoroscopic images of parent artery occlusion with coils in right vertebral artery proximal (solid black arrow) and distal (thin black arrow) to the site of injury. The chemoport (curved black arrow) is seen traversing close to this site (BA = basilar artery; PCA = posterior cerebral artery; SCA = superior cerebellar artery) (2***d***).

complications. To prevent further thromboembolic incidents and circumvent retrograde arterial filling, we chose to trap the right VA proximal and distal to the site of injury.[6]

After undergoing chemo port insertion, VAI stands as a rare yet serious complication necessitating immediate management through suitable EVT or surgery. When cases involve suspected infarction arising from arterial injury, EVT emerges as the preferred treatment method, characterized by a minimal risk of neurological complications.

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