THE ROLE OF MULTISLICE CT IN EVALUATION OF SUPERIOR VENA CAVA SYNDROME

Thesis
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Abstract

SVCS is most common with small cell lung cancer as it grows rapidly in central airways. CT chest is the investigation of choice which provides information on location, possible etiology, extent of collaterals and guide biopsy attempts The advent of multi-detector CT has revolutionized imaging of the mediastinal vascular structures. In comparison to single-detector helical CT scanners, multi-detector scanners not only provide faster speed, greater coverage, and improved spatial resolution, but also have the unique ability to create images of thick and thin collimation from the same data set. One of the greatest benefits of this new technology is the improved quality of two-dimensional (2D) multi-planar and three-dimensional (3D) reconstruction images.MSCT can easily prove or exclude the affection of SVC by partial or complete obstruction, the development of collateral circulation as well as detecting the cause of obstruction whether thrombosis, compression or infiltration and its extent.

Key word

2D-3D-MSCT-SVCS- **CAVA-*CL***

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List of Abbreviations

ACTH	*Adreno-cortico-trophic Hormone*
ADH	*Anti-diuretic Hormone*
APUD	*Amine Precursor Uptake Decarboxylase*
BCV	*Brachicephalic vein*
CT	*Computed Tomography*
FM	*Fibrosing Mediastinitis*
HLA	*Human Leukocyte Antigen*
HRCT	*High Resolution Computed Tomography*
Minip	*Minimum Intensity Projection*
MIP	*Maximum Intensity Projection*
MRI	*Magnetic Resonance Imaging*
MSCT	*Multi Slice Computed Tomography*
NSCLC	*Non-small cell Lung Cancer*
PET	*Positron Emission Tomography*
PICC	*Peripherally inserted Central Venous Catheter*
Post-histo FM	*Post-Histoplasmosis Fibrosing Mediastinitis*
SCLC	*Small cell Lung Cancer*
SVC	*Superior Vena Cava*
SVCS	*Superior Vena Cava Syndrome*
WHO	*World Health Organization*

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Introduction

The **superior vena cava (SVC) syndrome** is a clinical entity caused by obstruction of the superior vena cava by infiltration, compression or thrombosis.

Although clinical symptoms of the disorder were first described in 1757 in a patient with a syphilitic aneurysm of the ascending aorta, vascular causes are now rare and approximately 90% of cases are associated with a cancerous tumor that is compressing the superior vena cava, such as bronchogenic carcinoma including small cell and non-small cell lung carcinoma, Burkitt's lymphoma, lymphoblastic lymphomas, acute lymphoblastic leukemia (rare), and other acute leukemias ***(Krimsky et al, 2002).***

Tuberculosis has also been known to cause superior vena cava syndrome (SVCS). SVCS can be caused by invasion or compression by a pathological process or by thrombosis in the vein itself, although this latter is less common (approximately 35% due to the use of intravascular devices) ***(Ansari et al, 2006).***

Malignant Superior Vena Cava Obstruction

In most published studies, cancer is the most common underlying cause of superior vena cava obstruction e.g. lung cancer and lymphoma ***(Sakura et al, 2007).***

Most primary malignant tumors of the superior vena cava, such as leiomyosarcoma or angiosarcoma, are uncommon. The presence of arterial enhancement of the thrombus is highly suggestive of tumor thrombus ***(Garlitski et al, 2006).***

Benign Causes of Superior Vena Cava Obstruction

- Iatrogenic superior vena cava obstruction—the incidence of catheter-induced superior vena cava obstruction is rapidly increasing e.g. large central venous catheters, such as dialysis catheters, Hickman catheters, and parenteral nutrition catheters ***(Rice et al., 2006)***.

- Fibrosing mediastinitis— Fibrosing mediastinitis is a rare histologically benign disorder caused by proliferation of collagen tissue and fibrosis in the mediastinum ***(Yangui et al., 2010)***.

- Behçet disease—Behçet disease is a rare systemic disease in which superior vena cava stenosis or occlusion may result ***(Hiller et al, 2004)***.

Clinical presentation of SVC syndrome:

SVC syndrome is caused by gradual compression of the SVC, leading to edema and retrograde flow, but it can also be caused more abruptly in thrombotic cases. Symptoms may include cough, dyspnea, dysphagia, and swelling or discoloration of the neck, face and upper extremities. Often, collateral venous circulation causes distension of the superficial veins in the chest wall. Although SVC syndrome is usually a clinical diagnosis, plain radiography, computed tomography (CT) and venography are used for confirmation. ***(Khalili et al, 2007).***

CT Findings:

CT can detect subclinical superior vena cava obstruction in patients who are relatively asymptomatic ***(Yu JB et al, 2008).***

Regardless of its cause, the CT diagnosis of superior vena cava obstruction includes lack of opacification of the superior vena cava, an intraluminal filling defect or severe narrowing of the superior vena cava, and visualization of collateral vascular channels ***(Eren et al, 2006).***

MDCT, with its multiplanar and 3D imaging capabilities, allows thorough anatomic delineation of the various collateral pathways diverting the blood from the site of obstruction. Although axial images allow evaluation of potential causes of superior vena cava obstruction, such as a mediastinal mass, MDCT provides information about the level and degree of superior vena cava obstruction, the length of the affected segment, and the presence or absence of intraluminal clot distal to the obstruction, thereby allowing the interventional radiologist to choose the optimal treatment option. ***(Plekker et al, 2008).***

Aim of the work:

To evaluate the role of Multislice CT in study of superior vena cava obstruction syndromes and assessment of collateral circulation in different causes of superior vena caval obstruction.

ANATOMY OF THE SUPERIOR VENA CAVA

The superior vena cava (SVC) is a large valveless venous channel formed by the junction of the right and left brachiocephalic veins **(Fig.1).** It is 6-8 cm long, receives blood from the upper half of the body and returns it to the right atrium. It begins behind the lower border of the first right costal cartilage and descends vertically behind the second and third intercostal spaces to end in the right atrium at the level of the third costal cartilage. Its lower half is covered by the fibrous pericardium, which it pierces at the level of the second costal cartilage. The azygos vein loops over the right mainstem bronchus and connects to the posterolateral wall of the SVC **(Fig.2).** The SVC lies in a relatively confined space and is surrounded by several lymph node groups that predispose it to compression, invasion, or involvement in inflammatory conditions ***(Richardson, 2005)***

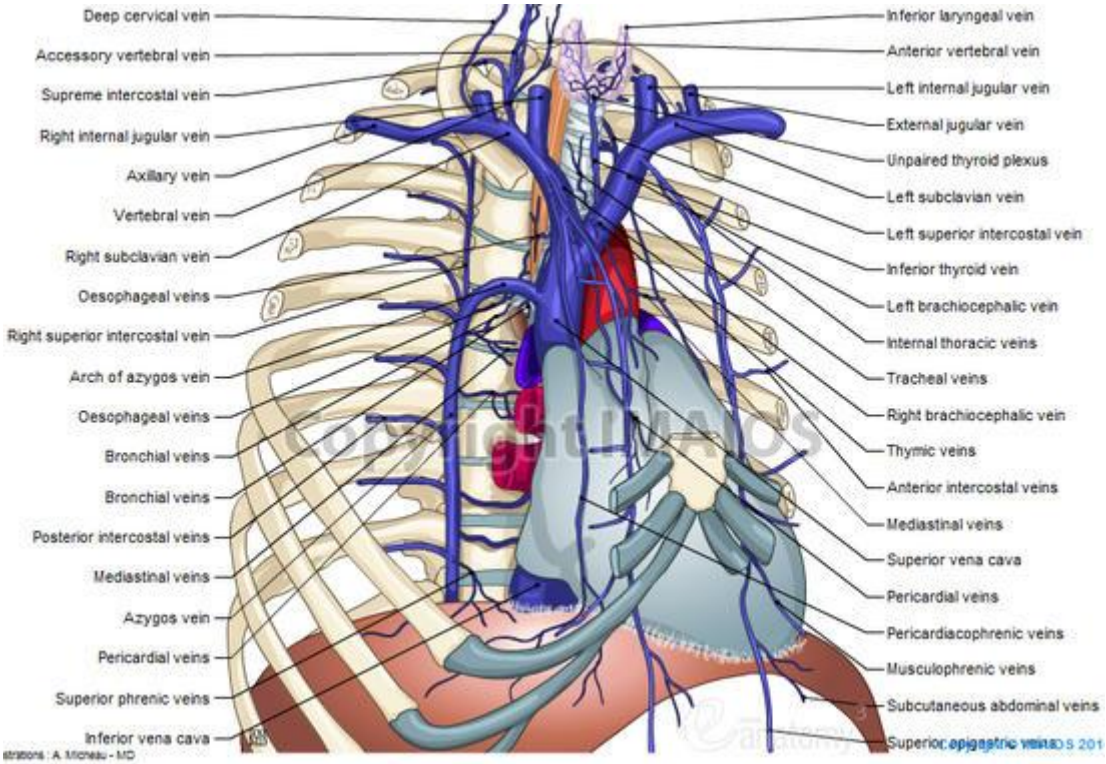

Figure (1) *Superior vena cava, anterolateral view* ***(Antoine Micheau, 2010).***

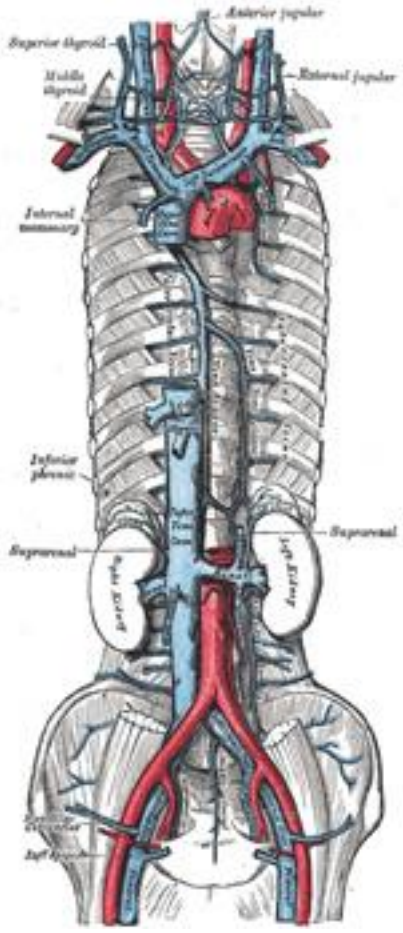

Figure (2): *The venae cavae and azygos veins, with their tributaries* ***(Moore, 2008).***

ANATOMY OF THE SUPERIOR MEDIASTINUM (Fig.1,3)

The mediastinum lies between the right and left pleurae in and near the median sagittal plane of the chest. It extends from the sternum in front to the vertebral column behind, and contains all the thoracic viscera excepting the lungs. It may be divided for purposes of description into two parts: an upper portion, above the upper level of the pericardium, which is named the superior mediastinum; and a lower portion, below the upper level of the pericardium. This lower portion is again subdivided into three parts, that in front of the pericardium, the anterior mediastinum; that containing the pericardium and its contents, the middle mediastinum; and that behind the pericardium, the posterior mediastinum ***(Henry Gray, 2012)***.

The Superior Mediastinum **(Fig.3)** is that portion of the interpleural space which lies between the manubrium sterni in front, and the upper thoracic vertebrae behind. It is bounded below by a slightly oblique plane passing backward from the junction of the manubrium and body of the sternum to the lower part of the body of the fourth thoracic vertebra, and laterally by the pleurae. It contains the origins of the Sternohyoidei and Sternothyreoidei and the lower ends of the Longicolli; the aortic arch; the innominate artery and the thoracic portions of the left common carotid and the left subclavian arteries; the innominate veins and the upper half of the superior vena cava; the left highest intercostal vein; the vagus, cardiac, phrenic, and left recurrent nerves; the trachea, esophagus, and thoracic duct; the remains of the thymus, and some lymph glands ***(Henry Gray, 2012)***.

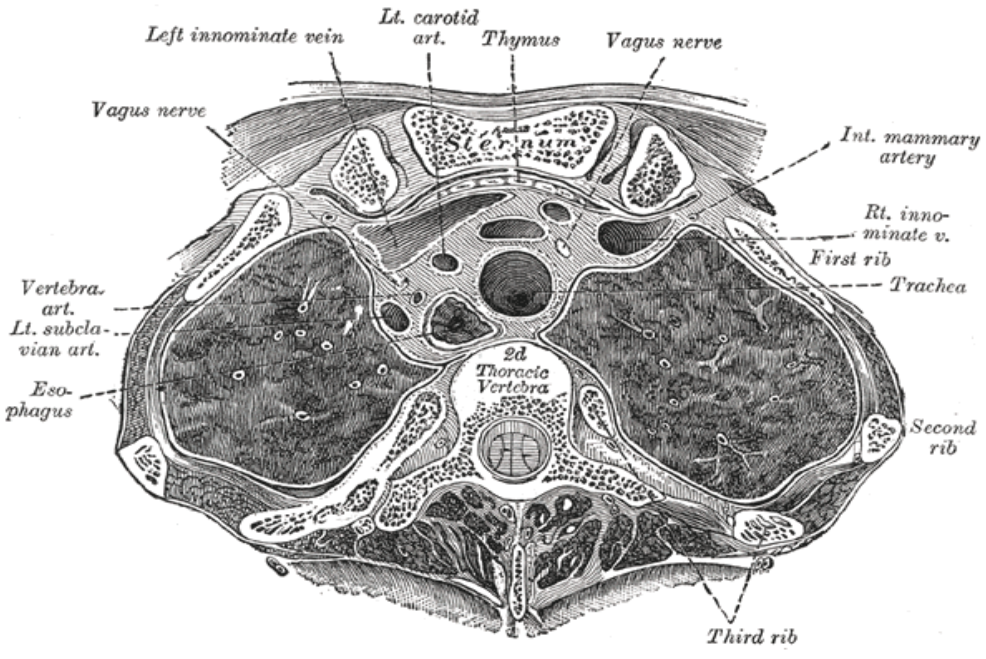

Figure 3: Transverse section through the upper margin of the second thoracic vertebra ***(Braune, 2009).***