

# Anatomy of the Thoracic Duct

Hamid Hematti, MD<sup>a</sup>, Reza J. Mehran, MD<sup>b,\*</sup>

## KEYWORDS

- Thoracic duct • Lymphatic capillaries • Vertebra
- Cisterna chyli

## ANATOMY OF THE THORACIC DUCT

The thoracic duct is a major anatomic structure of the upper part of abdomen, chest, and the lower part of the neck. A precise knowledge of the anatomy of the duct is essential in the safe performance of any surgical procedures involving these areas.

Lymphatic capillaries are joined from the most remote parts of the interstitium by tissue channels, many of which are only a few tens of microns long. These channels form collecting systems that are many centimeters long and drain lymph from the initial lymphatic capillary into the venous system.<sup>1</sup> Lymphatic capillaries consist of single layers of flat endothelial cells, which are slightly larger and thinner than blood capillary cells. Basement membrane is absent or vestigial, which allows large molecules to permeate the wall easily.<sup>2</sup> Because of their greater permeability lymphatic capillaries are more effective than blood capillaries in removing protein-rich fluid from the intercellular spaces.

When the collected fluid enters the lymphatic vessels, it is called lymph. The lymphatic vessels also serve to transport proteins and lipids that are too large to cross the fenestrations of the absorptive capillaries of the small intestine. Before returning to the blood, lymph passes through lymph nodes, where it is exposed to the cells of the immune system.<sup>3</sup> The lymphatic vessels merge to create the thoracic duct, which drains the lymph toward the venous system at the base of the left part of the neck at a volume estimated

to be 1.38 mL/kg of the body weight per hour.<sup>4</sup> Because of this large volume of lymph, understanding the complex anatomy of the thoracic duct is key to preventing traumatic chylothorax.

## EMBRYOLOGY

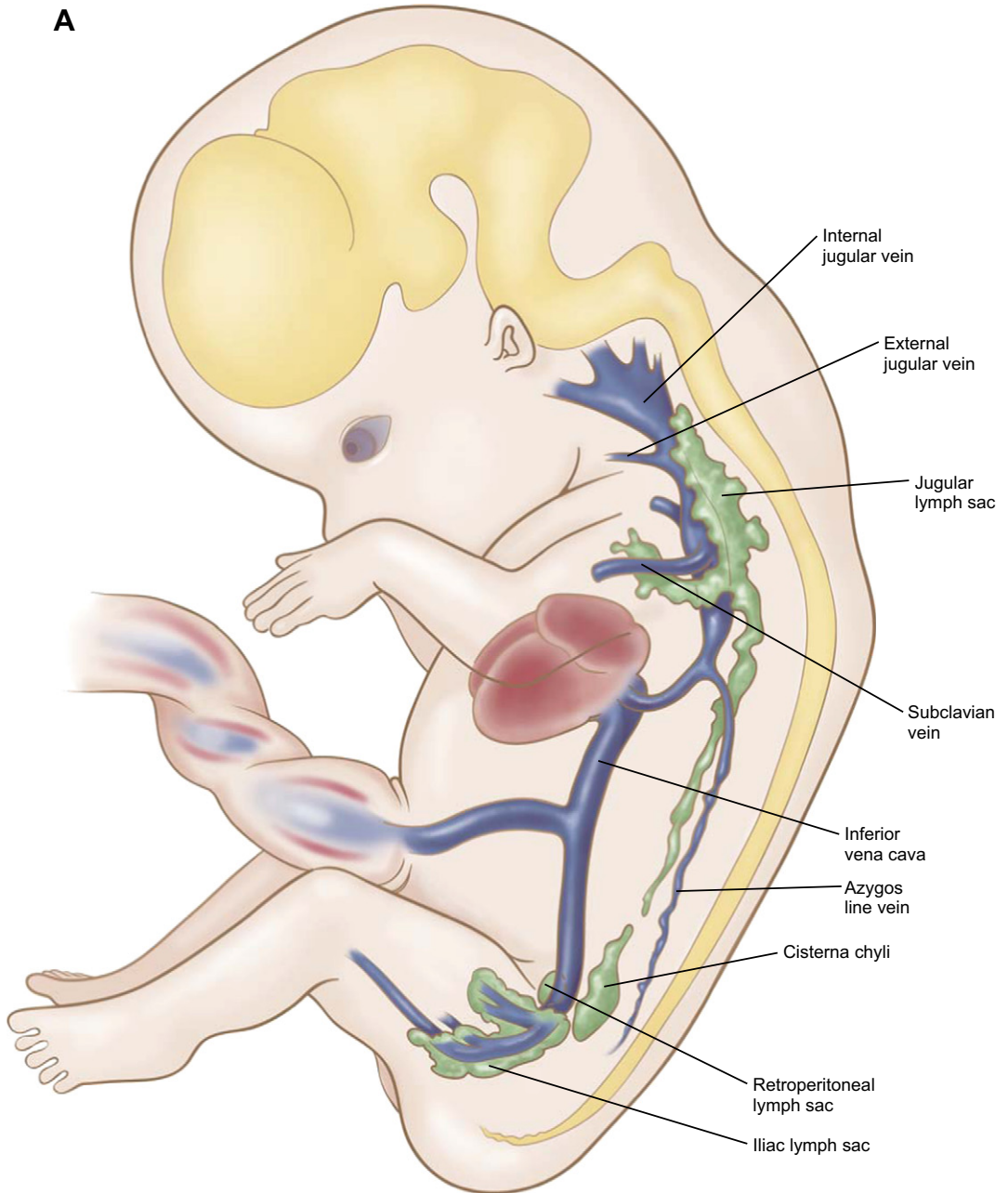
The lymphatic system begins forming in the human embryo during the sixth week of development when the embryo is about 10 mm in length. These first lymphatics are blunt buds, which are located near the internal jugular veins at the root of the neck.<sup>5</sup> At the end of the embryonic period, there are 6 primary lymph sacs: 2 jugular lymph sacs, 2 iliac lymph sacs, 1 retroperitoneal lymph sac, and 1 cisterna chyli (**Fig. 1**). Lymphatic vessels develop in a manner similar to blood vessels and join the lymph sacs.<sup>6</sup> Linkage of the jugular lymph sacs with the cisterna chyli, the abdominal origin of the thoracic duct, is initially in the form of a bilateral system of lymphatic trunks, connected with one another across the midline by numerous collateral anastomoses. Of these trunks, the inferior portion of the right trunk and the superior portion of the left trunk, together with a diagonal anastomosing channel at the level of T4-T6 segments, forms the definitive thoracic duct<sup>7</sup>; the rest of the ducts regress with time. Except for the superior part of the cisterna chyli, the lymph sacs are transformed into groups of lymph nodes during the early fetal period.<sup>6</sup> The uppermost lymph node to form is generally called the Virchow node and is located at or near the jugulosubclavian venous junction.<sup>8</sup>

<sup>a</sup> Department of Thoracic and Cardiovascular Surgery, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, TX 77030, USA

<sup>b</sup> Department of Thoracic and Cardiovascular Surgery, Unit 445, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, TX 77030, USA

\* Corresponding author.

E-mail address: [rjmehran@mdanderson.org](mailto:rjmehran@mdanderson.org)



**Fig. 1.** Development of the lymphatic system. (A) Left side of an 8-week embryo showing the primary lymph sacs. (B) Ventral view of the lymphatic system at and after 9 weeks' gestation, showing the paired thoracic ducts and the regression of the left duct. (Adapted from Moore KL, Persaud TVN. The developing human. 7th edition. Philadelphia: WB Saunders; 2003; with permission.)

### CISTERNA CHYLI AND ABDOMINAL LYMPH TRUNKS

The 4 main abdominal lymph trunks converge to form an elongated arrangement of channels referred to as the abdominal confluence of lymph

trunks or the cisterna chyli (see **Fig. 1**). To further complicate matters, this group of channels may have a simple ductlike structure or may be duplicated, triplicated, or plexiform.<sup>9</sup> A fusiform area of dilatation in the lymphatic channels, which extends 5 to 7 cm in the caudocephalad direction,

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