

Gross and histomorphology of gut-associated lymphoid tissue (GALT) in dogs

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ABSTRACT

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GALT in one month old pups was comprised of DPPs, CPP and SLNs. While first two forms were distributed over small intestines, the third was limited to large intestine. The DPPs were arranged mainly on either side of mesenteric attachment. A single long band like CPP was present in the terminal part of ileum. The SLNs were present as small oval or round nodules in caecum and rectum. Some follicles of ALNs possessed domes covered with special FAE devoid of goblet cells. The SLNs were devoid of dome areas.

Key words: GALT, Dogs, Gross Anatomy, Histology.

INTRODUCTION

The intestinal immune system provides basis for a number of problems in pediatrics, gastroenterology, immunology and pathology such as food allergy, inflammatory diseases of the gut, tolerance to nutritional antigens and oral vaccines (Pabst *et al.*, 1988). Peyer's patches constitute major sites where antigens from the gut lumen encounter immunocompetent cells and trigger events leading to immune responses (Owen and Bhalla, 1983).

Perusal of literature reveals dearth of information in relation to gross distribution and histomorphology of GALT in dogs especially during various stages of postnatal development. The present study is therefore aimed at exploring the status of GALT in one month old dogs.

MATERIALS AND METHODS

The study was conducted on six pups of one month age. Three pups were used for gross anatomical and the remaining for histomorphological studies. For gross localization of GALT, the intestines were prepared according to the method described by Carlens (1928). The whole intestine was opened along mesenteric attachment and after gentle washing with cold water it was fixed in 2 per cent acetic acid for 12 hr. The intestine was then stained in 0.5 per cent methylene blue solution for 3 min., rinsed in running water in 2-3 hr. and examined against translucent light. The intestinal samples were collected from duodenum, jejunum, ileum, caecum, colon and rectum and fixed in 10 per cent

formalin solution for histological and histochemical studies. The tissue pieces were processed by routine paraffin technique and stained in haematoxylin and eosin (Bancroft and Stevens, 1977) to study the histoarchitecture and Masson's trichrome stain (Masson, 1929), Gomori's method (Gomori, 1937) and Verhoeff's stain (Verhoeff, 1908) for the demonstration of collagen, reticulin and elastic fibers respectively.

RESULTS AND DISCUSSION

In one month old pups, GALT was present in two distinct morphological forms (1) aggregated lymphoid nodules (ALNs) and (2) solitary lymphoid nodules (SLNs). The ALNs were further divisible in discrete Peyer's patches (DPPs) and continuous Peyer's patch (CPP). The ALNs were distributed over various segments of small intestine while SLNs were limited to large intestine only. Nickel *et al.* (1973) also reported the ALNs to be distributed mainly in small intestines in pigs, however, these were reported to be extending in large intestine also in horse (Nickel *et al.*, 1973), buffalo (Vyas and Mudholkar, 1972), cattle (Liebler *et al.*, 1988) and sheep (Aleksandersen *et al.*, 1991). The SLNs were found to be spread over the whole intestine in cattle, horse (Nickel *et al.*, 1973) and buffalo (Vyas and Mudholkar, 1972). The DPPs presented circular or oval outline and occurred on the opposite side and occasionally close to mesenteric attachment. Torres-Medina (1981) while working in calves and pigs, Vyas and Mudholkar (1972) in buffalo and Getty (1975) in horse found that the Peyer's patches occurred only on the opposite side of the mesenteric attachment. These patches had clearly discernible lymphoid follicles with dark central and light peripheral areas. The average minimum length of these patches was recorded to be 0.5 cm with a range of 0.4 to 0.6 cm in the proximal part of duodenum and the maximum average length as 1.2 cm with a range of 1.0 to 1.4 cm in the terminal part of jejunum or initial part of ileum. The total number of these patches varied between 13 and 16 in different animals. The number of DPPs was reported to be 20-58 in calves (Getty 1975), 19-25 in young swine (Chu *et al.*, 1979) and 32-47 in buffalo calves (Vyas and Mudholkar, 1972). The first and the last Peyer's patches were located at a mean distance of 6.4 cm and 159.1 cm respectively from the pyloric end of duodenum. The distance of first DPP from the pyloric end was reported to be 50 cm in cattle and 1.0 meter in pig (Nickel *et al.*, 1973). The reason for this distance being shorter in dog may be due to its relatively shorter small intestine.

A single long band like CPP was located in the terminal part of the ileum extending upto the ileo-caecal junction. The patch gradually widened caudally and occupied the whole circumference terminally except at the mesenteric attachment. The lymphoid follicles of the patch were indistinct. The mean length of the CPP was 12.2 cm with a range of 11.0 to 13.0 cm. A terminal CPP was also reported by Getty (1975) in horse, Nickel *et al.* (1973), Inoue and Sugi (1978) and Pabst *et al.* (1988) in pig, Parsons *et al.* (1991) in cattle, Vyas and Mariappa (1970) in buffalo and Reynold and Morris (1983) in sheep. The solitary lymphoid nodules were small round or oval. Their number varied from 80-100 in caecum and 15-20 in rectum. The lymphoid nodules were not visible in colon. Nickel *et al.* (1973), however, reported that SLNs were present throughout the small intestine but were rarely visible with the naked eye because of their submucosal location. The histological study revealed that the lymphoid follicles of discrete and continuous patches were located in submucosal layer and were surrounded by a thin connective tissue sheath. These findings were corroborated by the observations of Vyas and Mariappa (1970) in buffalo calves and Torres-Medina (1981) in calves. The sheath was made up mainly of reticulin and a few elastic fibers as also recorded by Lalitha (1991) in buffalo calves. The cross sectional profiles of lymphoid follicles presented oval, rectangular or truncated shapes. The follicles were so crowded within the patches that the submucosa was reduced to a thin layer around the follicles. The follicles were densely packed with lymphocytes. Some follicles pos-

sessed dome shaped areas protruding toward intestinal lumen. These findings were supported by the observations of Chu *et al.* (1979) in pigs, Torres-Medina (1981) in calves and Aleksandersen *et al.* (1991) in sheep. These domes were lined with special type of thin follicle associated epithelium (FAE) which was devoid of goblet cells as also observed by Liebler *et al.* (1988) in cattle and Aleksandersen *et al.* (1991) in sheep. The average short and long diameters of smallest nodules of CPP were 192 μ and 266.6 μ with an observation range of 144 to 240 μ and 240 to 288 μ respectively. The largest nodule of CPP had the mean short and long diameters of 499 μ and 736 μ with a range varying from 352 to 592 μ and 640 to 800 μ respectively. The interfollicular space ranged between 16-48 μ .

The solitary lymphoid nodules were present as isolated nodules in the submucosa of caecum and rectum. The average short and long diameters were measured to be 613.3 μ and 906.7 μ with a range of 400 to 800 μ and 800 to 1120 μ respectively. At certain places the muscularis mucosae was discontinuous through which the surface epithelium extended into the lymphoid nodule forming lymphoglandular complex. The solitary nodules and lymphoglandular complexes did not possess dome areas. Atkins and Schofield (1972) however, did not find lymphoglandular complex in rectum of dog.

REFERENCES

- Aleksandersen, M. Nicander, L. and Landsverk, T. 1991. Ontogeny, distribution and structure of aggregated lymphoid follicles in the large intestine of sheep. *Developmental and Comparative Immunology*. **15**: 413-422.
- Atkins, A.M. and Schofield, G.C. 1972. Lymphoglandular complex in the intestine of dog. *Journal of Anatomy*. **113**: 169-178.
- Bancroft, J.D. and Stevens, A. 1977. Theory and Practice of Histological Techniques. Churchill Living Stone. Edinburgh, London and New York.
- Carlens, O. 1928. Studies on the lymphoid tissue of the intestine in some domestic animals. *Biological Abstract*. 2371.
- Chu, R.M., Glock, R.D. and Ross, R.F. 1979. GALT of young swine with emphasis on dome epithelium of aggregated lymph nodules (PPs) of small intestine. *American Journal of Veterinary Research*. **40**: 1713-1719.
- Getty, R. 1975. Sisson and Grossman's The Anatomy of Domestic Animals. 5th Ed. Vol. I. W.B. Saunders Co., Philadelphia, London.
- Gomori, G. 1937. Silver impregnation of reticulum in paraffin sections. *American Journal of Pathology*. **13**: 993.
- Inoue, T. and Sugi, Y. 1978. Gut associated lymphoid tissue of piglets. Bulletin of faculty of Agriculture Yamaguti University. **29**: 21-30.
- Lalitha, P.S. 1991. Gut associated lymphoid tissue in Indian buffaloes (*Bubalus bubalis*). *Indian Veterinary Journal*. **68** : 1057-1059.
- Liebler, E.M. Pohlenz, J.F. and Woode, G.N. 1988. Gut associated lymphoid tissue in the large intestine of calves : Distribution and histology. *Veterinary Pathology*. **25** : 503-515.
- Masson, P. 1929. Some histological Methods. Trichome staining and their preliminary techniques. *Bulletin of the International Association of Medicine* **12**: 75.

- Nickel, R. Schummer, A. and Seiferle, E. 1973. The Viscera of Domestic Mamals. Verlag Paul Parey, Berlin, Hamberg.
- Owen, R.L. and Bhalla, D.K. 1983. Cytochemical analysis of alkaline phosphatase and esterase activities and of lectin-binding and anionic sites in rat and mouse Peyer's patch M cells. *American Journal of Anatomy* . **168**: 199-212.
- Pabst, R Geist, M. Rothkotter, H.J. and Fritz. F. J. 1988. Postnatal development and lymphocyte production of jejunal and ileal Peyer's patches in normal and gnotobiotic pigs. *Immunology*. **64**: 539-544.
- Parsons, K. R. Bland, A. B. and Hall, G. A. 1991. Follicle associated epithelium of gut associated lymphoid tissue of cattle. *Veterinary Pathology*. **28**: 22-29.
- Reynold, J.D. and Morris, B. 1983. The evolution and involution of PP in fetal and postnatal sheep. *European Journal of Immunology*. **13**: 627-635.
- Torres-Medina, A. 1981. Morphologic characteristics of the epithelial surface of aggregated lymphoid follicles in the small intestine of newborn calves and pigs. *American Journal of Veterinary Research*. **42**: 232-236.
- Verhoeff, F.H. 1908. Some new staining methods of wide applicability including a rapid differential stain for elastic tissue. *Journal of American Medical Association*. **50**: 876.
- Vyas, K.N. and Mariappa, D. 1970. Distribution of the lymphoid tissue in the ileum of the Indian buffalo (*Bos bubalis*) *Indian Veterinary Journal*. **47**: 487-490.
- Vyas, K.N. and Mudholkar, D.R. 1972. On the distribution of the lymphoid tissue in the alimentary tract of the Indian buffalo (*Bos bubalis*). *Gujarat Veteriarian*. **6**: 30-32.