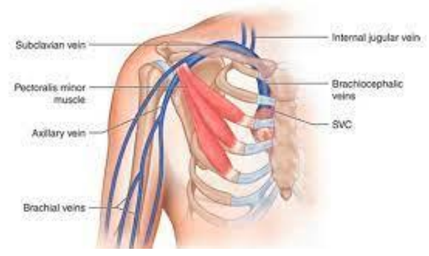
Upper Extremity Deep Vein Thrombosis Secondary to Superior Vena Cava Syndrome

O' Sullivan, Marion [1,2], O' Brien, Maria [2], Cronin, Kevin [1]

[1] Radiography and Diagnostic Imaging, School of Medicine, University College Dublin, Ireland.
[2] Radiology Department, Mercy University Hospital, Cork.

INTRODUCTION

Upper Extremity Deep Vein Thrombosis (UEDVT) is a rare (10% of thrombosis) but clinically significant vascular disorder characterized by the formation of blood clots within the deep veins of the upper limbs (Walusimbi et al., 2022). An upper extremity deep vein thrombosis is one that affects the deep venous system (radial vein, ulnar vein, brachial vein, axillary vein, subclavian vein, internal jugular vein) or one that occurs in the superficial venous system but near the junction (Valeriani et al., 2022).



The aetiology of upper extremity deep vein thrombosis is multifactorial, involving a diverse array of predisposing factors such as central venous catheters, thoracic outlet compression, malignancies, hypercoagulable states, pregnancy, and postpartum period. Additionally, trauma, infections, immobilization, and hormonal contraceptive use have been implicated as potential contributing factors (Walusimbi et al., 2022).

Superior Vena Cava (SVC) syndrome is the compression or obstruction of the superior vena cava leading to upper extremity deep vein thrombosis due to the impaired blood flow, venous congestion, and increased propensity for clot formation in the upper extremity veins (Weeraddana et al., 2023).

According to Haider et al. (2022), superior vena cava syndrome results from malignancy in 90% of cases however it is unknown how many cases of upper extremity deep vein thrombosis which are a direct consequence of SVC syndrome.

The leading causes of upper extremity deep vein thrombosis include catheter devices, cancer, trauma, surgery, or oral contraceptive usage (Valeriani et al., 2022). The majority of UEDVT cases present with severe onset of pain, arm swelling and visible superficial collateral vessels (webbing) (Walusimbi et al., 2022).

One of the major complications seen in patients who get an upper extremity deep vein thrombosis is pulmonary embolisms therefore timely diagnosis and management is key (Khalifa, Patel and Moser, 2016).

PATIENT BACKGROUND

A 74-year-old male presented to the emergency department with sudden onset of right arm pain with localised tenderness, arm swelling and shortness of breath. The patient had a relapse of lung cancer three months prior to presentation and had refused any further treatment.

An initial chest x-ray demonstrated a large right apical lung mass. Bloods revealed a raised D-dimer of 3.72 and the patient's clinical predication score was 2 out of 3. He was consequently referred for Ultrasound to identify a cause.

Primary differential diagnoses include UEDVT, Thrombophlebitis or cellulitis.

ULTRASOUND EXAMINATION

As per Royal College of Radiologists (RCR), Ultrasound is the modality of choice when excluding an upper limb DVT (SCoR, 2021).

Upon receiving the referral, it was deemed clinically justified in accordance with the BMUS guidelines for professional practice and the patient was brought to the radiology department. The patient was positioned semi supine with affected arm outstretched. The arm position was changed throughout the exam to follow the path of the veins. The right arm was scanned according to local policy which included the internal jugular vein, subclavian vein, axillary vein, brachial vein, basilic vein, cephalic vein, and radial and ulnar veins.

B-mode, colour Doppler and spectral Doppler were utilised and both transverse and longitudinal planes were assessed. Compressions are usually performed transversely using b-mode where possible as this is classed as gold standard in identifying thrombus (SCoR, 2021).

Ultrasound findings included an occlusive thrombus involving the axillary and subclavian veins which further extended cranially into the internal jugular vein. B-mode imaging, Colour Doppler and spectral Doppler were utilised, and compressions were minimally used due to risk of dislodgement.

ULTRASOUND EXAMINATION

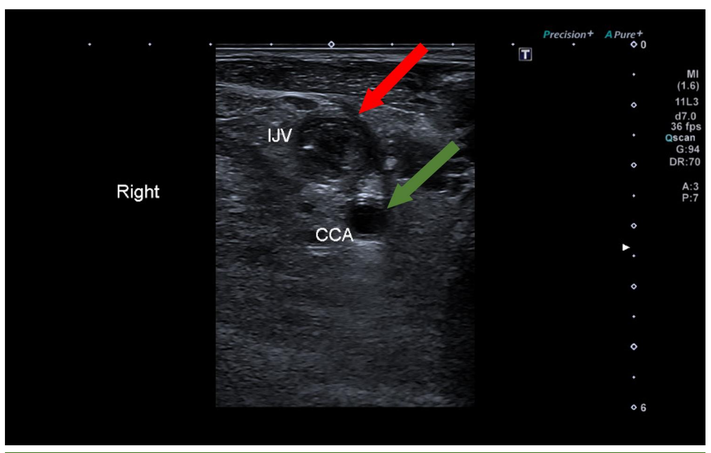


Image (1): A B-mode transverse image of the right common carotid artery (CCA) as indicated by the green arrow and the thrombosed internal jugular vein (IJV) as indicated by the blue arrow. (Hospital "X", 2023).

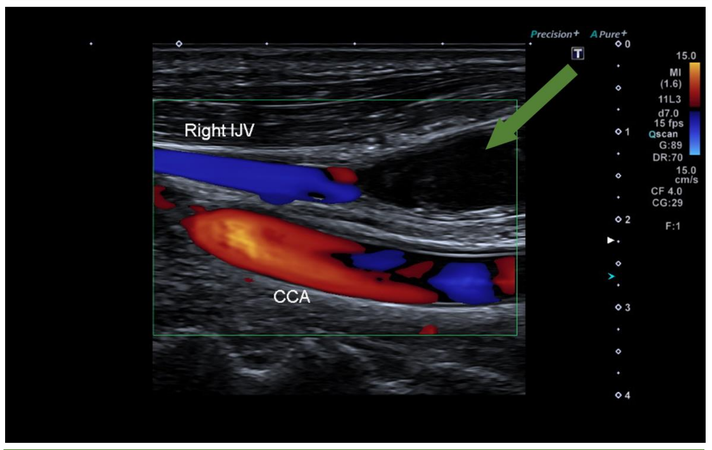


Image (2): A Duplex (B-mode and colour Doppler) longitudinal image of the right common carotid artery (CCA) and internal jugular vein as labelled. The green arrow highlights the area of occlusive echogenic thrombus and therefore no blood flow within (Hospital "X", 2023).

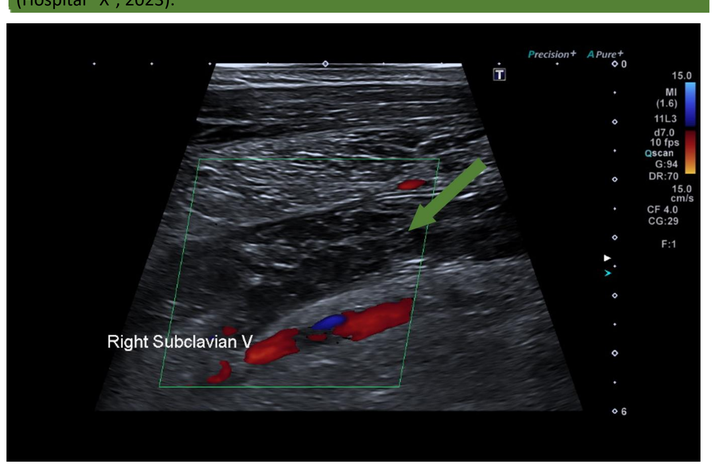


Image (3): A Duplex (B-mode and colour Doppler) longitudinal image of the right subclavian vein (green arrow). There is mixed echogenicity thrombus within and a complete absence of blood flow to the vein. (Hospital "X", 2023).

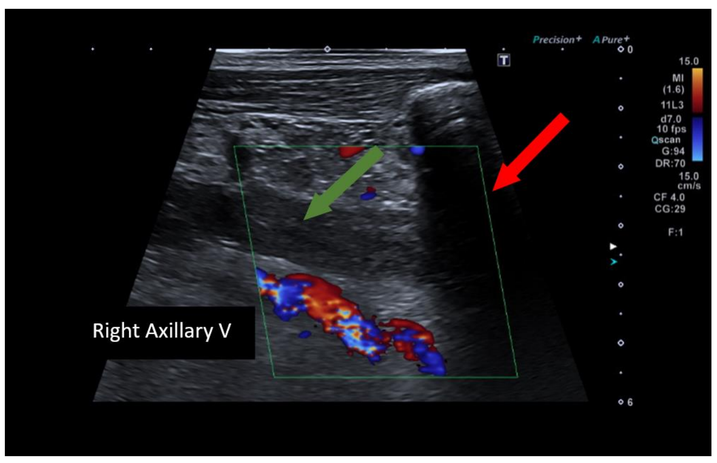


Image (4): A Duplex (B-mode and colour Doppler) longitudinal image of the right axillary vein (green arrow). There is mixed echogenicity thrombus within and a complete absence of blood flow to the vein. Red arrow indicates posterior shadowing from the clavicle bone. (Hospital "X", 2023).

DIAGNOSIS

In this case study, then gentleman had an extensive occlusive thrombus extending from the axillary veins up and into the internal jugular vein. The internal components of the thrombus and compressibility was assessed on B-mode, lack of any internal flow was proven on colour Doppler and absent waveforms was demonstrated on spectral Doppler.

It was a positive study for upper extremity deep vein thrombosis.

5-8% of patients who have an UEDVT are likely to suffer from pulmonary embolism therefore an urgent CT Thorax was requested which had a dual role of excluding a PE and assessing the known apical lung mass (Walusimbi et al., 2022).

Ultrasound has a high sensitivity and specificity in the detection of UEDVT, however in the instance of a negative ultrasound study but there is a raised clinical predication score in a symptomatic patient, a CT scan can be deemed necessary.

OTHER MODALITIES & DIAGNOSIS

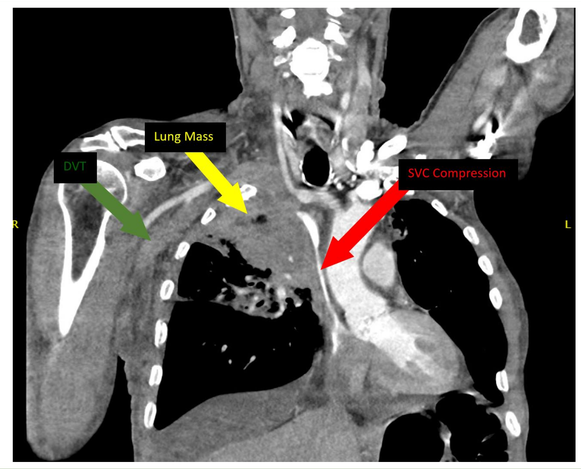


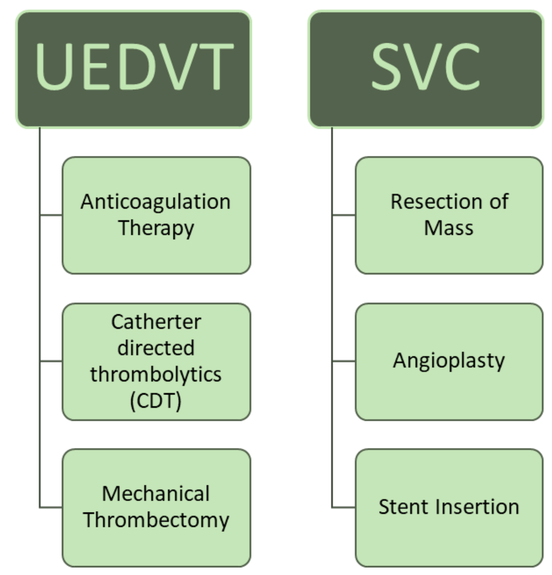
Image (5): A coronal image from a CT Thorax demonstrating the UEDVT (green arrow), apical lung mass (yellow arrow) and the SVC syndrome (red arrow). (Hospital "X", 2023).

The ultrasound scan successfully detected an occlusive thrombus in the patient's right upper arm. It identified its location, extent and appearances.

The patient had a subsequent CT Thorax with contrast which excluded PE. The CT scan also described the extent of the lung mass in the right lung as being 9.5cm in size and was causing severe compression of the SVC, otherwise referred to as SVC syndrome.

Due to the nature of the patient's history, symptoms and decline in further treatment, the condition was managed rather than treated. Unfortunately, the patient passed away several days later.

Treatment Options:



CONCLUSION

Early recognition and prompt intervention are crucial in managing upper extremity deep vein thrombosis, as it can lead to pulmonary embolism and irreversible damage to the limb affected. The source of the thrombosis in this case, SVC syndrome was important to discover as it can lead to its own unique serious implications such as cyanosis, neurological issues and respiratory distress.

Ultrasound plays a primary role in the diagnosis of thrombosis and continues to be the Gold standard. The sonographer's knowledge of the various sonographic appearances of upper extremity deep vein thrombosis is vital. Application of B-mode, colour Doppler and spectral Doppler resulted in a positive diagnosis for this patient. A subsequent CT uncovered the contributing cause, SVC syndrome.

REFERENCES

BMUS (2021)" Guidelines for Professional Ultrasound Practise" 6th ed., Society of Radiographers and British Medical Ultrasound Society

Haider, M. S. *et al.* (2022) 'Superior Vena Cava Syndrome Due to Thrombosis: A Case Report', *Curēus (Palo Alto, CA)*, 14(5), pp. e24811, Available: Cureus Inc. DOI: 10.7759/cureus.24811 (Accessed 07/08/2023).

Khalifa, M., Patel, N. and Moser, S. (2016) 'Superior Vena Cava Obstruction Complicated by Upper Extremity Deep Vein Thrombosis: A Novel Endovascular Approach', *Vascular and endovascular surgery*, 50(3), pp. 180-182, Available: SAGE Publications. DOI: 10.1177/1538574416639148 (Accessed 07/08/2023).

Valeriani, E. *et al.* (2022) 'Anticoagulant treatment for upper extremity deep vein thrombosis: A systematic review and meta-analysis', *Journal of thrombosis and haemostasis*, 20(3), pp. 661-670, Available: Wiley Subscription Services, Inc. DOI: 10.1111/jth.15614.

Walusimbi, M. *et al.* (2022) 'Upper Extremity Deep Venous Thrombosis Risk Factors, Associated Morbidity and Mortality in Trauma Patients', *World journal of surgery*, 46(3), pp. 561-567, Available: Springer International Publishing. DOI: 10.1007/s00268-021-06383-y.

Weeraddana, P. *et al.* (2023) 'Internal Jugular Venous Thrombosis With Superior Vena Cava Syndrome: A Rare First Presentation of Gray Zone Lymphoma', *Curēus (Palo Alto, CA)*, 15(4), pp. e37096, Available: Cureus Inc. DOI: 10.7759/cureus.37096.