

The role of MDCT in Diagnosis of Congenital Venous Anomalies: Case Report

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Abstract:

Congenital abnormalities of the major mediastinal venous structures occur in less than 2 % of people who have no other abnormalities. Venous malformations are the most common vascular malformation, accounting for 44–64% of all vascular malformations. Multi-detector computed tomography (MDCT) is beneficial in the diagnosis and workup treatment planning of congenital anomalies. The current study presents a case report of a 27-year-old male who came to the CT department at Al-Shifa Hospital for evaluation of venous drainage patterns to the chest. In the first exam (one side contrast media injection), congenital absent both subclavian and brachiocephalic veins with blood seen draining through numerous small mediastinal venous collaterals are observed during the two exams. The second exam (bilaterally and simultaneously contrast media injection) gives the same diagnosis in addition to huge network of collaterals around the lower esophagus and gastroesophageal junction forming cavernous transformation (significantly increased). Highly recommended to use direct-MDCT angiography and venography injecting contrast media bilaterally and simultaneously via the upper extremity.

Keywords: MDCT, Venography, Venous Anomalies

1. Introduction

Congenital abnormalities of the major mediastinal venous structures occur in less than 2 % of people who have no other abnormalities (Demos et al., 2004; Ho et al., 2009; Tamer et al., 2017). Venous malformations (VMs) are the most common vascular malformation, accounting for 44–64% of all vascular malformations (Gray et al., 1980; Hall-Griggs, 1985; Loose, 2007). Furthermore, venous congenital anomalies can be categorized into systemic venous system (including SVC and the Azygos system) and pulmonary venous system (Padhani and Hale, 1998; Loose and Weber, 1999; Pilcher and Padhani, 2001; Byung-Boong, 2014).

Multi-detector computed tomography (MDCT) is beneficial in the diagnosis and workup treatment planning of these clinical malformations. Multi-detector computed tomography (MDCT) venography is an effective tool in demonstrating the complex venous vasculature present in especially extra-cardiac pathology (Dillman and Hernandez, 2009). MDCT angiography and venography allows accurate identification of the cardiac and extra-cardiac arteries and veins and their relationships collaterals. The enriched understanding of venous anomalies provided by MDCT venography allow intensive surgical planning with the potential to reduce post-surgical complications (Venkatraman et al., 2014).

2. Case Report

A 27-year-old man with a complex congenital venous system had attacks of discomfort chest pain with shortness of breathing. The patient was referred to CT department for chest CT with contrast in 2013, MDCT chest venography was done. Patient referred recently in 2017 for follow-up, MDCT angiography and venography of the neck, chest, abdomen, pelvis and both lower limb arterial and venous system was performed.

2.1 MDCT Chest Venography Technique

2.1.1 First Venography in 2013

MDCT venography was performed using a 64-MDCT scanner (SIEMENS SOMATOM Definition AS) with the patient positioned supine with arms above the head. Anterior-posterior scout scan was performed, with a scan range from the apex of the chest to the

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suprarenal region. The scan parameters were: Detector width 64×0.625 mm; pitch 0.6; rotation time 0.33 s; exposure factors 140 kVp, 220 mA, and scanning time of 9s. A craniocaudal scan direction was employed after 45 sec automatically from start contrast injection. Contrast material was injected with an automated single power injector via a 20-gauge venous catheter in the right arm of patient. Injection occurred at 3 ml/s, the volume of contrast used totaled to 75 ml, and time of injection was 25 seconds.

2.1.2. Post MDCT Procedure Processing

The images displayed and post-processing 3D images were obtained such as Volume Rendering Technique (VRT) and Maximum Intensity Projection (MIP).

2.2.1 First Venography in 2017

MDCT angiography and venography were performed using a 64-MDCT scanner (SIEMENS SOMATOM Definition AS) with the patient positioned supine with arms above the head. Anterior-posterior scout scan was performed, with a scan range from the apex of the chest to the big toe. The scan parameters were: Detector width 64×0.625 mm; pitch 1.2; rotation time 0.33 s; exposure factors 140 kVp, 200 mA. A craniocaudal scan direction was employed after bolus tracking on abdominal aorta at 150 Hounsfield thresholds. Contrast material was injected with an automated single power injector via a 20-gauge venous catheter in the LT arm. Injection occurred at 5 ml/s, the total volume of contrast media was 100 ml, and time of injection 20 seconds, and the scan time about 21 seconds. The second scan caudocranial direction was employed immediately after angiography finished which about 60 seconds from stating the contrast injection.

2.2.2. Post MDCT Procedure Processing

The images displayed and post-processing 3D images were obtained such as Volume Rendering Technique (VRT) and Maximum Intensity Projection (MIP). The images compared to the study which done in 2013 to confirm any changes or any anomalies in other parts of the body.

3. Results and Discussion

3.1. First MDCT

Congenital absent both subclavian and brachiocephalic veins with blood seen draining through numerous small mediastina venous collaterals. Prominent dilated tortuous veins are seen along the

subcutaneous area of the chest wall more anteriorly, smaller prominent tortuous veins seen in the mediastinum more in middle and anterior part. (Figure 1,2,3 and 4).



Figure 1:- MIP Axial shows absent intrahepatic part of the IVC with collaterals seen at the area of hepatic veins.



Figure 2:- Coronal view shows absent intrahepatic part of the IVC with collaterals seen at the area of hepatic veins.

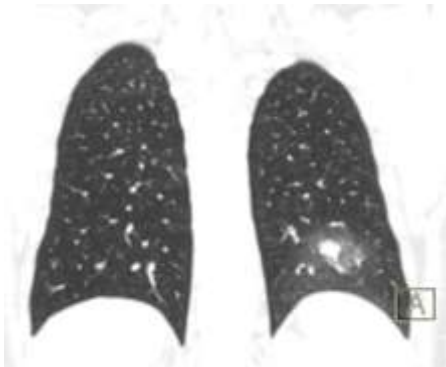


Figure 3:- Coronal lung window shows focal dilation of the LT lower lobe pulmonary artery segment with ground glass appearance.



Figure 4:- Coronal view shows absent of both brachiocephalic veins.

Focal small area of dilation in the LT lower lobe pulmonary artery branch with ground glass appearance. There are large tortuous veins collaterals seen in the liver around the intrahepatic part of the IVC which is absent (Figure 5).



Figure 5. 3D-VRT shows prominent dilated tortuous veins seen along the subcutaneous area of the chest wall more anteriorly, smaller prominent tortuous veins seen in the mediastinum more in middle and anterior part.

3.2. Second MDCT

Congenital absent both subclavian and brachiocephalic veins with blood seen draining through numerous mediastinal venous collaterals. The contrast was injected through LT upper limb pass through collaterals to LT Common Femoral Vein (CFV) area to drain to central circulation (Figure 6 and 7).

Dilated tortuous veins seen along the subcutaneous area of the neck, both upper limb proximal part, and chest wall more anteriorly, smaller prominent tortuous veins seen in the mediastinum more in middle and anterior part (almost not changed), huge network of collaterals around the lower esophagus and gastroesophageal junction forming cavernous transformation (significantly increased).

Large tortuous veins collaterals was observed in the liver around the intrahepatic part of the IVC (seen in first MDCT). In addition, new abnormal network of intrahepatic vascular venous collaterals from mesenteric vein was observed with interrupted upper IVC and single large hepatic vein.



Figure 6:Coronal lung MIP shows a huge network of collaterals around the lower esophagus and gastroesophageal junction forming cavernous transformation (significantly increased).



Figure 7: Axial image shows collaterals along RT diaphragm capula. (newly developed)

Newly developed collaterals in segment 2 and 4 of the liver along the ligamentum teres and umbilical vein insertion. More collaterals along right diaphragm capula were developed, and these collaterals are seen to have continuity with the same area and very close to the right atrium and extend to the inferior pulmonary veins (Figure 8).

Starting from both CFV and Common Femoral Artery (CFA), all lower limb veins and arteries shows normal opacification, no occlusion, no thrombosis, no arterial stenosis, and no features of venous occlusion.



Figure 8. 3D-VRT shows Dilated tortuous veins are seen along the subcutaneous area of the neck, upper limb, proximal part and chest wall more anteriorly, smaller prominent tortuous veins are seen in the mediastinum more in middle & anterior part (almost not changed).

4. Conclusion

MDCT angiography and venography, in the present study, accurately provided the evaluation of complex venous vascular anomalies' information. It helped exquisitely depict pathological conditions affecting the vascular network as a consequence of its superior spatial resolution, very fast image acquisition and detailed evaluation of adjacent and distant organs with one single imaging technique.

In this particular case, our opinion the use of direct-MDCT angiography and venography injecting contrast media bilaterally and simultaneously via the upper extremity because of its multiple advantages when diagnosing and evaluation of complex venous vascular anomalies which considerably improve visualization the collateral drains of both side and any deformity or occlusion of vessels.

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