UPPER LIMB MONOPARESIS: IMAGING EVALUATION AND ENDOVASCULAR MANAGEMENT OF IATROGENIC PSEUDOANEURYSM

Vaishnavi Thakker \textsuperscript{1,a}, Sambhaji Pawal \textsuperscript{b}, Rahul Arkar \textsuperscript{b} and Vijetha Chanabasanavar \textsuperscript{a} \\
\textsuperscript{a} Department of Radiodiagnosis, Dr D Y Patil Medical College, Hospital and Research centre, Pimpri-411018. \textsuperscript{b} Department of Interventional Radiology, Dr D Y Patil Medical College, Hospital and Research centre, Pimpri-411018.

ABSTRACT Background: Cannulation of the internal jugular vein is a common procedure in hospitals. The development of false aneurysms, emboli, fistulae and hematomas are common complications due to vascular interventions. False aneurysms, or pseudoaneurysms, constitute the majority of these iatrogenic complications. Pseudoaneurysms can be life-threatening and are considered a surgical emergency due to their high relative risk of rupture and bleeding. Case Presentation: This is a case of a 29-year-old female who presented with symptoms of delayed paralysis of the brachial plexus due to transverse cervical artery pseudoaneurysm following iatrogenic trauma. Discussion: The brachial plexus is the primary source of peripheral nervous innervation to the upper extremity, associated muscles of the upper chest and cutaneous supply to the skin and hand. In the thoracic outlet region, the brachial plexus comes in close contact with major subclavian vessels supplying the upper extremity. Because of the anatomic proximity between the brachial plexus and transverse cervical artery in the thoracic outlet, a pseudo aneurysm or hematoma in this region can cause compression of the neuroplexus and lead to the gradually progressive neurological deficit over days to weeks as opposed to direct penetrating injuries. If left untreated, brachial plexopathy has an unfavourable prognosis. Endovascular therapy and surgical management play a crucial role in their treatment. Endovascular repair has been more widely accepted in recent years due to increased procedural efficacy and its less invasive nature. Since the subclavian artery exposure and difficult vascular control in open surgery pose a challenge in managing pseudoaneurysms, endovascular treatment is the preferred treatment method.

KEYWORDS Pseudoaneurysm, Complications, Endovascular treatment/therapy, Subclavian artery, Digital subtraction angiography

Introduction

Cannulation of the internal jugular vein is a common procedure in hospitals.\textsuperscript{(1)} Development of false aneurysms, emboli, fistulae and hematomas are common complications due to vascular interventions.\textsuperscript{(2)} False aneurysms, or pseudoaneurysms, constitute most of these iatrogenic complications. A pseudoaneurysm can also be referred to as a pulsatile hematoma or communicating hematoma.\textsuperscript{(3)}

Aneurysms can be discussed under two broad categories – true and false. True aneurysms are bounded by all 3 layers of the blood vessel. In contrast, a pseudoaneurysm is described as an encapsulated pulsatile hematoma communicating with the lumen of a ruptured vessel following the disruption of one of its layers.\textsuperscript{(4)} This deficiency in the 3-layered wall structure makes it more susceptible to rupture; hence, Pseudoaneurysms can be life-threatening and are considered a surgical emergency due to
their high relative risk of rupture and bleeding,\(^{(5)}\).

More often than not, aneurysms and pseudoaneurysms of the subclavian artery causing compressive myelopathy are responsible for sudden or delayed onset limb paresis,\(^{(6)}\)

In this case, we report endovascular therapy’s utility in managing a subclavian artery pseudoaneurysm following iatrogenic trauma producing symptoms of delayed paralysis of the brachial plexus.

**Ethical Considerations**

This report followed all ethical standards for research. Written informed consent was obtained from the patient prior to conducting the study and for publication, along with relevant images. Patient identity is not disclosed.

**Case presentation**

A 29-year-old female patient was admitted to our hospital with complaints of diminished vision in the right eye, associated with pain and redness. She also complained of nonspecific lower limb weakness for 10 months without fever, diarrhoea, or vaccination. She denied any history of trauma to the head or eye region, hypertension, diabetes, rash, and joint pain. There was no family history of autoimmune disease.

Following back her clinical history, it was discovered that she was diagnosed with Neuromyelitis Optica. Magnetic resonance imaging showed a bulky right optic nerve with mild post-contrast enhancement. One year later, the patient presented with bilateral diminution of vision, and she underwent serial magnetic resonance imaging which was suggestive of bilateral optic neuritis. (Figure 1)\(^{(7)}\)

**Management and Outcome**

**Role of Interventional Radiology in the management of pseudoaneurysm**

Under local anaesthesia, 6F right femoral arterial access was taken. Right, subclavian angiogram showed small (approximately 2.0 x 1.5mm size), anterosuperior projecting pseudoaneurysm arising from a transverse cervical branch of right thyrocervical trunk. (Figure 3)\(^{(9)}\)

6F Envoy guiding catheter was placed in the right thyrocervical trunk using Terumo guidewire. Transverse cervical artery pseudoaneurysm was crossed with 0.014 Gandslam J guidewire. Subsequently, Graftmaster (3.5 x 16mm) stent graft was deployed across the pseudoaneurysm. (Figure 4)\(^{(10)}\)

Post-procedure right subclavian angiogram showed complete exclusion of transverse cervical artery pseudoaneurysm from circulation. The procedure was uneventful. (Figure 5)\(^{(11)}\)
Discussion
The brachial plexus is the primary source of peripheral nervous innervation to the upper extremity, associated muscles of the upper chest and cutaneous supply to the skin and hand. In the thoracic outlet region, the brachial plexus comes in close contact with major subclavian vessels supplying the upper extremity. It is known to course postero-superiorly to the subclavian artery and vein. Anatomically, the subclavian artery, the transverse cervical artery, courses along the base of the scalene triangle bounded on either side by the anterior and middle scalene muscles. Brachial plexopathy can result from various causes such as traumatic vascular and nervous injuries, invasion by intrinsic masses, compression by extrinsic masses such as pseudoaneurysms, and hematoma formation.\(^{12}\)

Although rare, injuries to the transverse cervical artery account for 1–2% of all vascular injuries.\(^{13}\) More often than not, they arise due to iatrogenic causes, such as unintended arterial puncture during internal jugular venous cannulation,\(^{14}\) as was in our case. Because of the anatomic proximity between the brachial plexus and transverse cervical artery in the thoracic outlet, a pseudo aneurysm or hematoma in this region can cause compression of the neuroplexus and lead to the gradually progressive neurological deficit over days to weeks as opposed to direct penetrating injuries. Direct injuries to the brachial plexus are more readily picked up in clinical practice due to the sudden onset of paralysis.\(^{15}\)

If left untreated, brachial plexopathy has an unfavourable prognosis and can lead to irreparable damage causing functional disturbance of the involved extremity. Increasing neurological deficits in patients with such injuries should urge speedy surgical intervention to prevent permanent damage.\(^{16}\)

Pseudo aneurysms warrant prompt treatment and life-threatening risk of rupture and neurological and embolic complications. Endovascular therapy and surgical management play a crucial role in their treatment.\(^{16}\) MR imaging is pertinent in order to identify and differentiate between various causes of brachial plexopathy. Aneurysms and pseudo aneurysms are represented by concentric rings of varying signal intensities due to various stages of blood products in the walls of pseudoaneurysms or as flow voids in T2WI depending on the flow rate through the artery.\(^{12}\)

Due to increased procedural efficacy and its less invasive nature, endovascular repair has been more widely accepted in recent years.\(^{17}\)

Since the subclavian artery exposure and difficult vascular control in open surgery pose a challenge in managing pseudoaneurysms,\(^{18}\) endovascular treatment is the preferred treatment method. Self-expanding systems seem to be exceptionally promising in the endovascular management of pseudo aneurysms, owing it their flexibility.\(^{14}\) Arterial dissections, arterio-venous fistulae and aneurysms in various arterial vessels have been treated using stent grafts and bare stents.\(^{14}\) Selective coil placement can be used to treat traumatic pseudo aneurysms quickly since they heal spontaneously in most cases.\(^{19}\) Although promising results have been obtained, the data on the outcome of endovascular treatment in the subclavian artery is currently limited due to its infrequent occurrence.\(^{20}\)

Acknowledgements
Department of Interventional Radiology

Competing interests
The authors declare that we have no financial or personal relationship that may have inappropriately influenced them in writing this article.
Author contributions
All authors meet the criteria for authorship as outlined in the authorship policy and author contribution statement policies.

Funding
We have not received any specific grant or funding to conduct this study.

Data availability
All research articles are encouraged to have a data availability statement.

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The views expressed in the submitted article are the author’s own and not an official position of the institution or funder.

References


7. Figure 1 – self obtained image
8. Figure 2 – self obtained image
9. Figure 3 – self obtained image
10. Figure 4 – self obtained image
11. Figure 5 – self obtained image


