POST NATAI DEVELOPMENT OF CAPRINE HAEMAL NODES:  
A GROSS AND HISTOLOGICAL STUDY

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Abstract: Post natal development of caprine haemal nodes from 0th day to 5th months of age were studied by light microscopy. The haemal nodes were harvested from cervical, shoulder, thoracic and abdominal regions. The shape and size of the haemal node was elliptical to spherical and 5 mm in average diameter. The two layers thick capsule was found around the parenchyma. Besides connective tissue fibres smooth muscle and blood capillaries were predominant in the innermost layer. The parenchyma was incompletely divided by the trabeculae which was distinct from 2nd months onward. From the date of birth cortex, medulla, subcapsular and medullary sinuses were observed. Megakaryocytes, proerythroblasts and erythroblasts were detected from the day old goat and size increase according to the advancement of age. Efferent lymph vessel was found but there was no trace of afferent lymph vessel. The lymph vessels were present around the border of the secondary lymph nodules. Some goat of 4th months of age histologically the eosinophilic pink colour appeared yellow brown. Our results had demonstrated that the rate of destruction of erythrocytes was more from 4th months onward.

Key words: Caprine haemal nodes, Post natal development

INTRODUCTION

The structure, fine structure and blood supply of haemal nodes are currently uncontroversial. In particular, current anatomical knowledge provides a basis for distinguishing between haemolymph nodes, which are endowed only with blood vessels. This structure is named haemolymph node by Robertson [1]. But their development is still unanswered. Haemal nodes are independent lymphoid organs located within the blood vascular system between arterioles and venules of different mammalian species and also in some birds [2]. True haemal lymph nodes occur in the sheep [3]. The haemolymph nodes of sheep and goats contain myeloid cells and erythroblast, and suggested that they act in the same way as bone marrow. Haemolymph nodes are very similar to lymph nodes except that afferent and efferent lymphatic vessels are absent and the sinuses contain blood instead of lymph. True haemal related to the spleen, because they undertaken blood filtration, and to the bone marrow because erythropoiesis and myelopoiesis takes place in them [4]. Antibodies are produced in haemal nodes and thus they clearly belong to the lymphatic system [5]. By contrast with their anatomy, the function of the nodes has not been fully elucidated. Postulated functions include erythropagocytosis, erythropoiesis, platelet formation and immune functions. The present study is restricted to elucidate the post natal development of caprine haemal nodes.

MATERIALS AND METHODS

Haemal lymph nodes were collected from clinically healthy zero day and month wise from one month to

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fifth months old Black Bengal goats (Capra hircus) from the farm maintained by AICRP (All India Coordinate Research Project) on goat. The animals were maintained in the farm house according to the stipulated guideline and permission of Institutional Animal Ethical committee of faculty of Veterinary and Animal sciences; West Bengal University of Animal and fishery Sciences, Kolkata. Two goats of either sex were utilized for this experiment in each age group. The samples were harvested from cervical, shoulder, thoracic and abdominal regions and were fixed in 10 per cent neutral buffered formalin. The fixed samples were processed for paraffin sections and routine staining was done as per Luna [6].

**RESULTS**

The haemal lymph nodes which were collected from different regions and from different age groups of animals were mostly dark red to blackish red in colour. The shape of the glands were mostly elliptical to spherical. The haemal nodes were present along the ventral border of the molar part of the mandible at the junction of the lingual and facial veins. Small haemal nodes lie at the dorsal side of the cranial part of the neck, ventral to the wing of the atlas, usually embedded in fat. Between the costocervical vessels small haemal nodes were seen in its vicinity.

In the cranial mediastinum dorsal to the brachiocephalic trunk and the cranial venacava various size of haemal nodes were embedded in fat between the longus colli and the trachea, lying on the preceding structures or the esophagus. In the caudal mediastinum between the thoracic aorta and the esophagus haemal nodes were seen in the vicinity. Between the tracheal bifurcation and pulmonary trunk small haemal nodes were present. The nodes were observed in the neighborhood to the base of the heart, trachea and azygos vein. The sizes of the nodes were 3-4 mm up to 2nd months of age and thereafter the size increased 5-6 mm from 3rd months onwards.

The lymph nodes were encapsulated with two distinct layers. The outer layer was made up of connective tissue and inner layer was made up of smooth muscles fibers (Fig.4). Capsule tightly packed the parenchyma and was absent at the point of hilus (Fig.1). The capsular extension in the form of trabeculae within the parenchyma was ill developed from 0 day to 1 month age group of goat and appeared clearly from 2 months onward age groups of goats which incompletely divided the parenchyma. Collagen fibers were predominantly found around the capsule and spindle shaped nucleus denoted the presence of smooth muscle fiber component of the capsule (Fig.7). The inner layer of capsule was characterised by dense net work of blood capillaries.

The parenchyma was differentiated in the form of cortex and medulla however secondary nodules were more evenly distributed in the parenchyma from 0th day of age (Fig.2). Subcapsular sinuses (Fig.7) and medullary sinus (Fig.8) were observed from 0th day and they were filled up with blood in of lymph. The sinuses were lined by endothelial cells.

Small blood capillaries were seen in the interfollicular areas (Fig.3). The lumens of the capillaries were occasionally occupied by lymphocytes. Besides this diffuse interfollicular lymphocytes were observed.

In an around the trabeculae of the sinuses 7.5 to 8.5 µm megakaryocytes with multilobed nuclei and

**Explanation of figures:**

**Fig 1:** Overview of histological appearance of Caprine haemal node in the day old goat; C: capsule; LF: lymphoid follicle; arrow: hilus.

**Fig 2:** Histological appearance of Caprine haemal node in the 1 month old goat; C: capsule; LF: lymphoid follicle; T: trabeculae; MS: medullary sinus.

**Fig 3:** Histological appearance of Caprine haemal node in the 4th months old goat; C: capsule; LF: lymphoid follicle; I: inter follicular zone; A: blood vessels; arrow: central sinus.

**Fig 4:** Histological appearance of Caprine haemal node in the 2nd months old goat; C: capsule; arrow: fibrocyte; N: solitary node; SM: smooth muscle; SS: subcapsular sinus.

**Fig 5:** Histological appearance of Caprine haemal node in the 3rd months old goat; RC: red cells; arrow: megakaryocyte.

**Fig 6:** Histological appearance of Caprine haemal node in the 5th months old goat; MS: medullary sinus; EB: erythroblast; arrow: proerythroblasts.

**Fig 7:** Histological appearance of Caprine haemal node in the 4th months old goat; SS: subcapsular sinus; arrow head: smooth muscle cell; arrow: fibroblasts; asterisk: megakaryocyte.

**Fig 8:** Histological appearance of Caprine haemal node in the 4th months old goat; SS: subcapsular sinus; RC: red cells; arrow: proerythroblasts.
granulated basophilic cytoplasm were observed from 0th day onward (Fig.7). Perinodular lymphatic tissues were found from same age group. A few clusters of red cells were observed in the subcapsular sinus in association with perinodular lymphatic tissue (Figs. 5,8). These cells were measured 6 to 7 µm in size and there was a high nucleus / cytoplasm ratio and a vesicular nucleus, prominent nuclei and intensely basophilic cytoplasmic ring. This cell resembled as proerythroblasts (Figs.6,8).

Besides this, in the other regions of the node particularly in the lumen of the medullary sinuses there were some cells of 5 to 6 µm with small, dense spherical nucleus and basophilic cytoplasm was observed. These cells represented as polychromatophilic erythroblasts (rubricytes) (Fig.6).

The medulla was composed of irregular medullary chords and these chords were separated by blood sinuses. The most predominant cells types were erythrocytes, lymphocytes, macrophages and plasma cells. The occurrence of macrophage was first evidenced from 1st month old goats and onwards. The shape and size increased from the advancement of age. At hilus single lymph channel was found in association with radial lymphatics.

The lymph vessels were identified by presence of wide lumen containing lymph in which few cells were seen. Cells were mostly found radially towards the border line of the cortex.

Grossly the color of the haemal nodes appeared brownish in some of the goats of 4th month of age and histologically the eosinophilic pink appeared yellowish brown. Under microscopical observation the phagocytic / macrophage cells were observed. It resembled the presence of haemocederin in the haemal node sinuses and in the cytoplasm of some macrophage cells.

DISCUSSION

Haemal nodes were mainly located in the thoracic, abdominal and pelvic retroperitoneal cavities of sheep and goats [7, 8]. However in the present study we observed nodes from the birth itself in the neck and shoulder regions besides these regions. This finding corroborate in case of bovine [5]. In small ruminants they rarely exceed 5mm [5].The haemal nodes were generally small, brown to dark red organs, but their size and number varied within wide limits [9,10].This in accordance in our finding but the size of the glands increased according to the advancement of age.

In the sheep but not the goat, a cortex and a medulla can be differentiated [5,11] which is not in accordance with our findings. Cortex and medulla were differentiated. The similar finding was cited in goat [8,12].

A single efferent lymphatic was formed at the hilum by confluence of the radial lymphatic. The lymphoid tissue contains plasma cells and mast cells in goats of different age [8]. Similar observation was noted in the present study.

The presence of smooth muscle were observed in the capsule and trabeculae play an important role in the contraction of the capsule and trabeculae to concentrate the red blood cells in the sinuses in mechanism similar to that reported in the spleen [13].

The caprine hemal node consisted of a capsule, subcapsular and other sinuses, cortex, medulla and hilus. Elements of circulating blood filled the interstices of the reticular meshwork and associated macrophages which traversed the lumina of subcapsular and medullary sinuses. The latter were rare in 1-month-old goats, progressively increased in number and size in 2 to 4 month old goats and coalesced with each other and the subcapsular sinus in adult animals [8]. This is accordance with our findings.

Erythrophagocytosis is currently defined as the process by which an organism removes old or degenerate erythrocytes from the circulation. It is performed primarily by macrophages, mainly in the spleen but also in liver, lung, bone marrow and, in certain species, in haemal or haemolymph nodes [14-17]. Our findings in this study corroborate the performance of erythrophagocytosis in caprine haemal nodes. We observed large quantities of haemosiderin, the pigment produced by degradation of haemoglobin, in both the sinuses and the cytoplasm of some macrophages.

In haemal nodes of goats, [14] reported observing erythrophagocytosis by endothelial cells, reticular cells, lymphocytes and eosinophils as well as by macrophages [12,14].Observed no erythrophagocytosis by plasma cells this was similar with our
observation. The observation of erythroblast in haemolymph nodes was reported [4,18]. In this study of caprine haemal nodes we found red cells in several stages of erythropoiesis.

CONCLUSION

The presence of secondary follicles is indicative of a role for antibody production. The findings of this study corroborate the occurrence of both erythropoiesis and erythrophagocytosis in caprine haemal nodes started from the date of birth. Rate of destruction of erythrocytes was observed in high frequency from 4th months onward.

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REFERENCES