

An unexpected position of the dialyses catheter during routine x-ray examination: a case of the double superior vena cava

Case Report

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Abstract: This paper presents a case of a 55 year old male patient, who after hospitalization at the Intensive Care Unit, due to acute renal failure, at first had a central venous catheter inserted through his right subclavian vein, and then a dialysis catheter inserted through his left subclavian vein. A routine X-ray examination confirmed that the central venous catheter was visualised in the expected position of the right atrium, which was reached via superior vena cava. The dialysis catheter was not visualised in the expected position of the right atrium, but in the surprising location of the left ventricle, with its line continuously passing by the left sternal edge instead of crossing the middle line in order to enter the superior vena cava, thus raising a concern over its misplacement and possible side-effects (abstract image photo). Due to the absence of pneumo- or haemato-thorax, as the most common signs of the venous rupture, the possible explanation was an anatomical variation. Dialysis catheter displacement in the left internal thoracic vein was proposed as another possibility. Literature research explained it as a case of double superior vena cava, which was confirmed by analysis of the computerised tomography pulmonary angiogram.

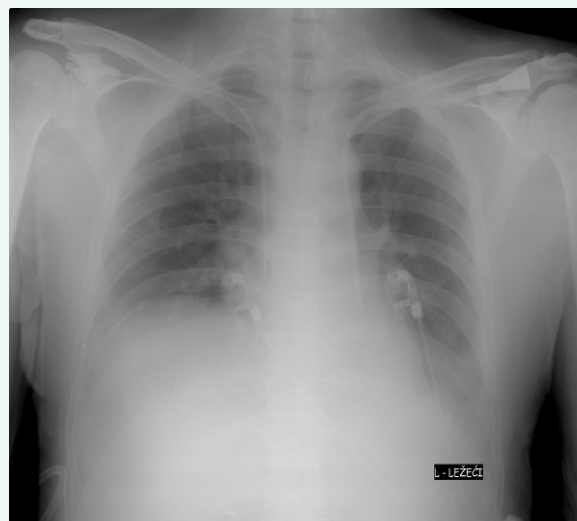


Figure. X rays examination conducted on the patient in lying position.

Keywords: Vena cava superior • Anatomical variations • Radiology • Dialysis catheterisation • Central venous catheterisation

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1. Introduction

The superior vena cava is a large and short vein that carries deoxygenated blood from the upper half of the body to the right atrium. It is formed from the left and right brachiocephalic veins which receive blood from the upper limbs, head and neck. Duplication of the superior vena cava is a rare anomaly. Its incidence is 0.3% in general population and 10-11% in patients with congenital heart disease. Its gender ratio is 1:1. Double superior

vena cava cases have clinical importance if the left vein drains itself into the left atrium [1,2].

Double superior vena cava was first described by Chouke in 1939. During the dissection of the body of a 50 year old man, who died from the chronic myocarditis, the left superior vena cava was observed together with the right superior vena cava. The former was formed by the union of the left internal jugular vein and the left subclavian vein, and descended vertically to the left of the arch of the aorta and to the back of the left atrium where

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it joined the coronary sinus below the base of the heart, and through it emptied itself into the right atrium. The later was formed normally and emptied itself into the right atrium. The calibres of both veins were equal [3].

2. Case report

A 55 year old male patient was hospitalized at the Intensive Care Unit due to acute renal failure. Two weeks prior to hospitalization due to descendent colon adenocarcinoma the patient underwent total 'Sugarbaker' peritonectomy, left-sided Hartmann hemicolectomy, splenectomy, omentectomy, and appendectomy, which was followed by the double ileostomy formation, and was complicated with the abdominal bleeding, peritonitis and septic shock. After the re-hospitalization, he first had a 7 french central venous catheter inserted through his right subclavian vein and then a 9 french dialysis catheter inserted through his left subclavian vein, its position had to be confirmed by a routine chest X-ray examination at the Department of Radiology (Figure 1).

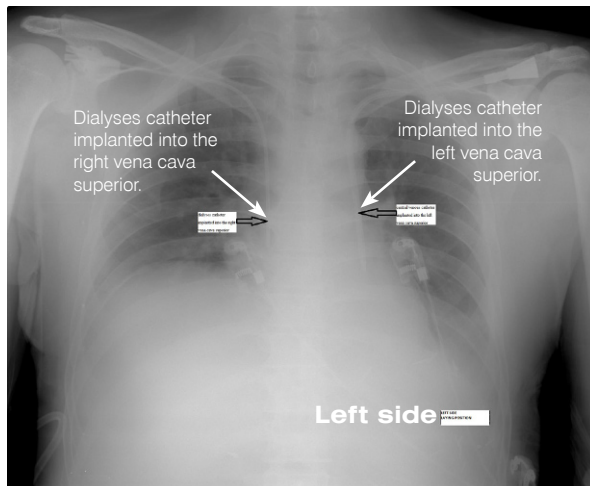


Figure 1. X rays examination conducted on the patient in lying position. Central venous catheter inserted into the right vena cava superior and the dialyses catheter inserted into the left vena cava superior.

The tip of the central venous catheter was visualised in the expected projection of the right atrium which it reached through the superior vena cava. On the contrary, the tip of the dialysis catheter was not visualised in the expected projection of the right atrium, but in the surprising projection of the left ventricle with its line continuously passing by the left sternal edge instead of crossing the middle line in order to enter the superior vena cava. There were no signs of pneumo- or haemo-

thorax, or other catheterization complications, and the line was freely aspirating the venous blood. Based on these findings, the existence of anatomical variation was suggested as a possible explanation. A combination of literature review and the comparison of available radiological images accurately identified the diagnosis as an occurrence of a double superior vena cava. It was further confirmed by the patient's recovery which clearly testified against a venous rupture.

In order to provide radiologic proof for the existence of the mentioned anomaly the patient's computerised tomography (CT) pulmonary angiogram, which was conducted a month earlier in order to assess the state of his pulmonary circulation, was re-evaluated. The CT pulmonary angiogram method is primarily used for the visualisation of the arteries, but the veins can also be seen, as was the case with this patient. Although the contrast multi-sliced computerised tomography (MSCT) is regarded as a gold standard for the vascular anomalies, it was dismissed in this case due to the patient's renal impairment and therefore the inability of contrast medium usage. It was deemed to be unethical to expose the patient to the unnecessary ionising diagnostic method in accordance with the 'as low as reasonably achievable' (ALARA) guidelines for the patients' examinations with ionising rays. In the end, the CT pulmonary angiogram revealed the patient's possession of double superior vena cava (Figure 2).

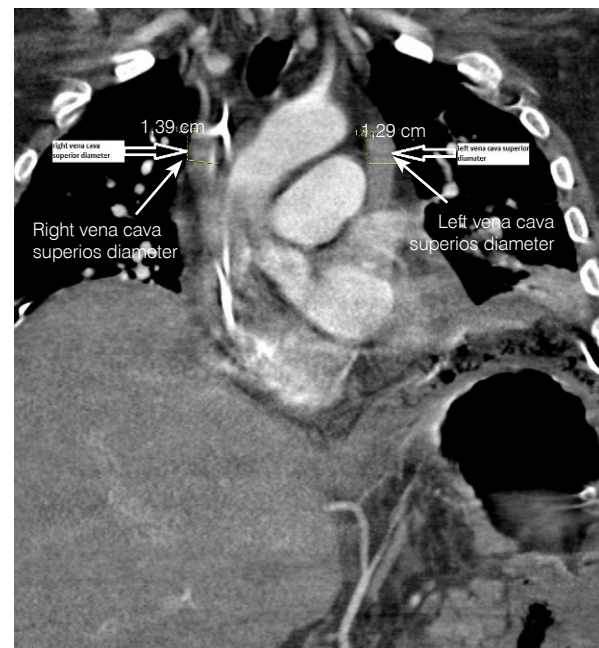


Figure 2. Frontal slice of the contrast CT pulmonary angiography in arterial phase. Diameters of the right and left vena cava superior are measured.

The angiogram revealed that while the right one drained itself into the right atrium, the left one ended in the supposed projection of coronary sinus (Figure 3). The angiogram also showed the hypoplastic left brachiocephalic vein as yet another anatomical variation in this patient (Figure 4).

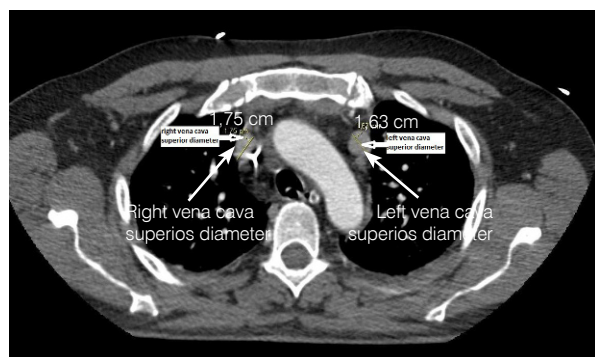


Figure 3. Axial slice of the contrast CT pulmonary angiography in arterial phase B. Diameters of the right and left vena cava superior are measured.

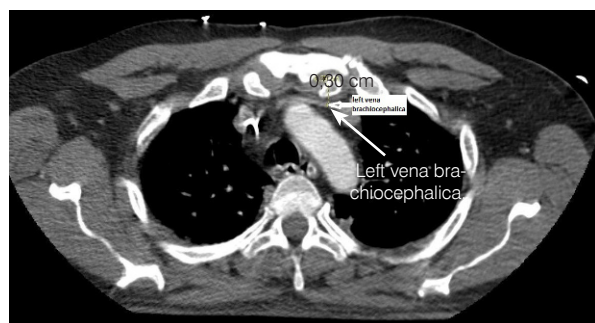


Figure 4. Axial slice of the contrast CT pulmonary angiography in arterial phase C. Diameter of the left brachiocephalic vein is measured.

3. Conclusion

The persistent left superior vena cava is a result of the failure of regression of the left anterior cardinal vein and of the left horn of the venous sinus, which usually occurs between the 24th and the 56th day of fetal development. The regression of the anastomosis between the thyme and thyroid veins does not occur as well [4]. As a result, the left jugular vein and the left subclavian vein drain into the anterior cardinal vein, which consequently becomes the left superior vena cava [5]. This vein then continues almost vertically downwards over the arch of the aorta and in front of the root of the left lung and opens into the right atrium through the coronary sinus [6]. Its anatomical course reflects the embryologic left anterior and common cardinal veins and the left horn of the sinus venosus [7]. The left superior vena cava receives the left brachiocephalic vein, which receives the pericardial and thymus veins, as well as the inferior thyroid veins. At the end of its path it receives the great coronary vein and forms the largely dilated coronary sinus [8].

Regarding the hypoplastic left brachiocephalic vein, which was also found on the patient's CT pulmonary arteriography, it should be mentioned that it is a rare anomaly with the reported incidence of 0.2–1% [9]. Its existence necessitates alternative pathways through which blood from the left upper extremity and the left internal jugular vein may reach the right atrium. The most common alternative pathway is the persistent left sided vena cava superior which drains into the coronary sinus, but alternatively it could drain itself into the left atrium as well, which has clinical significance [10].

Finally, it should be noted that the double superior vena cava is not the only anatomical variation which includes a persistent left superior vena cava [11]. The mentioned vessel could also exist solitary, meaning without its right counterpart, whose role it then compensates. Likewise, the coronary sinus is not the only possible confluence for its path. Alternatively it may open directly into the left atrium, the innominate vein, or the right superior vena cava. In this respect, when checking the correct catheter position, one should always be alert of the possible anatomical variations and aware of the spectrum of their developments.

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