Appearance And Visibility Of The Thoracic Duct On Computed Tomography Of The Chest

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Citation

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Abstract

The thoracic duct is the largest lymphatic vessel of the body. With modern imaging technology metastatic involvement of the thoracic duct has been reported. So, it is important for the radiologist to be familiar with its normal appearance and anatomy. For this purpose 100 selected thoracic CT- scans were reviewed to describe the thoracic duct in the posterior mediastinum. The thoracic duct could be identified in 63% of the patients and visibility was best at the caudal parts of the posterior mediastinum. In most cases the thoracic duct measured around 2mm (range 1-4mm). This is in accordance to older studies. In conclusion the normal thoracic duct can be seen in a large portion of patients undergoing CT scans of the chest. If an enlarged thoracic duct without nodal involvement may indicate lymphatic spread needs to be adressed in further studies.

INTRODUCTION

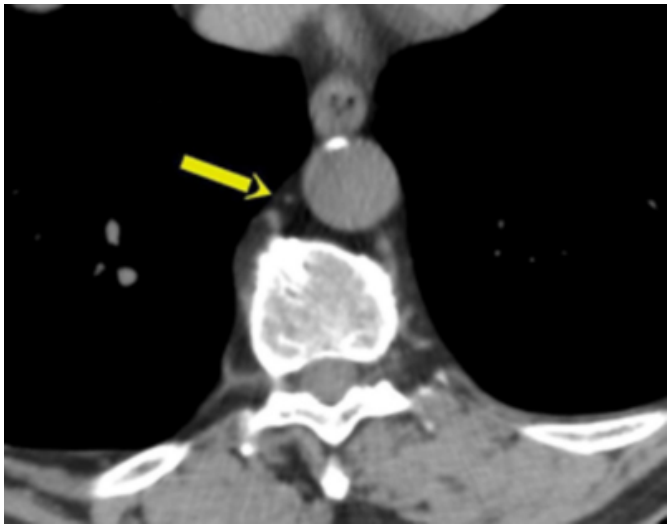
The lymphatic system is a separate network for the circulation of fluid throughout the body. The thoracic duct is the largest lymphatic vessel in the body and collects most of the lymph in the body. In general lesions of the thoracic duct are rare (1-7). Recently, with modern imaging technology (PET, CT) metastastic involvement in malignant disease has been reported (2,3), highlighting the importance of this lymphatic vessel. Thus it is important for the radiologist to be familiar with the normal anatomy and appearance the thoracic duct. The visibility of the distal thoracic duct in CT scans of the neck was recently described by Liu et al. (1). So the purpose of this study was to describe the normal thoracic duct in the posterior mediastinum in routinely performed CT scans of the chest.

MATERIAL AND METHODS

For this study 100 selected thoracic CT scans were reviewed. The CT scans were selected from all scans performed at a large teaching hospital from february through april 2009 (Oststadt Teaching Hospital, Hannover, Germany). All patients with altered posterior mediastinal anatomy because of postoperative changes, lymphadenopathy, tumors of the lungs or esophagus as well as large effussion or atelectasis were excluded. The 100 selected cases consisted of 59 men and 41 women with an average age of 65. 7 years (range 20-86 years). All patients were examined using the same parameters (130 kV, 80 mAs, CareDose®) on a 16 slice-scanner (Siemens Emotion®, Siemens Medical Solutions, Erlangen, Germany) after the intravenous admission of 60 ml iodinized contrast media (Imeron 300®, Bracco Altana Imaging Germany, Konstanz, Germany). The primary 1.5mm slices of all patients were studied on a standars workstation using a standard soft tissue window setting (W:400 HE; L:40 HE). The thoracic duct was searched in the posterior mediastinum and was called visible if there was a small and hypodense vessel on contiguous slices with no contrast enhancement in the typical anatomic localization between the aorta and the azygos vein (Figure 1).

Figure 1

Figure 1: Detail of a computed tomography scan of the chest of a 76- year old men in a soft tissue window setting. The thoracic duct (arrow) can be seen in typical localization between the thoracic aorta and the azygos vein.



Its course and the visibility in the posterior mediastinum below the tracheal bifurcation and above the bifurcation was assessed. The assesment of the distal course was not part of the study, because in most patients constrast media was applied over the right cubital vein with consecutive streak artifacts along the thoracic outlet. The diameter was measured in axial planes.

RESULTS

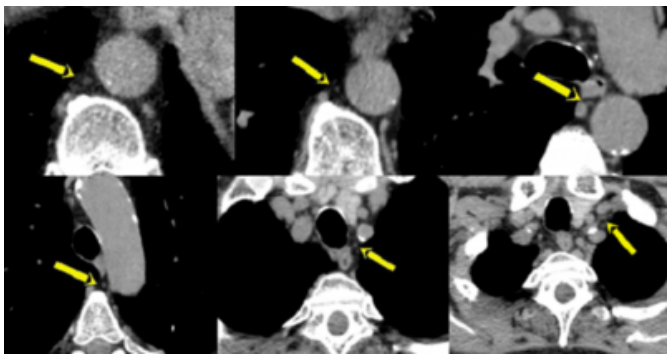
The thoracic duct could be identified in 63% of the cases (63 of 100 cases). Of these it was visible in 65% only below the tracheal bifurcation (41 of 63 cases) and in 35% the duct was visible along the whole posterior mediastinum (22 of 63 cases). In the patients with visible thoracic duct there were more men (32% vs. 56%), but there was little difference in the mean age (65.7 vs. 63.4 years). In most the diameter on axial planes was about 2mm in most cases, with no observed thoracic duct measuring more than 4mm (range 1-4mm).

DISCUSSION

The thoracic duct is the largest lymphatic vessel in the body and collects most of the bodys lymph. It originates at the confluence of the right and the left lumbar trunk in the abdomen and the instestinal trunk. In most cases there is a dilatation at the confluence called the cisterna chyli. It extends upwards in the posterior mediastinum, between the aorta and the azygos vein and curves to the left internal jugular vein to empty into the junction of the left subclavian and jugular vein (Figure 2).

Figure 2

Figure 2: Details of a computed tomography of the chest showing the course of the thoracic duct (arrows).

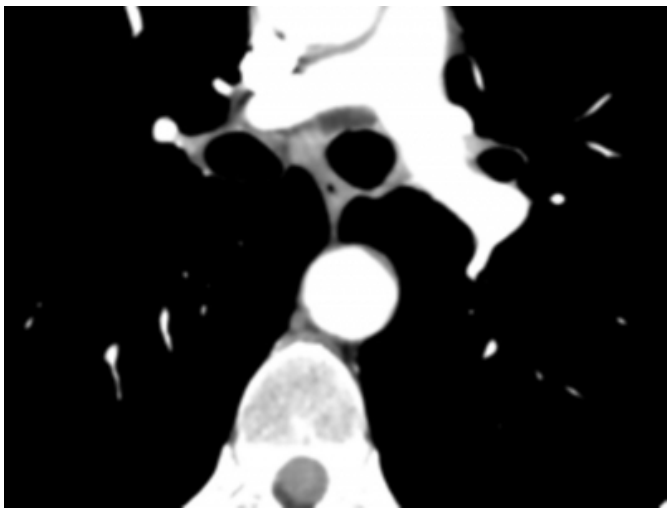


Imaging of the thoracic is possible using classic lymphography, CT and MRI (1, 8- 10). Pathologic changes are a rare occurance and most frequently consist of thoracic duct cysts (1,4). Diffuse dilatation with parasitic infection because of filiariasis infection has also been reported (5). The thoracic duct can be injured in thoracic trauma or iatrogen in operations with chylus effusions (6,7). With modern imaging technology metastastic involvement in malignant disease has been reported (2,3). As oncological imaging evolves this might be seen more often and may have prognostic or therapeutic relevance. Thus the radiologist performing cross- sectional imaging examinations should know this important anatomic structure. The anatomy of the thoracic duct in CT scans was first described in the english spoken literature by Adler and Rosenberger in 1981 using CT scans after bipedal lymphography (7). In our study the thoracic duct could be depicted in 63% of 100 selected thoracic CT scans. Schnyder et al. reviewed the scans of 80 patients and could localize the lower thoracic thoracic duct (including the cisterna chily) in about 81% of cases and the mid segments in about 54% of cases (8). Like in our study the visibility was best in the lower parts of the posterior mediastinum. So the visualization was better in the study by Schnyder et al.. This may be explained by the different slice thickness used. Schnyder et al. used 4 mm slices with a possible better visualization of the small thoracic duct because of less imaging noise compared to the 1.5 mm slices used in this study. The visibility of the distal thoracic duct in CT scans of the neck was recently described by Liu et al. (1). In their study they could identifiy the distal thoracic duct in the left side of the neck in 55% with an average diameter of 3.8mm (range 2-7mm). The right sided lymph collecting duct could be seen in only 11% of cases. Using MR-lymhpography with heavily T2- weighted images, the thoracic duct could be seen in all examined patients (n=6) in

a study by Hayashi et al., but the small sample size study has to be kept in mind (12). Visibility seems to depend on patient characteristics. Very small thoracic ducts are below the spatial resolution of the CT scanners. The separation of the contents of the posterior mediastinum by fat seems also to be important (Figure 3).

Figure 3

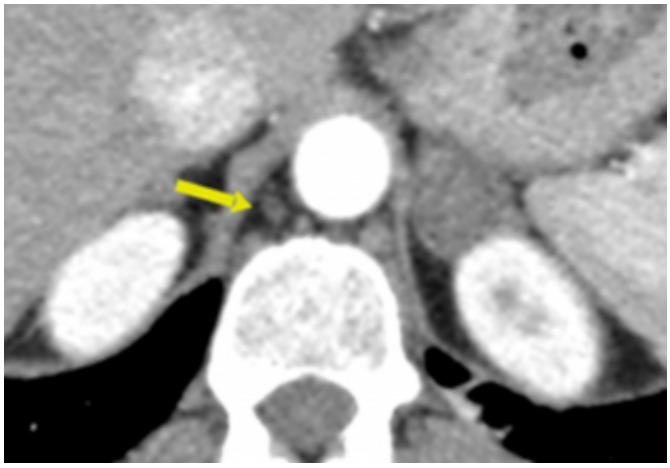
Figure 3: Detail of a computed tomography of the chest in a 60 year old male undergoing imaging because of chronic cough. In this very lean patient there is very little mediastinal fat, therefore vessels in the posterior are lying closely together and the thoracic duct can not be seen.



In this study all visible thoracic ducts had a diameter below 4 mm and could traced about several contiguous slices, so they could not be confounded with enlarged lymph nodes like described for the cisterna chili (11) (Figure 4).

Figure 4

Figure 4: Detail of a computed tomography of the chest in a 43 year old women undergoing imaging for suspect pulmonary embolism. At the beginning of the thoracic duct the cisterna chyli can be found (arrow). This should not be counfed with an enlarged lymph node.



This is in accordance to the reported diameters of 2 to 5mm in the lower and middle parts of the thoracic duct by Schnyder et al. (8). The fusiform dilatation of the distal thoracic duct before its termination in the venous angle (the confluens of the left internal jugular and subclavian vein) has been described in the anatomic literature and explains the greater mean diameter of the distal thoracic duct in the study by Liu et al. (1,12). In the first case with shown malignant invasion of the thoracic duct by Wilde et al. there was only a strong tracer accumulation following the thoracic duct and the lymph channels of the lower neck, with no enlarged lymph nodes above the diaphragma (2). In the second reported case by Ceulemans et al. there was also an enlarged supraclavicular lymph node (3). So in oncologic patients, an enlarged thoracic duct (i.e. >5mm in the posterior mediastinum), with or without enlarged lymph nodes, may indicate metastatic involvement. But as an involvement of a lymphatic vessel without nodal disease is not covered in the actual TNM classification system and its prognostic implications are unclear further studies are thoroughly needed to address this topic.

In conclusion the normal thoracic duct can be seen in a large portion of patients undergoing CT of the chest and radiologists should be aware of this anatomic structure to establish proper differential diagnosis. Further studies are needed to address the question of possible prognostic implications of thoracic duct involvement in malignancy.

References

1. Liu ME, Branstetter BF, Whetstone J, Escott EJ: Normal appearance of the distal thoracic duct. AJR 2006; 187: 1615-1620.
2. De Wilde V, Vandenbroucke F, Neyns B, et al.: PET and CT demonstration of metastatic invasion of the thoracic duct. Eur J Nucl Med Mol Imaging 2006; 33: 392.
3. Ceulemans G, Verdries D, Vanhove C, Everaert H: Metastatic invasion of the thoracic duct detected with PET/CT. JBR- BTR 2009; 92: 230.
4. Chen F, Bando T, Hanaoka N, et al.: Mediastinal thoracic duct cyst. Chest 1999; 115: 584-585.
5. Ahn PJ, Bertagnolli R, Fraser SL, Freeman JH: Distended thoracic and diffuse lymphangiectasia caused by bancroftian filiaris. AJR 2005; 185: 1011- 1014.
6. Euthrongchit C, Thoongsuwan N, Stern EJ: Nonvascular mediastinal trauma. Radiol Clin North Am 2006; 44: 251-258.
7. Korkut AK, Turna A, et al.: Chylomediastinum following tracheal surgery. Acta Chir Belg 2006; 106 : 89- 91.
8. Adler OB, Rosenberger A: Computed tomography of the thoracic duct: an anatomic study. Cardiovasc Intervent Radiol 1981; 4: 224- 228.
9. Schnyder P, Hauser H, Moss A, et al.: CT of the thoracic duct. Eur J Radiol 1983; 3:18-23.
10. Hayashi S, Miyazaki M: Thoracic duct: visualization at nonenhanced MR- lymphography- initial experience. Radiology 1999; 212: 598- 600.
11. Gollub MJ, Castellino RA: The cisterna chyli: a potential mimic of retrocrural lymphadenopathy on CT scans. Radiology 1996; 199: 477- 480.
12. Kinnaert P: Anatomical variations of the cervical portion of the thoracic duct in man. J Anat 1977; 115: 45-52.

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