

Short communication

Micro-macroscopic anatomy of the lymphatic vessels and lymph nodes that form the parietal lymphatic pathways of the human thoracic cavity

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ABSTRACT

Introduction and Aim: Information about the anatomy of lymphatic vessels and lymph nodes is necessary for the diagnosis and treatment of chest wounds, injuries to ribs and sternum, and while performing diagnostic studies. In the present study, we investigated the anatomy of the lymphatic vessels and lymph nodes of the thoracic cavity in humans.

Materials and Methods: The examination was performed on 60 cadavers of fetuses (25), new-born children (14), children (11), and adults (10). Lymphatic vessels of the rib periosteum, costovertebral, costotransverse, and sternocostal joints, as well as parietal lymphatic vessels and lymph nodes of the thoracic cavity were studied.

Results: The parietal lymph nodes of the thoracic cavity include parasternal, paramammary, intercostal, paravertebral, and upper diaphragm. The efferent lymphatic vessels of the periosteum and perichondrium of the first three ribs go to the intercostal lymph nodes, to the parasternal, paravertebral, and diaphragmatic lymph nodes. The regional nodes for the lymphatic vessels of the sternocostal joints are the parasternal, subclavian, supraclavicular, deep cervical, diaphragmatic, axillary, and superior mediastinal.

Conclusion: The presence of intercalated lymph nodes on the thoracic cavity is characteristic of the entire lymphatic system and should be considered in the pathology of the thoracic cavity.

Keywords: Bone marrow; haematopoiesis; megakaryocytes; reticulocytes; myelocytes; cadaveric bone marrow cells.

INTRODUCTION

The human immune system is a functionally combined set of lymphoid organs (red bone marrow, thymus, spleen, lymph nodes, hemolymph nodes, tonsils, appendix, Peyer's patches, and accumulation of lymphocytes on the mucous membranes) and the accumulation of lymphoid cells of the body, in which the processes of proliferation, differentiation, migration, cooperation, and apoptosis of immunocompetent elements constantly occur (1-3). Many pathological processes such as infections, intoxications, and malignant tumors were spread through the lymphatic vessels of the thoracic cavity. The formation of metastases on the ribs, spine, chest muscles, pleura, and lungs in breast cancer is by the spread of malignant cells through the intercostal lymphatic vessels and lymph nodes (4-6).

However, information regarding the anatomy of lymphatic vessels and lymph nodes was currently limited. Information about the anatomy of lymphatic vessels and lymph nodes is necessary for the diagnosis

and treatment of chest wounds, injuries of the ribs and sternum (5, 7- 9), as well as when performing diagnostic studies (ultrasound, computed tomography, magnetic resonance imaging). Therefore, in the present study, we investigated the anatomy of the lymphatic vessels and lymph nodes of the thoracic cavity in humans.

MATERIALS AND METHODS

The examination was performed on 60 cadavers of fetuses [25], newborn children [14], children [11], and adults [10]. Lymphatic vessels of the rib periosteum, costovertebral, costotransverse, and sternocostal joints, as well as parietal lymphatic vessels and lymph nodes of the thoracic cavity were studied.

Lymphatic vessels were identified by the introduction of a syringe through the needle into the thickness of the periosteum and capsules of the joints of the blue mass of Gerota; microscopic preparation of engorged lymphatic vessels under the MBS-2 microscope; histological slides were stained with hematoxylin and eosin; clarification of total preparations in salicylic

acid methyl ester; morphometry of lymphatic vessels, lymph nodes, as well as loops of lymphatic capillaries using a micrometer eyepiece. The distribution density of the lymphatic vessel network was calculated using a millimeter grid. A comparative study of arterial, venous, and lymphatic vessels was carried out.

RESULTS

The parietal lymph nodes of the thoracic cavity include parasternal (localized along the course of the thoracic arteries and veins), paramammary (located near the lateral edge of the pectoralis major muscle), intercostal, paravertebral, and upper diaphragm.

According to the blood vessels of the thoracic cavity, the following lymph nodes are distinguished along the:

- branches of the axillary arteries and veins.
- internal thoracic arteries and veins.
- long arteries and veins.
- intercostal arteries and veins.
- upper intercostal arteries and veins.
- unpaired, semi-unpaired veins and thoracic aorta.

The efferent lymphatic vessels of the periosteum and perichondrium of the first three ribs go to the intercostal lymph nodes, to the parasternal, paravertebral, and diaphragmatic lymph nodes. The efferent lymphatic vessels of the periosteum of the next five ribs (IV–VIII) and the perichondrium of their cartilage follow to the intercostal, parasternal, paravertebral, and diaphragmatic lymph nodes. Lymphatic vessels, formed from the periosteum of the last four ribs (XI–XII) and the perichondrium of the cartilages of the IX and X ribs, go to the intercostal and paravertebral lymph nodes.

The efferent lymphatic vessels of the costovertebral joints follow the regional lymph nodes: intercostal, paravertebral, prevertebral, deep cervical, subclavian, posterior mediastinal, and para-aortic. The relationship of intercostal collecting lymphatic vessels with intercostal blood vessels changes throughout the same intercostal space. Following the intercostal spaces, the collecting lymphatic vessels anastomose with each other.

The regional nodes for the lymphatic vessels of the sternocostal joints are the parasternal, subclavian, supraclavicular, deep cervical, diaphragmatic, axillary, and superior mediastinal. The number of nodes in a particular intercostal space is 3–5 with dimensions of 0.40×0.60 to 1.0×1.5 mm. The number of nodes in a particular intercostal space is not large (1–2) with dimensions of 1.75×2.0 to 2.0×4.5 mm.

The intercalated lymph nodes are located at the origins and on the path of the efferent lymphatic

vessels until they flow into the collecting lymphatic vessels and regional nodes. Their dimensions are 0.25×0.77 to 0.3×1.05 mm.

Collecting lymphatic vessels of the lower 5–6 intercostal spaces flow into the thoracic duct or its cistern at the level of T11–T12. Collecting lymphatic vessels of the 4th and partially 5th intercostal spaces join the thoracic duct at the level of T4–T5. Collecting lymphatic vessels, following the upper 2–3 intercostal spaces, go left to the arch of the thoracic duct, and to the right lymphatic duct. These collecting lymphatic vessels on each side are connected by anastomoses running longitudinally to the spine. Parasternal lymphatic collectors reach the bed of the venous system on the left and right in different ways and join the large veins of the neck.

Lymphatic vessels of the periosteum of the ribs (posterior) and costotransverse joints penetrate through the IV, V, VI, VII, and VIII intercostal spaces onto the inner surface of the thoracic cavity in the region of the posterior and middle axillary lines, as part of the intercostal neurovascular bundle and are directed to the side of the spine. Some efferent lymphatic vessels, arise from the periosteum of the ribs of the lateral thoracic cavity (superior and lateral thoracic artery). Additionally, independent lymphatic vessels arising from the ascending lymphatic collectors run under the serratus posterior superior muscle upward to the suprascapular and inferior deep cervical lymph nodes.

Lymph-collecting vessels following along the course of the musculophrenic arteries and veins receive the efferent lymphatic vessels of the periosteum and capsules of the costovertebral joints of the VI–VII ribs and their costal cartilages, as well as anastomoses from the lymphatic vessels above bones of VIII, IX, X ribs.

DISCUSSION

The lymph nodes of the thoracic cavity in humans belong to the parietal nodes and are located on the anterior, lateral, and posterior walls of the thoracic cavity, as well as on the surface of the diaphragm facing the thoracic cavity. The parietal lymph nodes are the parasternal and diaphragmatic lymph nodes, lymphatic drainage from the lung, esophagus, trachea, and thymus through the paratracheal lymph nodes (10).

Parietal lymph nodes of the thoracic cavity include 3 groups: lymph nodes of the anterior wall of the thoracic cavity (parasternal, parathoracic, axillary); lymph nodes of the posterior thoracic cavity (intercostal, paravertebral); lymph nodes of the lower thoracic cavity (diaphragmatic, pericardial - anterior, lateral, retro pericardial). Among the parietal lymph nodes of the thoracic cavity, there are: interthoracic,

deltoid, subclavian, parathoracic, parasternal, and intercostal (11).

The paravertebral and prevertebral lymphatic collectors, which are located on the anterolateral surfaces of the thoracic vertebral bodies, collect the efferent lymphatic vessels of the periosteum of the posterior ends of the ribs, as well as the costovertebral and costotransverse joints.

Our data on morphometry, topography, and morphology of parasternal lymph nodes are like the description of these lymph nodes in an adult (6).

CONCLUSION

The presence of intercalated lymph nodes on the thoracic cavity is characteristic of the entire lymphatic system and should be considered in the pathology of the thoracic cavity.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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