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Age Related Variations in The Architecture of Caprine Haemal Nodes

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ABSTRACT

Age related variations in the architecture of caprine haemal nodes were studied in West African dwarf goats aged between 1-24 months. Variations were observed in the thickness of the capsule, the content and organization of the cortical and medulary parenchyma as well as the stroma. In young goats aged between 1-4 months, the capsule was very thin (1-2um) and there was uniformly diffused lymphoid tissue in the cortical and medullary regions. The subcapsular and medullary blood sinuses were either absent or poorly developed in them. The older goats on the other hand, had thicker capsule reaching about 7um in 18-24 months old goats. Lymphoid nodules and blood sinuses were well developed. In the very old goats, features of involution were observed. Irrespective of age, haemal nodes in all animals showed evidence of myelopoiesis and lymphopoiesis. The study suggested that the architecture of haemal nodes so far described by earlier workers might have been influenced by the animal used for the study.

Keywords: Haemal nodes, Age Variation, Goat.

Haemal nodes represent independent organs that share some morphological and functional characteristics of lymph nodes. Divergent views have been expressed on the structure of haemal nodes. These variations were observed both between and within species (Winqvist, 1954; Weller, 1938).

The presence of two distinct regions-cortex and medulla was reported by Ezeasor and Singh (1988). Singh (1959) reported occasional finding of lymphatic nodules that were seeded over all areas. Some other reports show that the parenchyma was uniform mass of lymphatic tissue (Winqvist, 1954). While the presence of afferent lymphatics have been reported (Anderason et al, 1946), others have controverted its presence (Gargiulo et al., 1987, Dellman and Brown, 1987). Ezeasor and Singh (1989) described the presence of one or more efferent lymphatics on the concavity of the node, while the presence of trabeculae were reported in cattle and sheep by Folse et al (1971) and Gargiulo et al (1987) respectively. The trabeculae were reported to be absent in goats (Meyer 1914). It has been suggested that the structural variations may be attributed to the age of the animal examined by individual worker (Arvy, 19720.

The present study is therefore aimed at studying the age related variations in the development of caprine haemal nodes, using animals of different age groups.

MATERIALS AND METHOD

Sixteen West African dwarf (WAD) goats aged between 1-24 months were used for the study. The goats were divided into four age groups, each consisting of four animals as follows: Group I (1-4 months old) Group II (5-9 months old), Group III (10-17 months old), Group IV (18-24 months old). The grouping was done based on the postnatal development of caprine lymphoid organs as described by Wright et al (1956). The aging was based on dentition, using the eruption time and the rate of wear of both the temporary and permanent teeth as described by Clair (1960).

Each of the goats was euthanised with an overdose of pentobartbitone sodium (Sagatal®). Dissection was carried out and haemal nodes were randomly collected from various regions of each animal. The nodes were later processed for light microscopy, by fixing in 10% buffered formalin, dehydrated and embedded in paraffin wax. Sections of 5u thickness were cut. For each specimen, the slides were divided into 4 groups, and they were stained with hematoxylin-eosin, Weigert's iron baematoxylin, Giemsa Stain and van Gieson's stain respectively.

RESULTS

A. Group 1 (1-4 months old goats): The nodes were found to be very small in size. The capsule was found to be very thin (1-2um) with many blood vessels

abutting the circumference of the capsule. The capsule consists of fine collagen fibres. Trabecullae were not observed. The subcapsular blood sinus was absent. The capsular connective tissue merged closely with the peripheral cortical lymphoid tissue. A mass of diffuse but uniformly distributed lymphoid tissue occupied both the cortex and the medulla. Clear demarcation between the cortex and medulla was lacking (Fig. 1). Medullary blood sinuses were poorly defined, while medullary cords were not observed. Red blood cells were observed to be mixed up with population of lymphocytes within the parenchyma. Some of he lymphocytes were undergoing mitosis, while some immature blood cells were occasionally seen.

B. Group II (5-9 months old goats): The thickness of the capsule was about 5um. The number of blood vessels abutting the circumference of the capsule was reduced. Some of the nodes were observed to be polarized one side being occupied by a developing subcapsular blood sinus while the other half was occupied by a uniformly distributed lymphoid tissue (Fig. 2). Majority of the nodes contained well developed subcapsular blood sinus filled with lymphocytes and red blood cells. The cortex was observed to be separated from the subcapsular blood sinus by thin endothelial cells. The cortex contained aggregations of lymphoid tissues arranged in nodules (Fig. 3). Thin collageneous fibres that originated from the capsule partially traversed the cortex as the trabeculae. The deeper layer of the nodes contained blood sinuses-the medullary blood sinuses, and also cords of cells-the medullary cords. Red blood cells mixed with lymphocytes were also observed in the parenchyma.

C. Group III (10 –17 months old): The capsule consists of coarse collagen fibres. The blood vessels found abutting the circumferences of the capsule were fewer in number but with larger diameters (Fig. 4a). Trabeculae were also observed. The features of the trabeculae were as described previously in the Group II animals (Fig. 4b). The subcapsular blood sinuses were well developed. Distinct cortex and medulla were observed. The cortex contained lymphoid follicles, while the medulla contained cords of cells, the medullary cords. These cords were separated from one another by well-defined medullary blood sinuses (Fig. 5).

D. Age Group IV (18 –24 months old): The general architecture of haemal nodes of the present group was similar to those described in the Group III animals. It was further observed that the cortical lymphoid nodules showed areas of lymphocytic attenuation (thinning), vacuolation, fragmentation and depletion of both the cortical and medulary zones of lymphocytes (Fig.7).

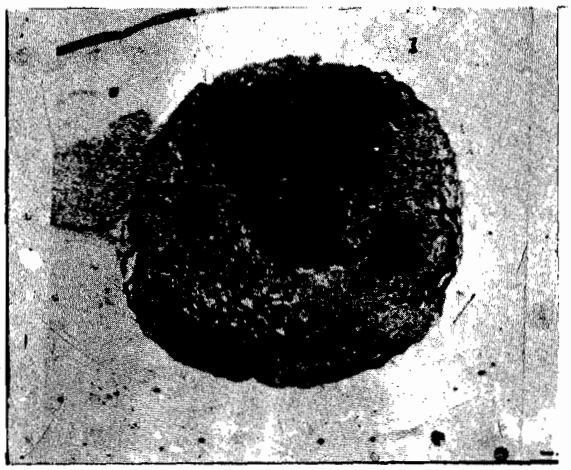

Fig. 1: Uniformly distributed lymphoid tissue in the haemal nodes of 1-4 months old goat H&E x 100

Fig. 2: A developing subcapular sinus s, and uniformly distributed lymphoid tissue L. from 5-9 months old goat. H&E x 100.

Fig. 3: a typical haemal node with cortical lymphoid follicle and medullary cords. The subcapuslar and medullary blood sinuses are developed. H&E 100.

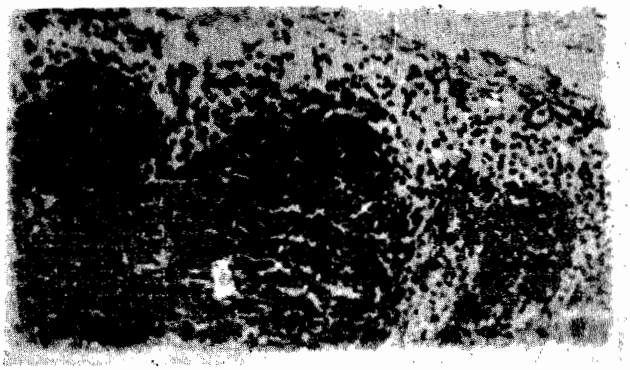

Fig. 4: Cortical lymphoid follicles and trabecula (arrow head). H&E x 400.

Fig. 5: showing the capsule c, subcarpsular blood sinuses s, cortical lymphoid follicle B, and medullary blood sinus a. H&Ex400

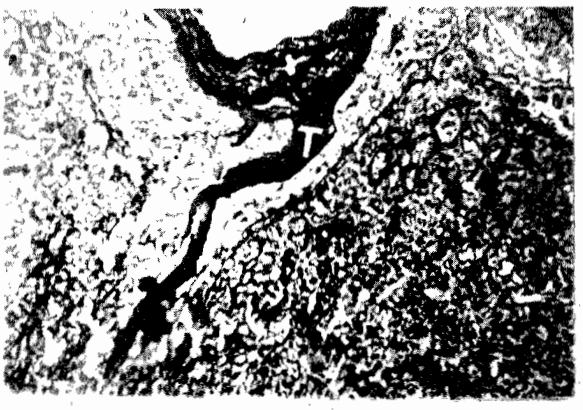

Fig. 4(b) Trabecula T. Transversing the parenchyma Van Gieson stain x 100

Fig. 6: Showing areas of lymphocyte depletion, liquifactive necrosis, and vacuolation (arrow heads). H&E x 400 (from 18-24 months old goat)

Fig. 7: Showing aras of lymphocytic attenuation, fragmentations and fibrosis H&E x 400 (from 18-24 month old goat).

DISCUSSION

Variations were observed in the histology of haemal nodes among the age groups studied. This further confirms the speculation of Arvy (1972), that the variation in the architecture of haemal nodes so far reported may be attributed to the age of the animals studied. Blood sinuses were found to be absent in the younger goats (1-4 months of age), while the circumference of the nodes were highly vascularized. The vascularization could be survival strategy for an early stage of development, as similar relationship has been reported in a supernumerary spleen (Meyer, 1914). The absence of blood sinuses at an early age, and their appearance later, could suggest that these structures develop later in the life of the animals.

The preponderance of uniform mass of diffused lymphoid tissue and organized cortical lymphoid follicles in the young (1-4 months old) and older goats (5 months and above) respectively, suggests that the organization of cortical lymphoid tissues into follicules commences at about five months of age in goats. Diffused cortical lymphoid tissues were occasionally observed even in older goats. This need to be further studied, as it could be that new nodes might be formed even at old age. Winqvist, (1954) reported that the parenchyma of a haemal node was a uniform mass of lymphatic tissue, while Ezeasor and Singh (1988) reported the presence of distinct cortex with cortical lymphoid nodules and medulla. From the result of the present study, one may suggest that the observations of these earlier workers might have been influenced by the age of the animals used for their studies.

Trabeculae were found to be absent in the 1-4 months old goats. While in the older goats, trabeculae at different stages of development were encountered. The presence of trabecuale were reported in cattle and sheep by Folse et al (1971) and Gargiulo et al. (1987), while the trabeculae was reported to be absent in goats (Meyer, 1917). The results of the present study therefore suggest that age may be a determinant factor in the presence or absence of trabeculae. This may further be related to the rate of postnatal differentiation of the stromal elements.

The attenuation of both the cortical and medullary lymphocytes, coupled with necrosis, vacuolation and lymphocytic depletion as observed in the nodes of Group IV (18-24 months old) characterized involution. This is consistent with the observation of Jolly (1913), who characterized physiological involution as a process consisting gradual loss of cortical and medullary lymphocytes, with progressive fibrosis. The involution so observed in this study is at an early stage, as it is in consonance with the observations of Bickford et al. (1985) while studying early stage of involution in the Bursa of Fabricius. The stimulatory mechanism of involution of lymphoid organs is not known (Bickford et al., 1985). It has been stated that lymphoid organs involutes simultaneously with the development of functional gonad (Jolly, 1913; Payne, 1971; Firth, 1977). In the present study, involution was observed to be at early state at the age of 18-24 months. This is despite the fact that age at puberty in tropical goats was estimated to be at 4-8 months. Though late puberty at the age of 10 months and above have been recorded (Devendra and Burns, 1970), reasons behind this late initiation of involution in haemal nodes need to be further investigated.

CONCLUSION

While the present study confirms the findings of other workers, it, however established specifically that the development of the architecture of haemal node is age dependent in the vascularization of the circumference of the node, development of trabeculae, and subcapsular blood sinuses; demarcation between the medulla and cortex; development of medullary cord, organization of cortical lymph follicles and development of lymph nodules.

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