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Case Report

A rare case of overlapping thoracic outlet syndrome attributed to an anatomical variation in the anterior scalene muscle: Diagnostic challenges and treatment approaches ☆

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ABSTRACT

Mixed thoracic outlet syndrome, which compresses arteries and nerves, is a rare disorder. Mixed thoracic outlet syndrome due to anatomical abnormalities of the anterior scalene muscle is even more sporadic. We report a case of mixed thoracic outlet syndrome in a patient with no history of trauma or vigorous exercise. We reviewed the medical literature, emphasizing the clinical role and the role of diagnostic imaging methods in a sequential approach to this syndrome.

Introduction

Thoracic outlet syndrome (TOS) is a rare disorder characterized by pain and paresthesias in the hands, neck, shoulders, or arms related to compression of nerves or blood vessels through the thoracic outlet. Thoracic outlet syndrome is divided into 3 groups according to the compressed structure, of which neurogenic thoracic outlet syndrome (nTOS) is the most common (90%-95%), followed by venous thoracic outlet syndrome (vTOS) (3%-5%), and arterial thoracic outlet syndrome (aTOS) is the rarest (<1%) [1]. Studies have also reported mixed thoracic outlet syndrome when combined vascular and neurovascular compression [2,3].

Vascular TOS is often diagnosed between the ages of 20-30, while nTOS typically presents in the 20-40 age range. The common causes of TOS include trauma, compression, repetitive patient activities, or rare anatomical changes, leading to fibrosis and narrowing of the thoracic outlet. aTOS is more prevalent in athletes or individuals who frequently work with raised

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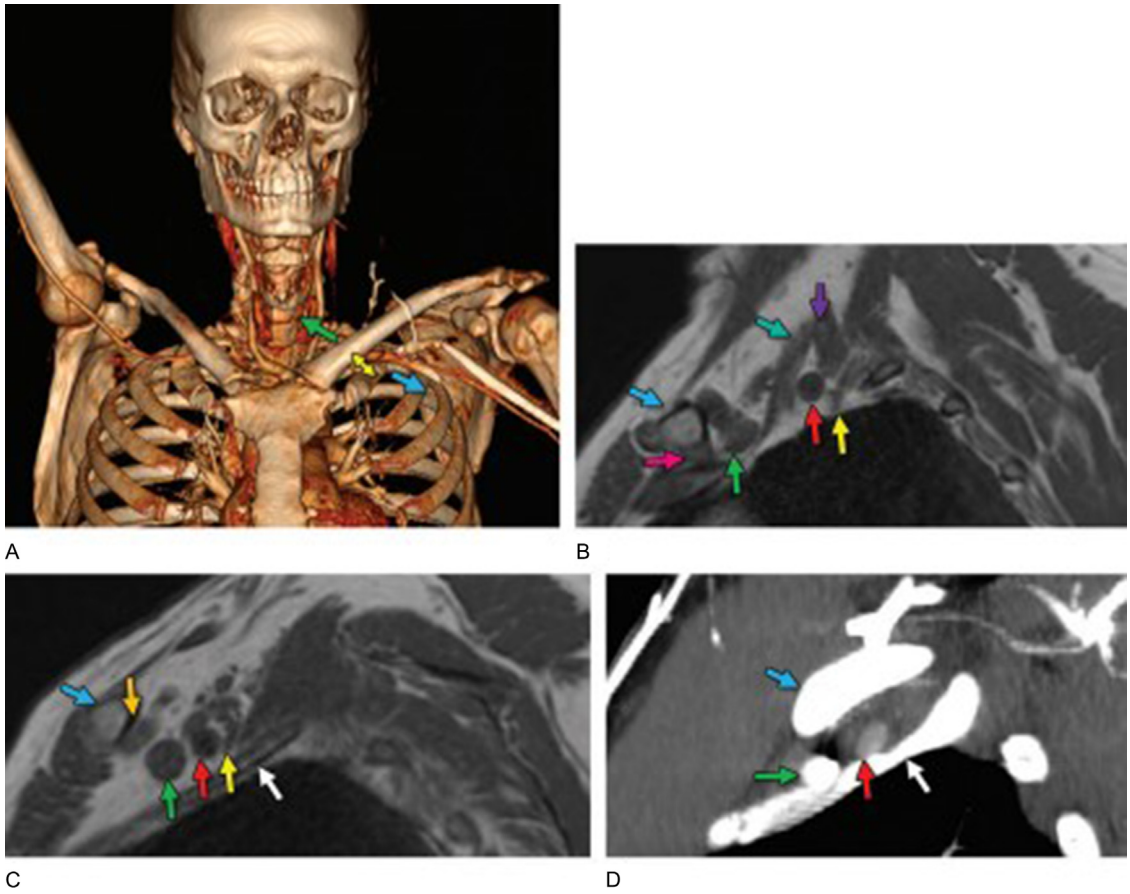

Fig. 1 – Cross-sectional anatomy of the thoracic outlet at computed tomography (CT) and magnetic resonance (MR) imaging (A) Volumetric CT reconstruction shows the locations of the 3 compartments of the thoracic outlet. The scalene triangle lies above the clavicle (green arrow). Moving laterally, the costoclavicular space lies between the clavicle and first rib (double-headed yellow arrow). The most lateral compartment, the pectoralis minor space, lies inferior to the clavicle (blue arrow), (B) Sagittal T1-weighted MR image at the level of the scalene triangle with the arms adducted shows key structures at this level, including the middle scalene muscle (purple arrow), anterior scalene muscle (teal arrow), clavicle (blue arrow), costoclavicular ligament (pink arrow), subclavian vein (green arrow), subclavian artery (red arrow), and brachial plexus (yellow arrow), (C) Sagittal T1-weighted MR image at the level of the costoclavicular space with the arms adducted shows the clavicle (blue arrow), subclavius muscle (orange arrow), subclavian vein (green arrow), subclavian artery (red arrow), brachial plexus (yellow arrow), and first rib (white arrow) and (D) Sagittal CT image of a different patient at the level of the costoclavicular space with the arms abducted shows how the clavicle (blue arrow) moves posteriorly over the neurovascular bundle, resulting in crowding of these structures. Green arrow, subclavian vein; red arrow, subclavian artery; white arrow, first rib.

arms. Furthermore, some cases of aTOS result from anatomical causes, with 85% attributed to cervical rib abnormalities [4]. Less common anatomic abnormalities that can cause aTOS include an anomalous first rib, a prominent C7 transverse process, callus formation from an old clavicular or first rib fracture, and soft tissue abnormalities [5,6]. If TOS is not detected and treated promptly, it can lead to dangerous complications, including ischemic necrosis, thrombosis causing pulmonary embolism, and permanent neurological damage [2].

Early and accurate diagnosis of the TOS subtype remains a significant challenge for clinicians. In this context, we report a case of mixed thoracic outlet syndrome attributed to a rare anatomical variation of the anterior scalene muscle in a patient with no history of trauma or vigorous exercise. Our review of the medical literature underscores the crucial roles of clinical and imaging diagnostics in a sequential approach to this syndrome.

Case presentation

A 41-year-old female healthcare worker was hospitalized on June 26, 2023, due to numbness and pain in her left hand. The symptoms started a year ago, manifested as numbness, pain, and coldness extending from the left hand to the forearm. These symptoms appeared when she raised her hand above her head for 1-3 minutes or drove for an extended period and

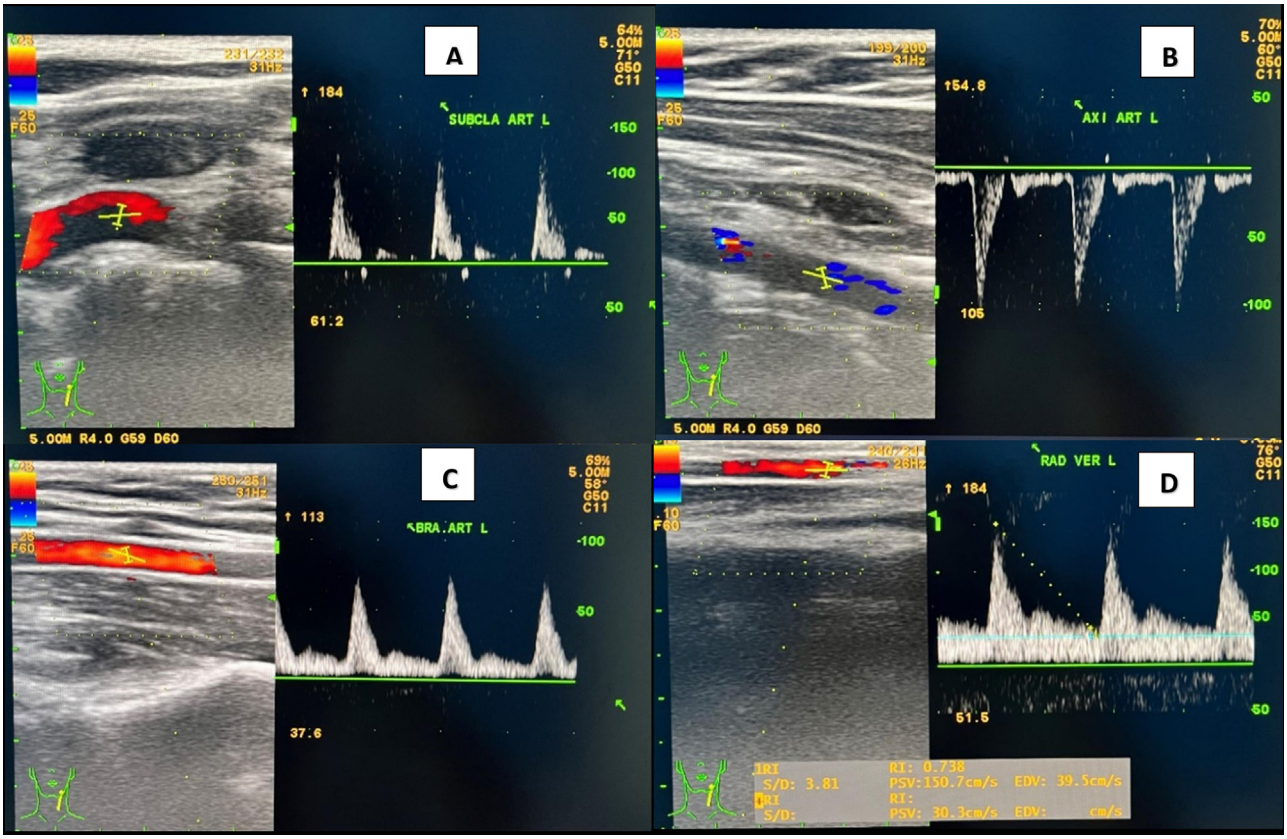

Fig. 2 – DUS images of the left Subclavian (A), axillary (B), brachial (C), radial (D) arteries in the arm-down position. The images include 2D, Doppler color, and PW (Pulsed Wave) mode representations. Notably, the PW Doppler spectra exhibit peak velocity and resistant index within the normal range.

gradually disappeared when she lowered her hand or massaged it.

The patient had a history of surgery in 2020 to place breast implants on both sides of the chest line under the breasts. She had no cardiovascular disease, no record of trauma or collision, did not smoke, and did not engage in heavy sports. Previously, she was diagnosed with cervical disc herniation and cervical nerve root compression and received acupuncture physical therapy, which proved ineffective. In current examination, the cardiologist had ordered a vascular Doppler ultrasound (DUS) test. Thoracic computed tomography angiography (CTA) and magnetic resonance imaging (MRI) were indicated only after abnormal vascular ultrasound results.

The patient presented with an average physical condition and a BMI of 21.8 kg/m^2. During clinical examination, a weak left brachial pulse was noted after raising her hand for 1-3 minutes. Blood pressure measured on her left arm when lowering her arm was 120/70 mmHg, and when raising her arms overhead, it was 110/60 mmHg. Notably, after 1 minute of raising her arms overhead, the blood pressure dropped to 80/40 mmHg. The radial pulses in both arms beat equally in the neutral position, but the left side exhibits a more pronounced decrease than the right when the arms are raised above the head. There was no muscle hypertrophy or amyotrophy in the upper limbs. Tendon reflexes and muscle strength were normal. Superficial and deep sensory examinations of both hands revealed no abnormalities. The Wright test was positive, while the results of the upper limb tension test, elevated arm stress test, and Adson test were unclear.

A DUS of the upper limb blood vessels was performed with suspicion of compression on the left subclavian artery anteriorly to the costoclavicular space during arms overhead positioning. The recorded image showed decreased flow from the subclavian artery posteriorly to the costoclavicular space, the axillary artery, brachial artery, and radial artery, with reduced velocity, decreased resistive index (RI), expressed monophasic Doppler spectra (tardus-parvus waves). The vessel wall showed nonatherosclerotic, and no evidence of aneurysm, stenosis, or thrombosis. The left vertebral artery was found to have hypoplasia measuring 1.2 mm (Figs. 2 and 3).

The CTA of the upper limbs with Iopromide 370 revealed that, with the arm raised, the left subclavian artery exhibited complete blockage, with no blood flow observed over a 24 mm segment of the vessel in the costoclavicular space. A narrow costoclavicular space was noted. In the neutral arm position, contrast typically circulates in the costoclavicular area (Figs. 4–7).

In Magnetic resonance imaging without contrast injection, T1-weighted images revealed the presence of the accessory branch of the left anterior scalene muscle. This branch ex-

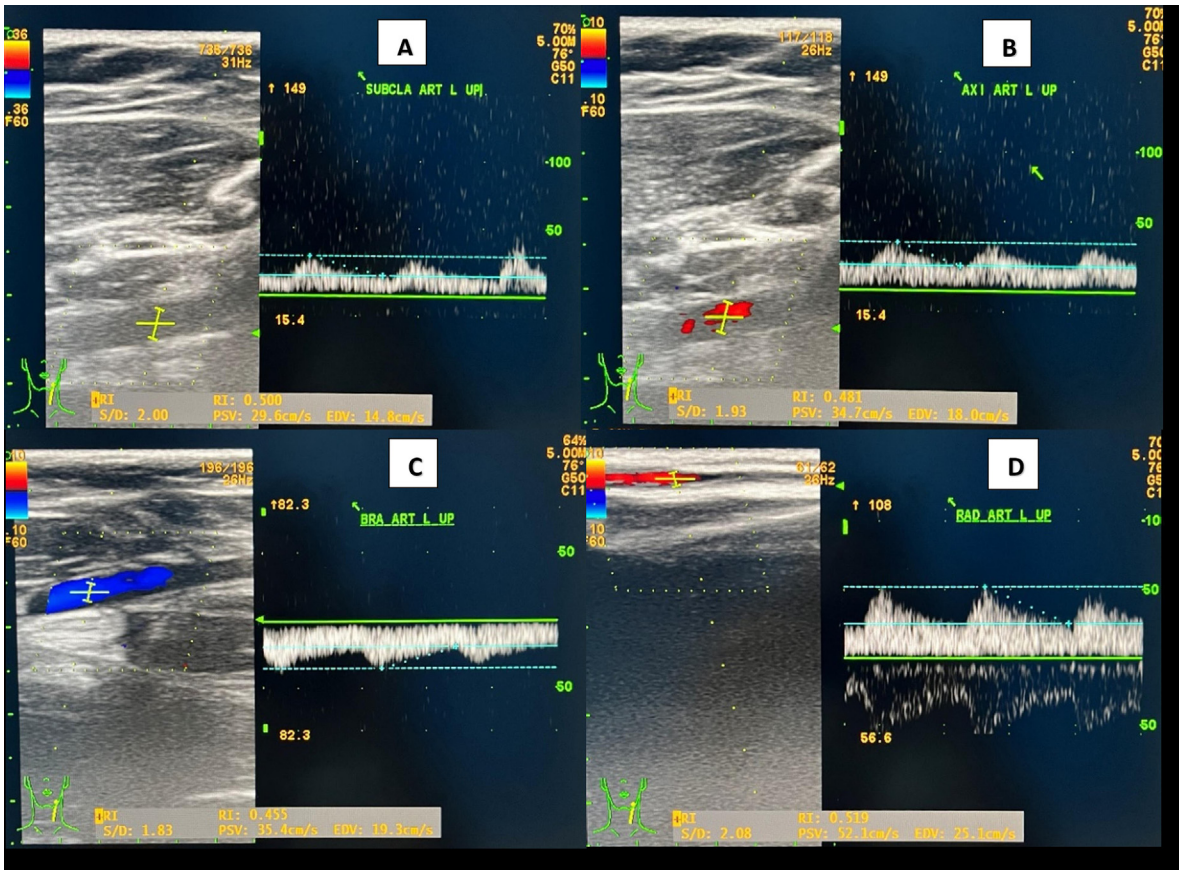

Fig. 3 – DUS images of the left subclavian artery posteriorly to the costoclavicular space (A), axillary artery (B), brachial artery (C) and radial artery (D) in the arms adducted position. The images depict 2D, Doppler color, and PW (Pulsed Wave) mode representations of the Subclavian artery posteriorly to the costoclavicular space (A), axillary (B), brachial (C), and radial (D) arteries in the arms adducted position. Notably, dynamic PW Doppler spectra show a decrease in peak velocity and resistant index compared with the arm-down position, indicating tardus-parvus waves. This suggests a severe stenosis in the subclavian artery anteriorly to the costoclavicular space in the overhead position.

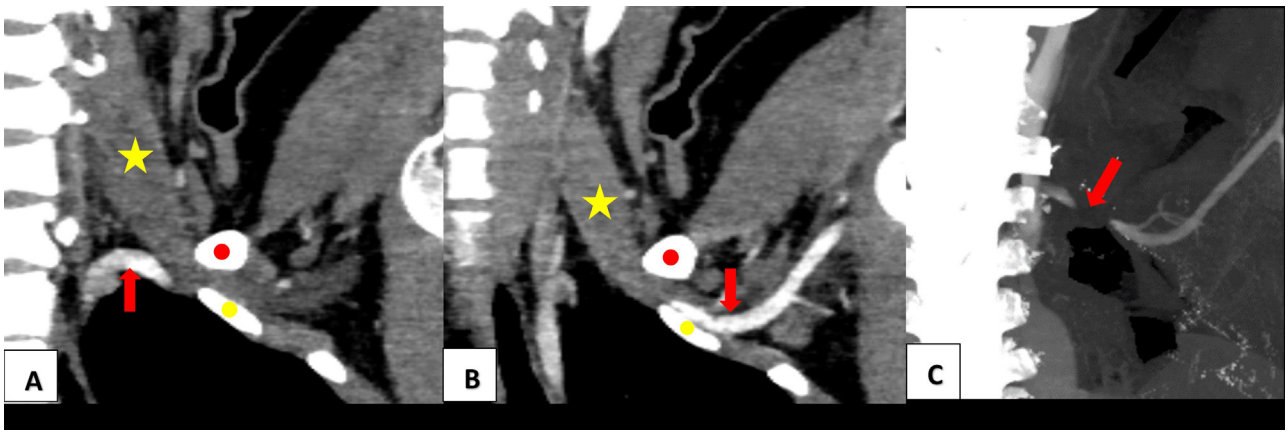

Fig. 4 – Coronal CTA images show the left subclavian artery in the costoclavicular space. The coronal CTA images with the arms adducted depict the left subclavian artery (red arrow) in three segments: before entering the costoclavicular space (A), out of the costoclavicular space (B), and a segment with a contrast defect inside the costoclavicular space (image C). This defect suggests a blocked arterial blood flow. red arrow, subclavian artery; yellow star, anterior scalene muscle; red dot, clavicle; yellow dot, first rib.

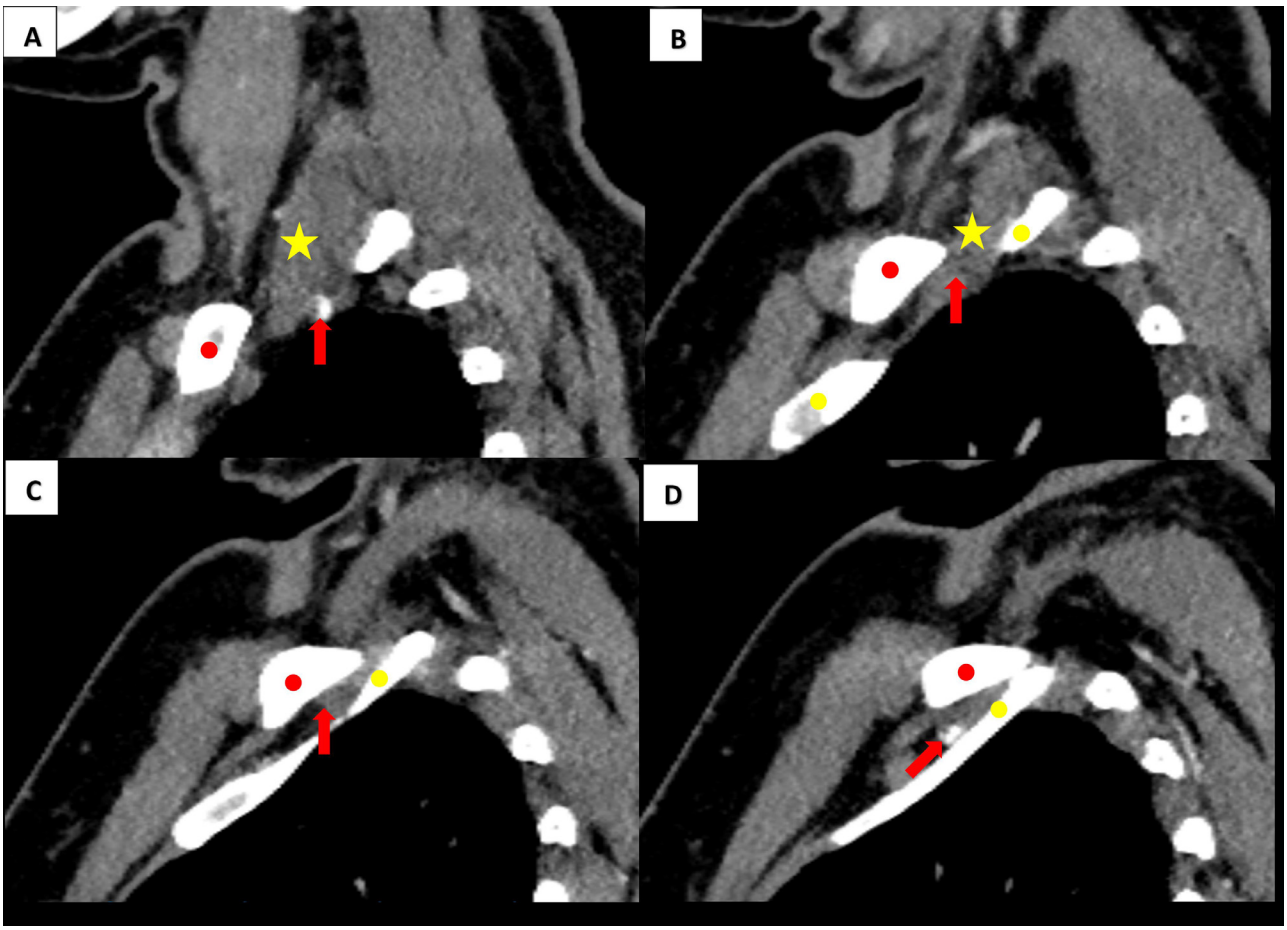

Fig. 5 – Sagittal CTA images show the left subclavian artery in the costoclavicular space. Four consecutive slices of sagittal CTA images with the arms adducted illustrate the left subclavian artery (red arrow) in sequence: before entering the costoclavicular space (A), a segment with a contrast defect inside the costoclavicular space suggesting blocked arterial blood flow (B and C), and out of the costoclavicular space (D). red arrow, subclavian artery; yellow star, anterior scalene muscle; red dot, clavicle; yellow dot, first rib.

tends from the back to the front and inserts into the medial 1/3 of the left clavicle. Notably, it exerts pressure on the left subclavian artery around the middle 1/3, leading to compression of the left brachial plexus (as indicated by hyperintensity on the Short Tau Inversion Recovery image). The level of compression intensifies when maintaining the position with both arms raised over the head (Figs. 8–11).

The electromyography results showed no abnormalities in both positions.

On August 8, 2023, the patient underwent surgery for treatment. Surgeons accessed the supraclavicular fossa by making an incision in the superior 1/3 of the left clavicle. The anatomical abnormality identified was the anterior scalene muscle attaching to the clavicle. The brachial plexus and subclavian artery were found to run close to the posterior aspect of the medial clavicle, with the middle scalene muscle laterally, the first rib posteriorly, and the clavicle anteriorly. During the procedure, surgeons carefully cut the anterior and middle scalene muscles, removed the first rib segment from the sternum head to the lateral brachial plexus and artery, and cut the subclavian power. This intervention successfully freed the nerves and the vessel from compression.

During the 1-month follow-up after surgery, the patient exhibited significant improvement in compression symptoms without any complications. CTA images with the arms adducted revealed well-circulation of the left subclavian artery in the costoclavicular space (Figs. 12 and 13)

Discussion

Epidemiology

Peet first described thoracic outlet syndrome [1]. It is a rare disease, with an occurrence rate in the community ranging from 1 to 3 cases per 100,000 people. The thoracic outlet is defined as the space from the supraclavicular fossa, medial to the axilla, traversing inferior to the clavicle, and laterally to the pectoralis minor, while superior to the first rib. Key neurovascular structures passing through the thoracic outlet include the brachial plexus, subclavian artery, and subclavian vein. The interscalene triangle, bordered by the anterior scalene muscle, middle scalene muscle, and the first rib, encom-

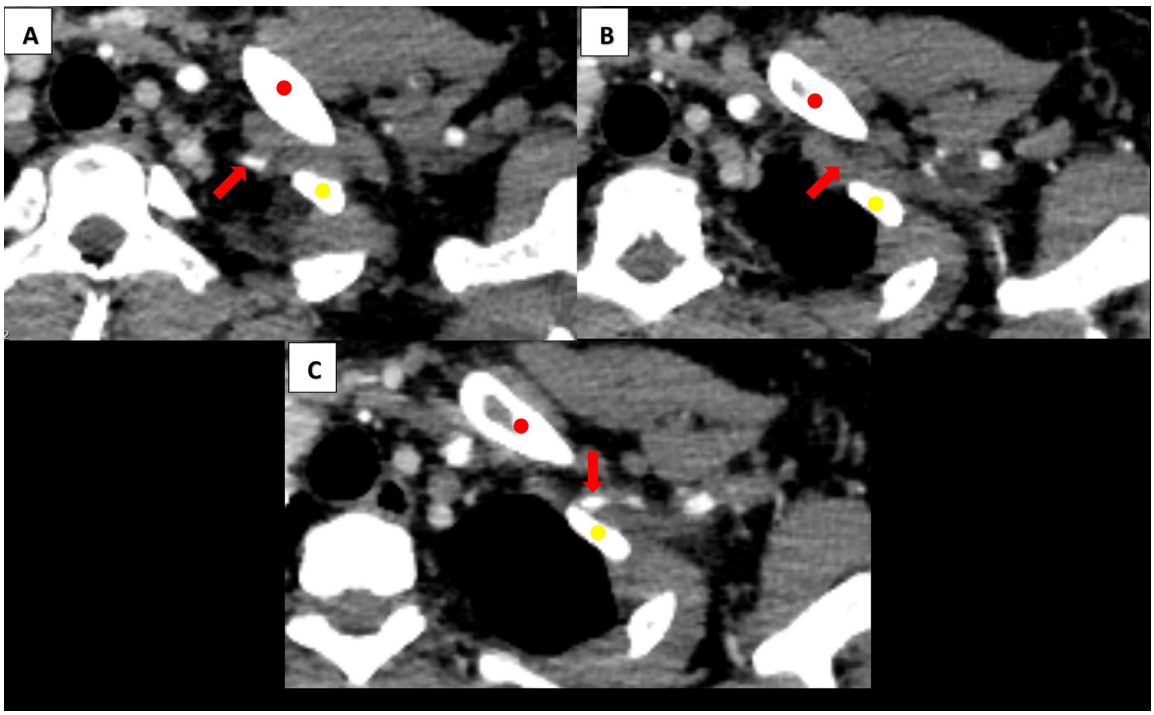

Fig. 6 – Axial CTA images show the left subclavian artery in the costoclavicular space. Three consecutive slices of axial CTA images with the arms adducted demonstrate the left subclavian artery (red arrow) in sequence: before entering the costoclavicular space (A), a segment with a contrast defect inside the costoclavicular space suggesting blocked arterial blood flow (B), and out of the costoclavicular space (C). red arrow = subclavian artery, red dot = clavicle, yellow dot = first rib.

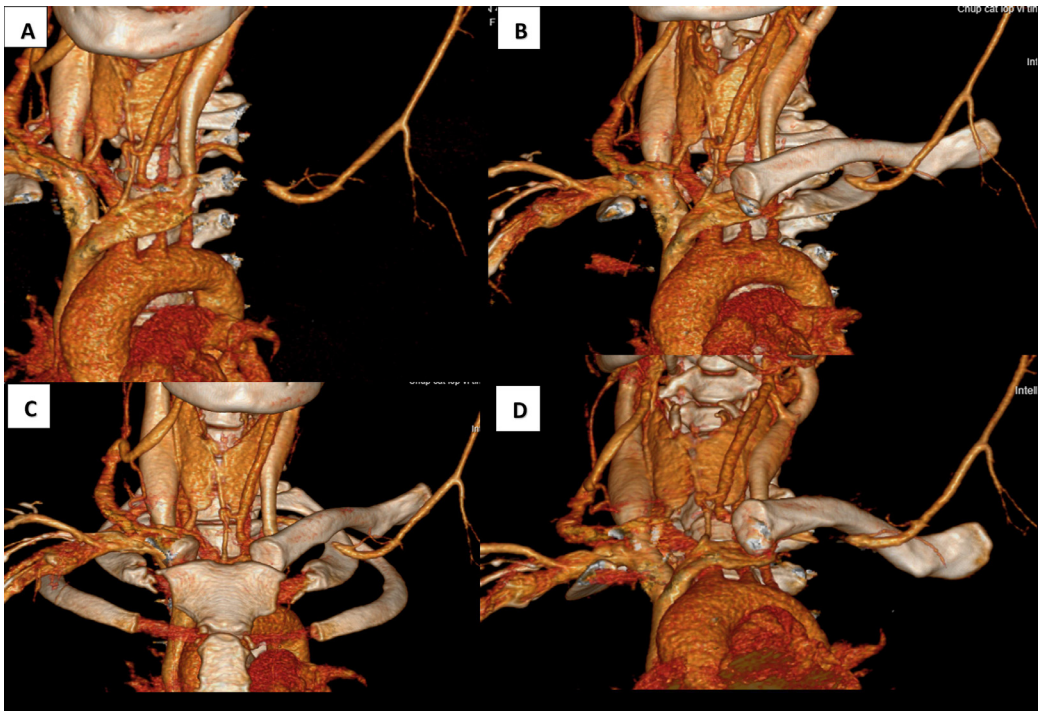

Fig. 7 – Volumetric CT reconstruction images show the left subclavian artery and correlation with adjacent structures in costoclavicular space.

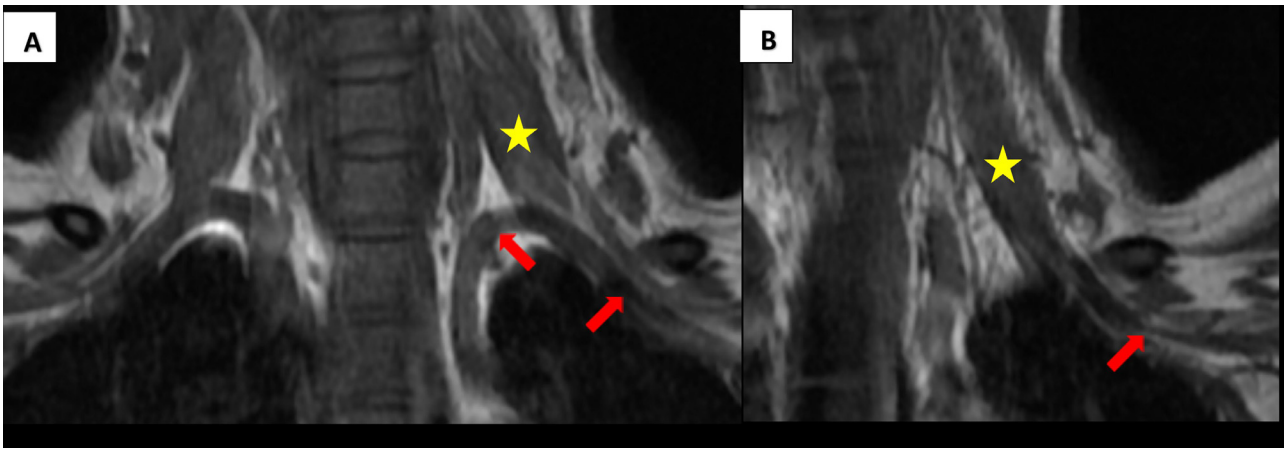

Fig. 8 – The noncontrast coronal T1-weighted MR images show the Left subclavian artery compressed in costoclavicular space. Two consecutive slices of non-contrast coronal T1-weighted MR images with the arms adducted reveal the compression of the subclavian artery (red arrow) inside the costoclavicular space. red arrow = subclavian artery, yellow star = anterior scalene muscle.

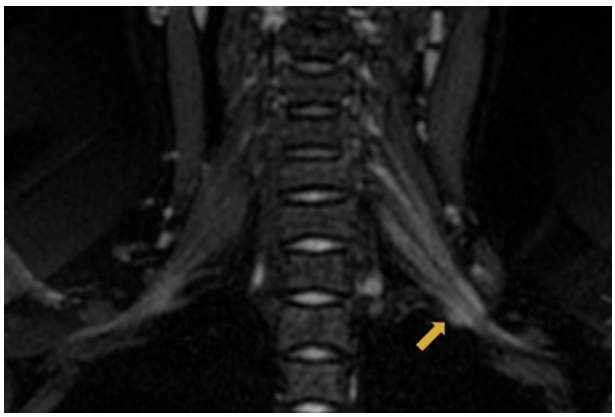

Fig. 9 – The Short Tau Inversion Recovery MR imaging show the left brachial plexus compressed in costoclavicular space. Signs of compression on the left brachial plexus (yellow arrow) within the costoclavicular space are evident as hyperintense and edema on Short Tau Inversion Recovery MR imaging with the arms adducted.

passes the subclavian artery and brachial plexus. The costoclavicular space, situated between the first rib and clavicle, includes the brachial plexus, subclavian artery, and subclavian vein, running medially to the anterior scalene muscle. Finally, the coracopectoral tunnel is the area between the ribs and the pectoralis minor muscle, containing the cords of the brachial plexus and the axillary artery [7]. The anatomy of the thoracic outlet is dynamic, and the abduction of the ipsilateral arm can potentially lead to the narrowing of the thoracic outlet in all 3 spaces. This phenomenon is observable in both symptomatic and asymptomatic patients and plays a significant role in the development of neurovascular compression in individuals with TOS [6,8] (Fig. 1). aTOS is even infrequent, accounting for less than 1% of all TOS cases. nTOS presenting with arterial symptoms can be observed in about 5% of patients. aTOS is typically diagnosed in individuals aged 20-30 years, affecting both sexes. It is associated with a history of compression trauma or heavy repetitive labor, leading to muscle fibrosis and narrowing of the thoracic outlet [2]. aTOS results from the compression of the subclavian artery at the root of the neck, commonly occurring in the costoclavicular space, with cervical rib abnormalities accounting for approximately 85% of cases. The causes of aTOS can be categorized into skeletal factors, such as congenital abnormalities of the cervical ribs, bone tumors, and fractures, as well as nonskeletal factors, including scalene muscle hypertrophy, postoperative scarring, or intrinsic arterial disease [3]. Soft tissue abnormalities contributing to TOS can be either congenital or acquired. Congenital soft tissue abnormalities encompass variations in scalene muscle insertions, hypertrophy of the scalene muscles, or the presence of accessory scalene muscles. The anterior and middle scalene muscles, originating from a common scalene muscle that later separates into distinct components, contribute to the brachial plexus. The anterior scalene muscle originates from the anterior tubercle of C3–C6 and inserts onto the scalene tubercle of the first rib. Various complex anatomic variations of the scalene muscles may be implicated in TOS. For instance, an accessory scalene muscle or scalenus minimus may have variations in its origin from C6 or C7, inserting into the scalene tubercle of the first rib or cervical pleura of the lung, potentially causing TOS. Anomalies such as fibromuscular bands extending between the transverse process of a cervical vertebra and the first thoracic rib have also been described by Roos [8–11].

The case we reported exhibited no risk factors documented in the literature. The onset of the disease occurred at the age of 41. This condition is particularly rare due to the combination of characteristics, including the presence of aTOS with neurological symptoms, the patient's age, the absence of known risk factors, and, notably, its unusual reason for the acces-

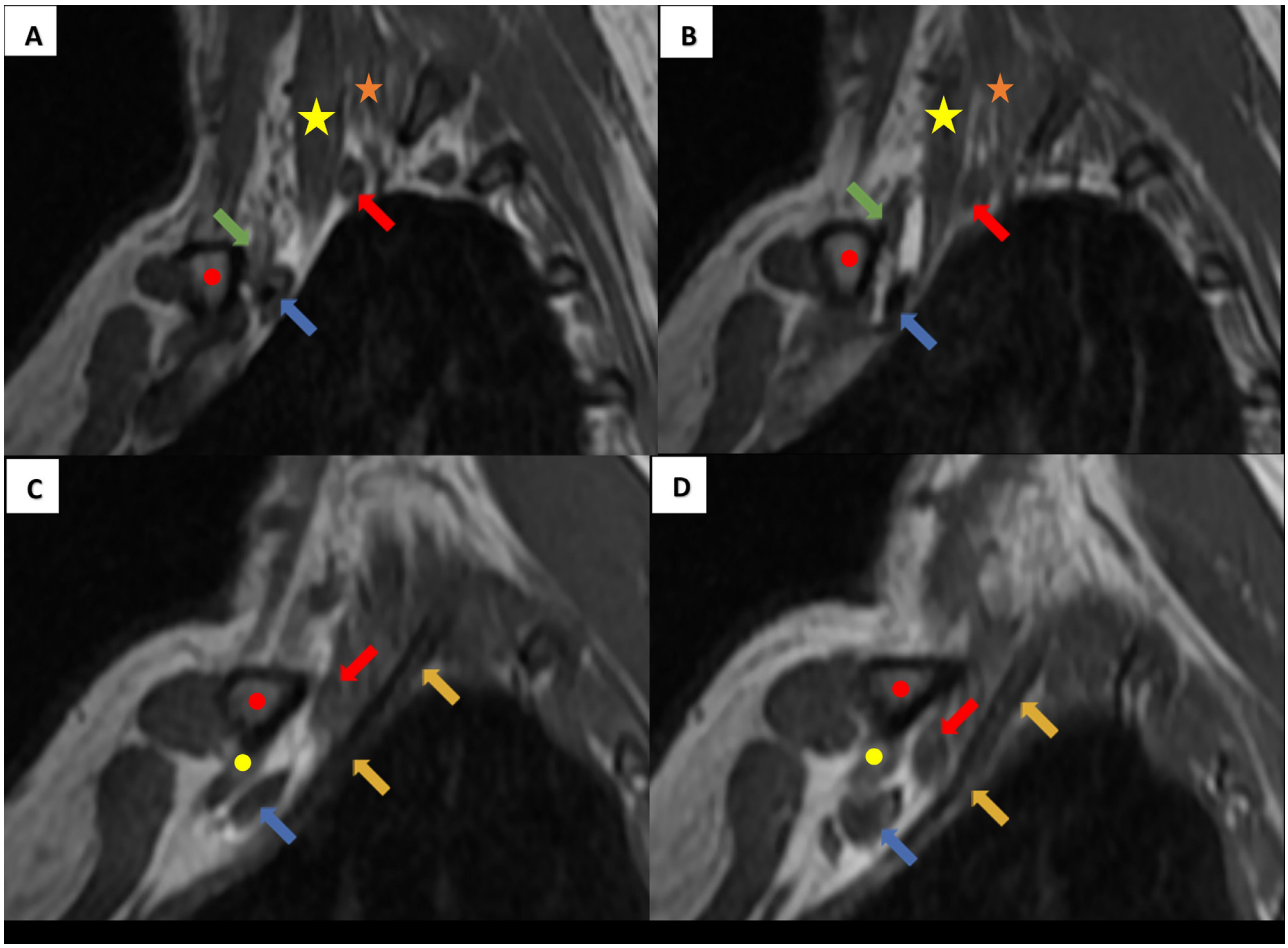

Fig. 10 – The non-contrast sagittal T1-weighted MR images show key structures in the interscalene triangle and costoclavicular space. Four consecutive slices of sagittal T1-weighted MR images at the level of the interscalene triangle (A-B) and costoclavicular space (C-D) with the arms adducted provide comprehensive insights. In (A-B), key structures at the interscalene triangle include the middle scalene muscle (orange star), anterior scalene muscle (yellow star), clavicle (red dot), subclavian vein (blue arrow), and subclavian artery (red arrow). Notably, an anatomical variation is observed—an accessory branch of the anterior scalene muscle (green arrow) inserting posteriorly to the clavicle, anteriorly to the subclavian vein. This accessory branch may contribute to the compression of the subclavian artery and brachial plexus as they traverse the costoclavicular space. In (C), signs of compression are evident on the 1/3 middle left subclavian artery (red arrow) as it traverses the costoclavicular space, marked by deformation of the artery wall and loss of fat around the artery. Finally, (D) illustrates the neuro-arterial bundle (red arrow) passing through the site of compression. Red dot= clavicle, yellow dot= subclavian muscle, yellow arrow= first rib, blue arrow= subclavian vein.

sory branch's abnormal attachment of the anterior scalene muscle.

Symptoms and diagnosis

Thoracic outlet syndrome often presents without specific symptoms, making it prone to misdiagnosis as other diseases. The most commonly reported symptoms include pain and paresthesia in the head, neck, and upper extremities, especially noticeable during positional changes, raising the arm above the head, or prolonged periods of holding the arm in a fixed position [12]. The symptoms of aTOS are often more dangerous, encompassing acute ischemia, aneurysm, complete occlusion, or dilatation of the subclavian artery [4] as well as chronic manifestations such as weakness, color changes, lameness or numbness, and coldness in the arms [3]. Several studies have demonstrated the association between different forms of TOS within a single patient. As a result, patients may present with a range of symptoms, such as neurological symptoms (paraesthesia in nTOS), venous symptoms (deep vein thrombosis in vTOS), or arterial stenosis or occlusion [4]. The diagnosis of TOS is challenging due to the presence of many other disorders with similar symptoms. Accurate diagnosis largely depends on the clinician's experience and a precise assessment of symptoms and risk factors [13]. Furthermore, there is a plethora of differential diagnoses ranging from peripheral compressive neuropathies to intrinsic shoulder pathologies and cervical spine pathologies. For instance, the presence of radicular pain may suggest cervical radiculopathy. Conversely, if pain and paraesthesia are

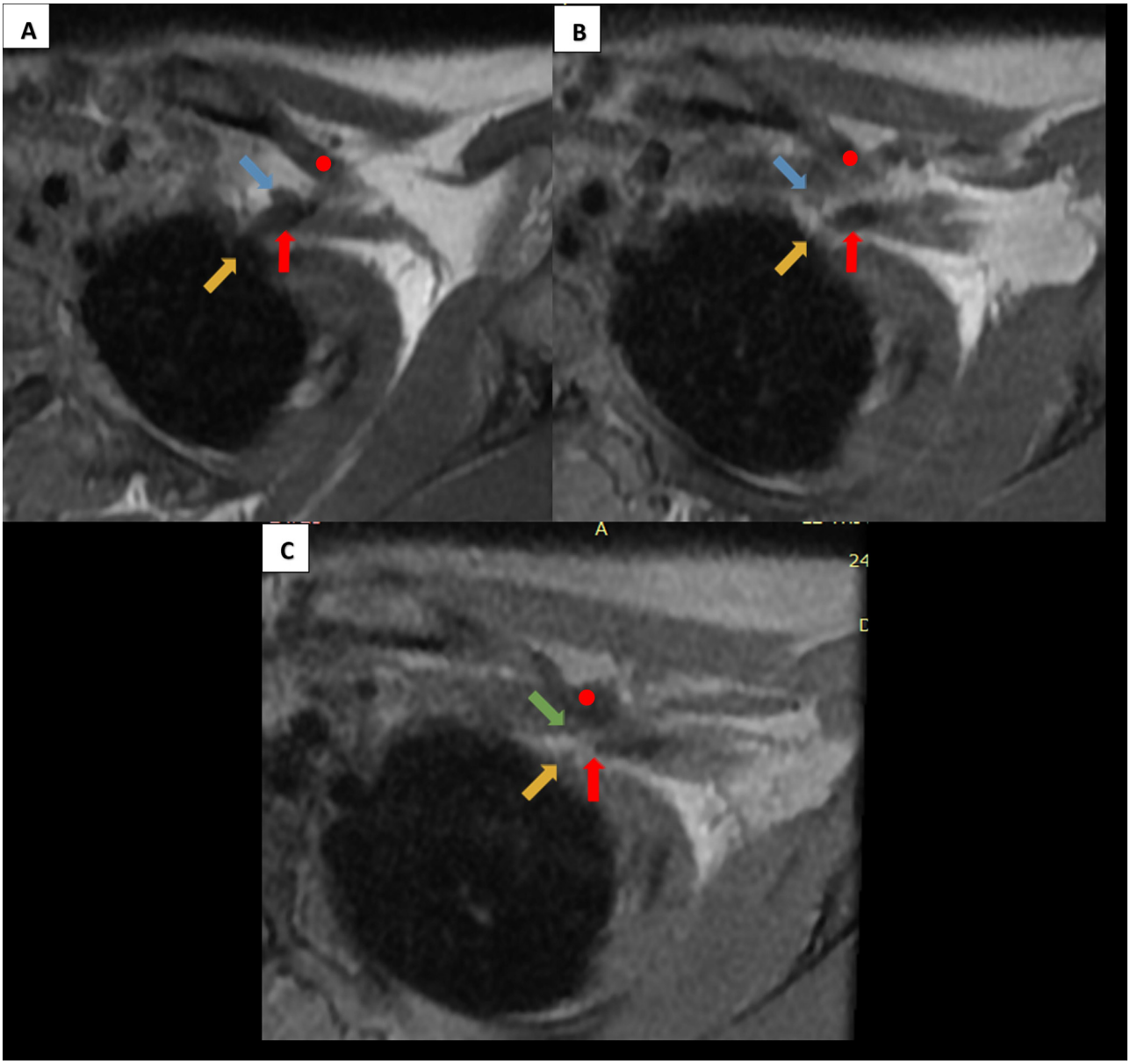

Fig. 11 – The noncontrast axial T1-weighted MR images show key structures in the costoclavicular space. Three consecutive slices of axial T1-weighted MR images at the level of the costoclavicular space with the arms adducted offer insights into the subclavian artery (red arrow). In (A-B), the images showcase the subclavian artery before entering the costoclavicular space, while in (C), signs of compression become apparent. The compression, marked by deformation and changes in diameter, occurs as the subclavian artery (red arrow) traverses the costoclavicular space. Notably, the artery is sandwiched between the accessory branch of the anterior scalene muscle (green arrow) medially, the clavicle (red dot) anteriorly, and the first rib (yellow arrow) posteriorly.

confined solely to the distribution of the median and ulnar nerves distal to the point of compression in the carpal and cubital tunnels, carpal tunnel syndrome, and cubital tunnel syndrome, respectively, should be suspected. It is important to note that these conditions may coexist with a diagnosis of TOS [14]. Imaging diagnostics and electromyography are often indicated after confirming the syndrome to distinguish the cause of compression (neurological or vascular) [12]. Due to the low prevalence and nonspecificity of clinical symptoms, aTOS is often misdiagnosed. The time from symptom onset to accurate diagnosis can exceed 6 months, posing the risk of chronic thromboembolism, ischemia, or stroke. When TOS is suspected, clinicians must conduct provocative tests to support the diagnosis. Commonly used provocative tests for identifying aTOS include the Adson and overhead exercise tests [13,15]. However, these tests have low sensitivity and specificity [12,14].

Our patient presented with symptoms related to nerves and arteries, such as numbness, pain, and coldness in the left hand, particularly noticeable when raising the hand above

Fig. 12 – Image of patient's follow-up examination after 1 month of surgery. After one month post-surgery, the images reveal that the patient's incision has healed well, and there is a significant improvement in compression symptoms, with no reported complications from the surgical procedure.

the head or holding it for an extended period. The onset of symptoms persisted for more than 1 year. The initial examination led to a diagnosis of cervical disc herniation and cervical nerve root compression. This misdiagnosis may be attributed to the nonspecific nature of the symptoms, leading clinicians to overlook TOS, resulting in less thorough examinations and a higher consideration for the more commonly encountered cervical radiculopathy. This delay in considering TOS as a potential diagnosis can prolong the illness and contribute to delayed diagnosis. Therefore, clinicians must remain vigilant and consistently consider TOS to adopt an appropriate pathway approach. The combination of clinical examination and imaging methods in this patient population facilitated a timely, appropriate, and comprehensive diagnosis, even in the absence of epidemiological or historical risk factors.

Typically, the sequence for approaching diagnostic imaging in patients with clinical manifestations suspicious of TOS involves chest X-ray (to detect bone abnormalities), followed by ultrasound, computed tomography, or magnetic resonance imaging. As per the American College of Radiology (ACR) recommendations in 2020, vascular DUS is deemed the most effective, economical, accessible, noninvasive, and repeatable choice for identifying abnormalities of the subclavian [16]. The sensitivity of vascular DUS is 87%-100%, and the specificity is 82%-100% in diagnosing vascular TOS [7]. Furthermore, DUS not only aids in the evaluation of blood flow dynamics during resting and abducted positions, enhancing the sensitivity of provocative tests but also proves valuable in assessing blood vessels postsurgery and detecting potential complications [17,16]. DUS must be performed with arms raised to 90° and arms lowered (Adson test) to measure changes in the caliber and flow of the artery and subclavian vein. The ultrasound examination must utilize both B-Mode Ultrasound for the morphological study of the subclavian and axillary arteries, aneurysmal change, arterial stenosis, or thrombosis, as well as scalene muscles and cervical ribs, and color DUS and Duplex DUS for the flowmeter study [19]. Findings include decrease in arterial diameter, changes in peak velocity, or reproducible symptoms considered to be diagnostic of aTOS [16]. Noncontrast MRI may suggest a diagnosis of TOS. Meanwhile, MRA or CTA serve as effective options to confirm vTOS or aTOS. Conventionally, abduction of the upper limb has been demonstrated to be relevant in diagnosing TOS and is, therefore, chosen as the postural maneuver of choice for cross-sectional imaging [8,18]. In the abduction of the upper limb, narrowing of the subclavian vessel is considered significant if the percentage change of the vessel's diameter between the neutral and the abducted positions is 30% for the subclavian artery and 50% for the subclavian vein [18]. However, it's important to note that MRI and CT scans are often high-cost and challenging to access, particularly in the context of community screening and primary health care [18].

The diagnosis of aTOS in our patient becomes highly suspected following the availability of abnormal vascular DUS results. According to the 2020 American College of Radiology guidelines on the appropriateness category of diagnostic imaging methods [16], we recommend a sequential approach in the diagnosis of aTOS, with vascular DUS as the first-level examination and routine test to evaluate vascular status, allowing for prompt diagnosis of this disease. Vascular DUS is a noninvasive imaging diagnostic method, easily accessible with reasonably priced machines. It provides high diagnostic accuracy and can be widely applied on a large scale in the community within primary healthcare systems, especially in low-income countries as Vietnam. Combining sequential imaging methods, including CTA and MRI, helps comprehensively evaluate the cause of the disease. A CT scan is instrumental in determining the location of the narrowing in the thoracic outlet and identifying compression causes related to bone abnormalities. CTA is particularly effective in evaluating the subclavian artery and localizing the site of thoracic outlet compression, ruling out bony abnormalities, and facilitating the shortening of MRI scan time, which is beneficial for patients with severe symptoms. Noncontrast MRI, on the other hand, excels in assessing soft tissue characteristics, playing a crucial role in diagnosing the cause of aTOS and identifying venous and nerve compression, providing valuable guidance for surgery. It's essential to emphasize that imaging methods approach both positions, neutral and abducted, to comprehensively evaluate the condition [3,20].

Treatment strategies

The treatment of TOS is a multifactorial process, and the available options vary depending on the cause of the compression and the severity of arterial complications. While various treat-

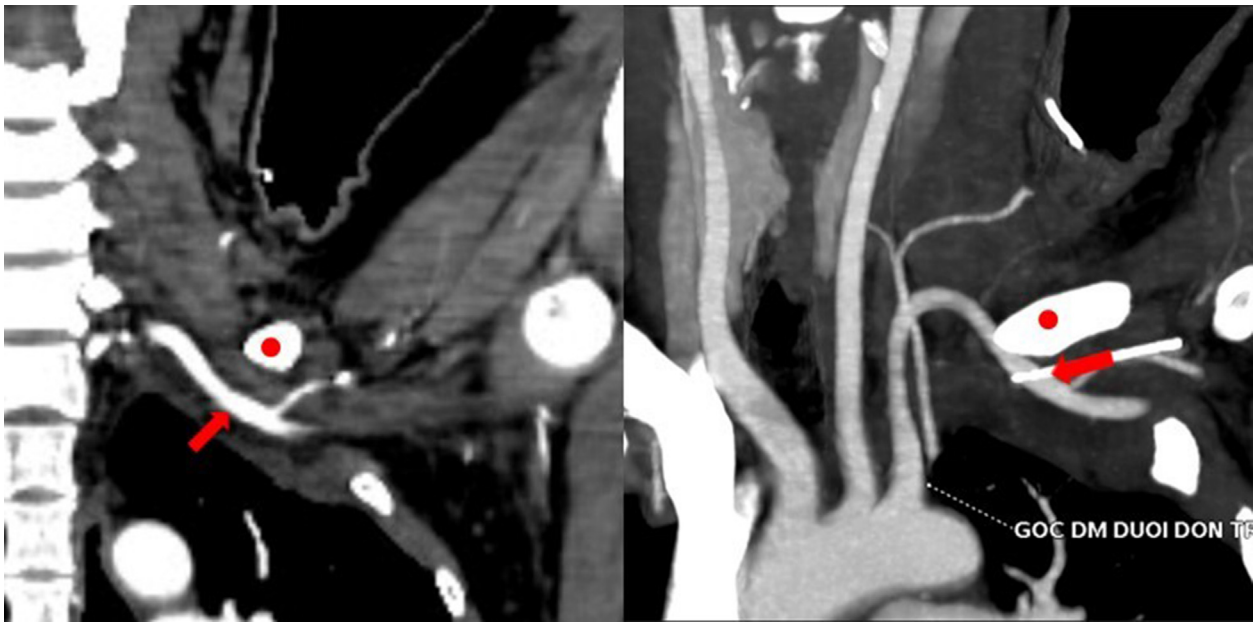

Fig. 13 – Coronal CTA images show the left subclavian artery in the costoclavicular space after 1 month of surgery. After 1 month postsurgery, the coronal CTA images with the arms adducted demonstrate a well-circulation of the left subclavian artery (red arrow) within the costoclavicular space, indicating positive outcomes from the surgical intervention. red arrow = subclavian artery, red dot = clavicle.

ment options exist for TOS, the optimal treatment regimen remains unclear. The approach to treating TOS patients can involve either conservative measures or surgical intervention [7,22]. Conservative therapy for aTOS is not well studied, primarily due to the rarity of the disease and diagnostic nuances [3]. Asymptomatic patients with subclavian artery compression, lacking evidence of arterial degeneration, may be managed nonsurgically due to a low risk of complications. It is reasonable to follow these patients with serial imaging of the arterial system, such as 6-month DUS, as the natural history of these patients is not clearly defined.

Surgical treatment becomes necessary for patients with symptoms and evidence of arterial complications, such as intimal damage, mural thrombus, embolization, poststenotic dilatation, or aneurysm formation [5]. While approximately 60%-70% of nTOS patients can be managed with medical treatments, the majority of aTOS patients often require surgical intervention [23]. Surgery is initially indicated only for symptomatic patients with objectively verifiable forms of TOS (fibrous band nTOS and vascular TOS) [7]. Surgery is indicated in patients with symptomatic nTOS who have received 4-6 weeks of medical therapy without response or vascular TOS. Surgical intervention aims to decompress the neurovascular bundle and reconstruct the involved vessels [3]. The decision regarding which procedure and approach to utilize primarily depends on the specific anatomic anomaly and surgeon preference [7]. Over half of aTOS patients can achieve complete recovery following first rib resection and anterior scalene muscle resection [21]. Surgical intervention is often highly effective, with multiple studies demonstrating improvement in Derkash's classification to the category of excellent/good in over 90% of aTOS patients [7]. Nevertheless, recorded complications after surgery include issues such as bleeding, infection, pneumothorax, and the risk of injury to vessels, thoracic duct, or nerves [4,21]. Postoperative care after TOS decompression focuses on pain control, minimization of swelling, maximizing neck/shoulder range of motion, wound healing, and appropriate graduated physical therapy. The exercise program depends on each patient and their postoperative goals [7].

In the case of the patient we report, surgical treatment is indicated due to the long-term symptoms. The surgical intervention involved cutting the anterior and middle scalene muscles, removing the first rib segment from the sternum head to the lateral brachial plexus and artery. Postsurgery, follow-up until 1-month revealed a significant improvement in compression symptoms without any complications. CTA images with the arms adducted demonstrated well-circulation of the left subclavian artery in the costoclavicular space. Additionally, longer-term follow-up is needed to discuss the patient's prognosis.

Conclusion

Thoracic outlet syndrome with arterial compression is a rare medical condition, particularly attributed to anatomical abnormalities of the anterior scalene muscle, posing diagnostic and management challenges. The patients in this report received timely and accurate diagnosis, along with appropriate intervention, by combining clinical examination and utilizing a sequential approach with tailored imaging diagnostic tools. Surgical decompression emerges as a suitable intervention that can lead to improved functional and pain scores.

We emphasize the importance of clinician vigilance and highlight the pivotal role and high applicability of tailored imaging modalities in the early detection, diagnosis, and treatment of Thoracic outlet syndrome.

Patient consent

The participant provided written informed consent before enrolment in the study.

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