RESEARCH REPORT

Anatomy of the thoracic duct: a cadaveric study.

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Introduction

The thoracic duct is the main collecting vessel of the lymphatic system. It drains 75% of the lymph in the body into the venous system. The cisterna chyli receives the lymph from bilateral lumbar and the intestinal trunks, forming the origin of the thoracic duct. The thoracic duct commonly drains into the junction of the left jugular and subclavian veins. The objective of this study was to assess the normal anatomy of the thoracic duct and the cisterna chyli.

Methodology

Ten (5; males and 5; females) fresh intact adult cadavers were dissected. Following the initial dissection, all of them were further sectioned sagittal in the midline and separated in to the half thoracic cavities, and the right thoracic cavities were assessed. The study was carried out in the department Anatomy, Faculty of medicine, Ragama, Sri Lanka from 2022 to 2024. The ethical clearance was obtained. No conflict of interest. In this study, the thoracic duct was divided into three anatomical segments: Lower segment: this ascends along the right side of the oesophagus, from the level of the aortic hiatus of the diaphragm to the level of the 5th thoracic vertebra where the thoracic duct turning to the left side of the oesophagus; The middle segment: the level where the thoracic duct ascends to the left side from the right side of the oesophagus to the level of the aortic arch; and the superior segment: this segment is above the level of the aortic arch. The cisterna chyli was identified as a tubular structure between the abdominal aorta and the right crus of the diaphragm.

Statistical Analysis

Social Science Statistical Package (SPSS Inc., Chicago, IL, USA) computer software was used for the statistical analysis. The descriptive data were presented as mean, standard deviation and range.

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Results

In all specimens, the cisterna chyli was located in the retro-crural space. 6 of the cadavers it was at the level of the lower border of the 12th thoracic vertebral body and in 4 it was at the level of L1–2 vertebrae. All were right to the abdominal aorta and tubular structures in morphology. And they traversed through the aortic hiatus of the diaphragm and entered the posterior mediastinum, right of the vertebral column and ascended in the posterior mediastinum, between the descending thoracic aorta on the left and the azygous vein on the right. Thoracic duct traversed posterior to the esophagus at the T7 level and crossed over the midline to the left side of the thorax around the T5 vertebral level. When it reached the level of the fifth thoracic vertebral body, it gradually inclined to the left side and enters the superior mediastinum. It first crossed anteriorly by the aortic arch, and it ran posterior to the left subclavian artery, and formed an arch. Finally, in all specimens the ducts terminated into the junction of the left subclavian and jugular veins. The length of the thoracic duct ranged from 39 to 44 cm. Its mean transverse diameter was 2.8 mm (range, 2.1–3.8 mm) at the upper segment, 1.8 mm (range, 1.4–2.1 mm) at the middle segment and 3.7 mm (range,3.4–4.5 mm) at the lower segment. Therefore, it is wider in diameter at its commencement, but diminishes in caliber at the mid-thoracic level and then slightly dilates before its termination. The mean maximum transverse diameter and length of the cisterna chyli were 4.2 mm and 14.5 mm. (Figure A & B)

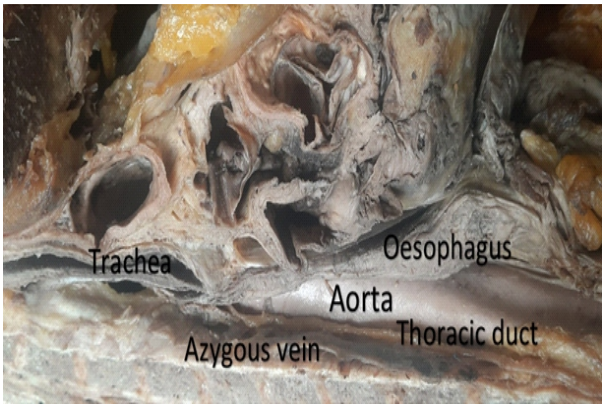

Figure A : cadaveric image of dissected right thorax.

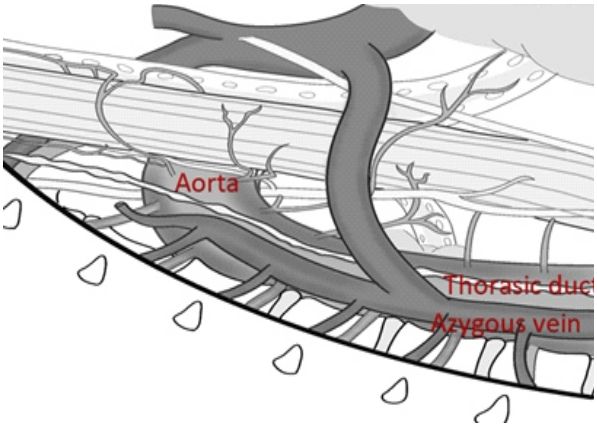

Figure B: shows the pictorial drawing of its anatomical arrangement

Discussion

To our knowledge recent comprehensive human cadaveric morphological and morphometric studies on cisterna chyli and thoracic duct were not numerous. Most of the studies were done were based on radiological imaging. [7-11] According to the available literature in radiology imaging the mean diameter and length of the cisterna chyli were 6.2 and 13.1 mm, respectively which is slightly lower in our cadaveric dissections. [5] But in some literature the mean diameter of cisterna chyli were lower compared to our study. [6] The most common location was at the level of T12/L1 which is similar to our study. [5] Even though there are very few descriptions on different types of configurations of cisterna chyli such as parallel or converging tube, tortuous tube, focal collection and focal plexus [4-7], in our study it was only a thin tubular structure that we found in all cadavers. According to studies [9-11] the thoracic duct was classified into nine types based on its position on the right or left side of the descending aorta and its outflow to the right or left venous angles. Among these, the most commonly recognized was the right thoracic duct with left outflow. To our knowledge, we haven't come across comprehensive study depicting percentages of the variations. In our study, variations, except for this common type, were not observed most likely because of our small study samples. It has been reported that chylothorax occurs by laceration of the thoracic duct following surgeries such as oesophagectomy, pneumonectomy and spine surgery; the prevalence of laceration ranges from 0.5% to as high as 2.0%. [9-11] Therefore, knowledge, recognition of the precise localization of the thoracic duct in surgery is important to avoid iatrogenic complications.

Conclusion

In our study, variations of cisterna chyli and thoracic duct except for this common type, were not observed such as flared configuration and fusiform configuration in thoracic duct, tortuous, sausage shaped, focal collection, focal plexus configuration of cisterna chyli. [2,7] Our data show similar results to the available literature. We have observed that thoracic duct was wider in diameter at its commencement, diminishes in caliber at the mid-thorax and dilates near to its termination. Further large sample size studies are recommended.

References

1. Sato T, Color atlas of applied anatomy of lymphatics anatomical basis for cancer operation. 1st edn. Tokyo, Japan: Nankoudou; 1997

2. Williams PL, editor Gray's anatomy. 38th edn. New York, NY: Churchill Livingstone; 1995]

3. Liu ME, Branstetter BF, 4th, Whetstone J, Escott EJ. Normal CT appearance of the distal thoracic duct. AJR Am J Roentgenol 2006; 187:1615–20

4. Feuerlein S, Kreuzer G, Schmidt SA, Muche R, Juchems MS, Aschoff AJ, et al. The cisterna chyli: prevalence, characteristics and predisposing factors. Eur Radiol 2009; 19:73–8

5. Gollub MJ, Castellino RA. The cisterna chyli: a potential mimic of retrocrural lymphadenopathy on CT scans. Radiology 1996; 199:477–80

6. Smith TR, Grigoropoulos J. The cisterna chyli: incidence and characteristics on CT. Clin Imaging 2002; 26:18–22

7. Pinto SP, Sirlin CB, Andrade-Barreto OA, Brown MA, Mindelzun RE, Mattrey RF. Cisterna chyli at routine abdominal MR imaging: a normal anatomic structure in the retrocrural space. Radiographics 2004; 24:809–17

8. Takahashi H, Kuboyama S, Abe H, Aoki T, Miyazaki M, Nakata H. Clinical feasibility of noncontrast-enhanced magnetic resonance lymphography of the thoracic duct. Chest 2003; 124:2136–42

9. Guermazi A, Brice P, Hennequin C, Sarfati E. Lymphography: an old technique retains its usefulness. Radiographics 2003; 23:1541–60

10. Sachs PB, Zelch MG, Rice TW, Geisinger MA, Risius B, Lammert GK. Diagnosis and localization of laceration of the thoracic duct: usefulness of lymphangiography and CT. AJR Am J Roentgenol 1991;157:703–5

11. Adachi B. Der ductus thoracicus der Japaner. Kihara T, Das lymphgefässsystem der Japaner. Tokyo, Japan: Kenkyusha; 1953. pp. 1–83

12.Hematti H, Mehran RJ. Anatomy of the thoracic duct. Thorac Surg Clin. 2011;21:229–38, ix. [PubMed] [Google Scholar] J Laryngol Otol

13.2013 Feb;127(2):128-33. Doi: 10.1017/S0022215112002939. Epub 2013 Jan 8. The surgical anatomy and clinical relevance of the neglected right lymphatic duct: review