PRENATAL DEVELOPMENT OF THORACIC AND TRACHEAL LYMPH DUCTS IN GOATS*

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Abstract

Prenatal development of thoracic and tracheal lymphductsin goats was studied using ten sexually indifferent fetuses of various ages, to trace their morphogenesis and histogenesis. By 48 days of gestation, thoracic duct formed the cranial continuation of cisterna chyli, near aorta and ventral to bodies of vertebrae. By 53 days it lay in relation to developing mediastinal lymph nodes, sympathetic trunk and aorta ventral to vertebrae towards the caudal part of the thoracic cavity. By 50 days, the tracheal lymph duct was seen in the developing carotid sheath on the left side ventral to the internal jugular vein and vagosympathetic trunk and on the right side in relation to right recurrent laryngeal nerve and internal jugular vein. By fourth month, both these ducts presented valves.

Key words: *Goat, thoracic duct, tracheal lymph duct, prenatal development*

Lymphatic vessels were first described in the seventeenth century by GasparoAselli as lacteae venae or milky veins in the mesentery of well-fed dogs (Asellius, 1627). The lymphatic system is a modification of the circulatory system and it returns the fluid exuded into the tissue spaces from the blood vesselsto the vascular system. The lymphatics originate as modified veins, developing from primary lymph sacs and spread by the budding of endothelial cells, with their direction of growth being determined by the arteries and veins (Sabin, 1902). Since a detailed research of the development of lymph ducts in goat is still lacking, this study was conducted to elucidate the histomorphogenesis of the thoracic and tracheal lymph ducts in goats at different stages of prenatal life.

Materials and Methods

The study was conducted on ten sexually indifferent fetusesfreshly collected from Municipal Slaughter House, Thrissur. After recording the body parameters, age of the foetuses was calculated using the formula derived by Singh *et al.* (1979), for goat foetuses, $W^{1/3} = 0.096$ (t - 30), where, W = Body weight of the foetus in g and t = Age of the foetus in days. Embryos and foetusesupto 60 days of age, were fixed as such. In older foetuses above 60 days, the area surrounding and including the developing lymph ducts were collected and fixed. From larger foetuses of 91 days of age and above, after recording the morphological features, the lymph ducts were dissected out and the morphometric parameters were recorded. Tissues collected were fixed for 48 hours in 10 % neutral buffered formalin, processed and stained with Ehrlich's haematoxylin and eosin (H & E), Mallory's phosphotungstic acid haematoxylin, Masson's trichrome, Verhoeff's method, Van Gieson's method, Silver orcein and Aniline blue and Toludine blue (Singh and Sulochana, 1996). Micrometrical data were recorded using an ocular micrometer. Data collected were analysed statistically following Snedecor and Cochran (1994).

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Results and Discussion

Thoracic Duct

From 48 days of gestation onwards, thoracic duct formed the cranial continuation of cisterna chyli near aorta and ventral to bodies of vertebrae (Fig. 1). According to Sabin (1905), in foetal pigs the duct developed from lymphatic spaces near the aorta and on the left side it developed more rapidly than on the right side. Yoffey and Courtice (1956) described it as a duct which grew down from the jugular sac and got united with the plexus arising from the cisterna chyli.

By 53 days of gestation, thoracic duct lay in relation to developing mediastinal lymph nodes, sympathetic trunk and aorta ventral to thoracic vertebrae towards the caudal part of the thoracic cavity (Fig.2). It was related to the sympathetic trunk in the cranial part of the thoracic cavity also (Fig.3). A similar relation was described for the thoracic duct in human beings (Tonar *et al.,* 2001) and rat (Orhan, 2003). Dumont and Rifkind (1968) reported that in mammals, the thoracic duct drained the abdominal viscera and lower half of the body.

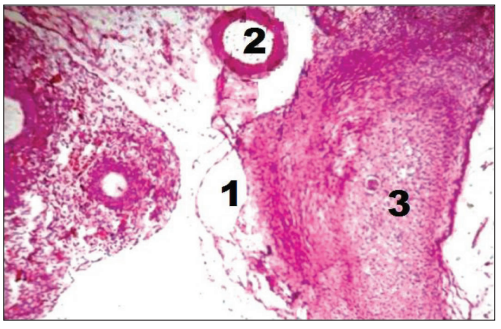

Fig.1. Thoracic duct (48 days). H & E x 100

1.Thoracic duct 2. Aorta 3.Body of vertebra

The wall of the duct consisted only of a single layer of endothelium by 53 days (Fig.3). Towards the second half of third month of gestation, an additional layer of fibroelastic tissue appeared (Fig. 4). From fourth month of gestation onwards, the duct wall presented valves (Fig. 5). This finding partially agreed with those of Kampmeier (1927) in human foetuses that the most active generation of valves occurred between the end of the second and the beginning of fifth month of foetal life.

In the present study, by the last month of gestation, the wall exhibited endothelium, internal elastic membrane, a thin intermediate layer of fibroelastic tissue with bundles of longitudinal muscle fibers and a thin layer of adventitia. This confirmed the findings of Copenhaver*et al.* (1971) in domestic mammals. But Krutsiak and Polianskii (1986) could not detect the typical structure of the thoracic duct in human foetuses and opined that the histogenesis of the thoracic duct wall was completed only after birth in human beings.

Tracheal Lymph Duct

Tracheal lymph duct was seen in the developing carotid sheath on the left side ventral to common carotid artery, internal jugular vein

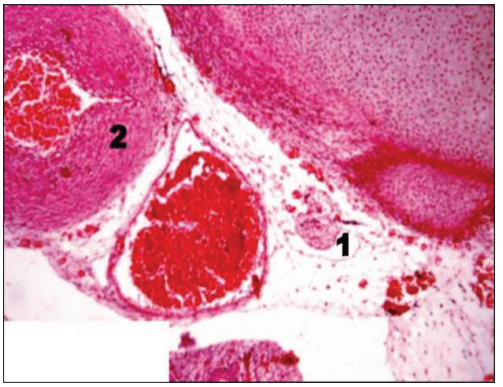

Fig.2. Caudal part of thoracic cavity (53 days). H & E x 100

1.Thoracic duct 2. Aorta

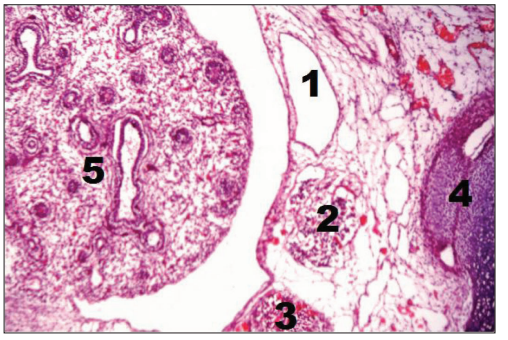

Fig.3. Cranial part of thoracic cavity (53 days). H & E x 100

1. Thoracic duct 2. Sympathetic trunk
3. Longuscolli 4. Body of Vertebra
5. Lung

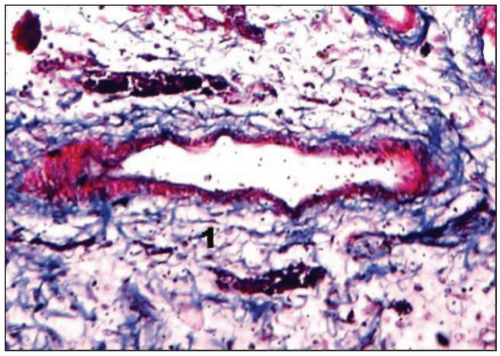

Fig.4. Thoracic duct (75 days). H & E x 400
1. Fibro-elastic layer

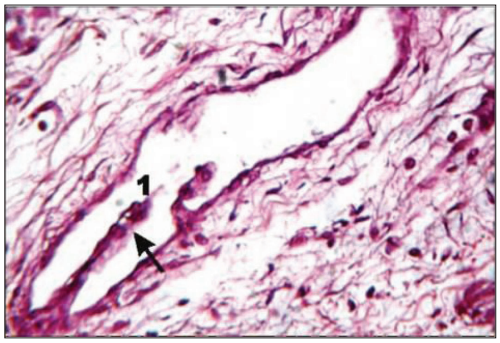

Fig.5. Thoracic duct (99 days). H & E x 400
1.Valve

and vagosympathetic trunk by 50 days during the second month of gestation (Fig. 6). On the right side, it was lying in relation to right recurrent laryngeal nerve and internal jugular vein. In 81 days-old fetuses, it was noticed in the vicinity of the deep cervical lymph nodes. In goat, the radicles of tracheal ducts are formed by the efferents of lateral and medial retropharyngeal lymph nodes and opens into the deep cervical lymph nodes (Tanudimadja and Ghoshal, 1972).

The wall of the tracheal duct also presented inner endothelial layer and outer fibroelastic layer towards the end of gestation. The mean cross sectional diameter of the duct increased from 90µm by 60 days-old fetuses to 270µm in full-term foetuses. McClure, (1915) opined that the lumina of the lymph vessels are formed by the union of discontinuous and independent lymph vesicles and lymph spaces. Moreover, the cells which constitute the wall of these spaces are derived *in situ* from the mesenchyme and not from the endothelium of vessels.From fourth month of gestation onwards, valves were observed in the duct wall. The presence of valves is a prominent feature of lymphatics, which gives these vessels a beaded appearance in mammals (Yoffey and Courtice, 1956).

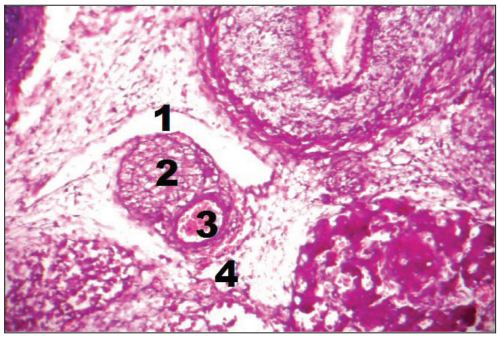

Fig.6. C.S. of neck region (50 days). H & E x 400
1. Internal jugular vein 2. Vagosympathetic trunk
3. Common Carotid artery 4. Tracheal Lymph Duct

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