

A study on 'Vermiform Appendix'-a caecal appendage in common laboratory mammals.

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Abstract

The vermiform appendix, a small structure without any known function in human being has been regarded as a vestigial remnant of a more developed distal caecum in man's herbivorous ancestors. A detailed study of the morphological and histological changes in the appendix and the caecum of different mammals with varying dietary habits revealed a distinctly well-defined vermiform appendix in rabbit only. However, the apical part of caecum among the carnivorous animals like cat and dog showed a clear histological picture with heavy infiltration of lymphoid tissue in the mucous & sub-mucous coats as seen in rabbit or human being. Thus, the vermiform appendix is in no way a vestigial organ but a specialized structure without any definitely known function, probably concerned with the establishment and maintenance of the body defence and immunity of the body

Key words: Vermiform appendix; Caecum; Lymphoid tissue; Argent affine cell.

The vermiform appendix is a narrow blind tube or an appendage rising from the postero-medial wall of caecum. The word vermiform derived from the Latin word "Vermiforma" means worm shaped or resembling worm, hence called 'vermiform'. Anatomically, it is one of the mobile viscera of abdomen⁶ with an average length of 6-9cms¹³ about 1cm longer in male than in female⁸. Microscopically, it consists of mucous, submucous, muscular and serous coats from inside out, with its surface epithelium consisting of simple columnar, Goblet, Paneth and Argentaffine cells. Due to the presence of extensive lymphoid tissues in the mucosa and submucous coats forming almost lymphoid follicles, it has been called 'Tonsil of the abdomen'. This small structure without any known function in human being has been regarded as a vestigial remnant of a more developed distal caecum in man's herbivorous ancestors⁷. However, in view of its rich blood supply and histological differentiation, the vermiform appendix has been accepted as a complex and highly specialized organ rather than a degenerate vestigial structure.

Review of literature

The vermiform appendix was recognized as an anatomical structure described as worm of the bowel by the ancient Egyptian embalmers. Morphologically, it is regarded as the lower blind end of caecum having failed to keep pace in growth with the remainder¹². The most characteristic feature of appendix is the lymphoid tissue bulging into its lumen that diminishes with the advancement of age

¹⁰. It has been postulated that the change of herbivorous diet of man's ape like ancestors, the appendix as well as caecum have been greatly reduced⁸. In a study of the alimentary tracts of animals, it has been found that the vermiform appendix is only present in a few rodents (rabbit and rat) and few primates (only anthropoid apes and man) but monkeys do not have such organ. During the 5th fetal week, appendix develops from a bud at the junction of small and large bowel and undergoes into a pouch. After the 5th fetal month, its proximal end starts growing to give rise to the true caecum. In fact, the appendix completes most of its function at the early end of the spectrum of life⁹. The appendix due to its content of highly specialized structures of lymphoid follicles could be the site for B-lymphocyte induction of antibodies; IgA type immunoglobins for secretory or mucosal surface immunity and IgM and IgG immunoglobins for humoral or bloodstream immunity¹⁶. A few animals like rabbit has a very large caecum acting as a fermentation tank but also a sizable and distinctive appendix with lymphoid aggregations in its wall

The carnivorous animals like cats and dogs take a mixed to carnivorous diet and get the nourishment by absorption of food products digested by their own bowel juices in a bigger caecum but no appendix.

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Objectives

To study the morphological and the histological changes in the appendix / caecum among the common laboratory mammals having different dietary habits.

Materials and methods

The common laboratory animals having different dietary habits such as herbivorous (albino rat, guinea pig, rabbit); carnivorous (cat & dog) and omnivorous (pig) were chosen for the study. The gross morphological structures of appendix and caecum were studied. The tissue samples were taken from the appendix, caeco-appendicular junction, and apical part of caecum which were kept in 10% formaline solution for 24-72 hrs. The 6-7u thickness section of these paraffin embedded tissues were stained with the following stains: --

- 1) Ehrlich's Haematoxylin & Eosin
- 2) Gomori-Burtner Methenamine silver method for Argentaffine cells.
- 3) Van Gieson's stain with Weigert's Iron Haematoxylin.

Then these histological sections were studied in details under the microscope.

Observations & Discussion

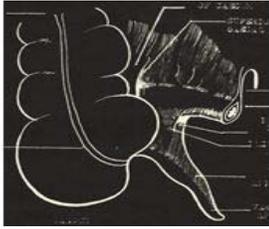
The study revealed the fact that a morphologically distinct vermiform appendix was found in the rabbit only, an herbivorous animal where as no animals showed any definite vermiform processes. A similar study among various other herbivorous animals like goat, sheep, horse and ox reveal the absence of well-formed appendix¹².

The caecum was quite largely dilated directed towards the right iliac region, among all the herbivorous animals like albino rat, rabbit, guinea pig and omnivorous animal like pig.

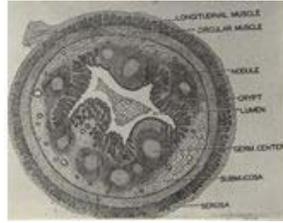
Between the carnivorous animals cat and dog, the caecum was found to be greatly reduced in size with its position in right lumbar region in the dog. It had been explained its position on developmental or embryological basis due to the arrest in the so called caudal migration of the caecum to the right iliac region as seen in human being. Similarly, the position of caecum on the left lumbar region in pig had been explained as due to the half rotation of the caecum during the intrauterine development of pig.

The histological or microscopic study of the appendix of rabbit showed very similar picture even the interruption of muscularis mucosae at places and large number of argentaffine cells as in human appendix. The present series of observations revealed that caecum were well developed and dilated among all the herbivorous animals but only the rabbit possesses a well developed appendix It has been suggested by various authors like Weichert that herbivorous animals have large caecum probably for the role of digestive, absorption or reservoir. Although there was no morphologically distinct vermiform appendix in carnivorous animals like cat and dog, the apical part of the caecum showed heavy infiltration of lymphoid tissues in the mucous & sub-mucous coats as in appendix. There were no signs of degeneration of any parts in the caecum or appendix in the present series of studies. Moreover there were no definite indications with the development of the vermiform appendix in relation to the dietary habits of neither the animals nor a degenerative organ.

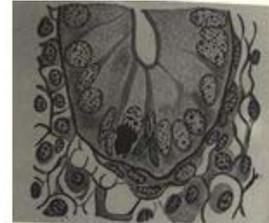
The diagrammatic representation of the appendix and caecum of common laboratory mammals are given as below:



Human Caecum and Vermiform appendix

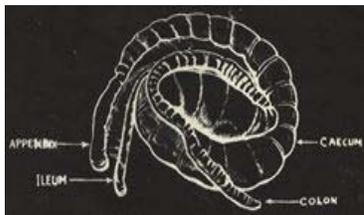


T. S. of Human Appendix

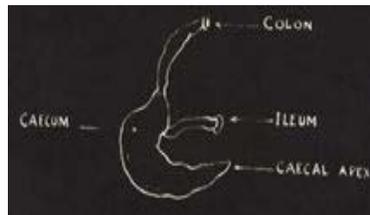


Crypt of Lieberkuhn with Argentaffine cell

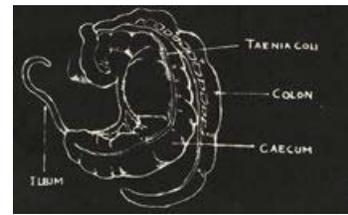
I) Herbivorous: -



Caecum & Vermiform appendix of Rabbit



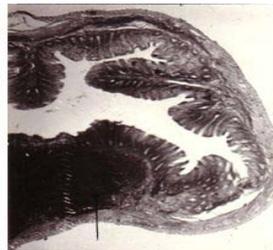
Caecum of Albino Rat



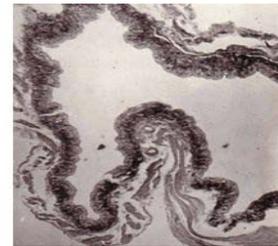
Caecum of Guineapig



Appendix of Rabbit (M.E.) showing lymphoid tissue mass

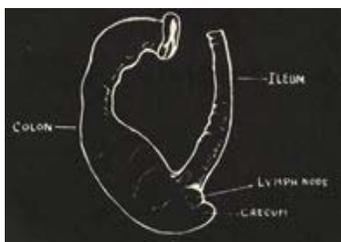


Caecum of Albino Rat (M.E.) showing lymphoid tissue mass

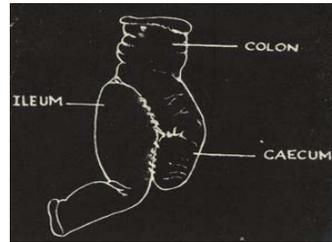


Caecum of Guineapig (M.E.) with no lymphoid tissue mass

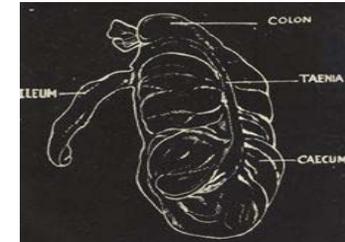
II) Carnivorous: -



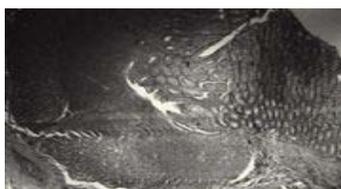
Caecum of Cat



Caecum of Dog



Caecum of Pig



Caecum of Cat (M.E.) showing lymphoid tissue in its apical part



Caecum of Dog (M.E.) showing lymphoid tissue in its apical part



Caecum of Pig (M.E.) showing lymphoid follicle in its apical part

III) Omnivorous

However, the apical part of caecum among the carnivorous animals like cat and dog showed a clear histological picture of appendix as seen in rabbit or human being with heavy infiltration of lymphoid tissue in the mucous & sub-mucous coats. No signs of degeneration in the appendix of rabbit and the apical part of caecum of cat or dog were observed. The muscle coat as a whole was distributed uniformly in the appendix of rabbit / the apical part of caecum of dog & cat, but not forming thickened bands as taenia coli¹⁵

Summary and conclusion

The detailed morphological and histological study in the appendix and the caecum of different mammals with varying dietary habits revealed a distinctly well-defined vermiform appendix in rabbit only. The caecum was found greatly dilated among herbivorous and omnivorous animals, where as it was greatly reduced in size among the carnivorous animals. A large amount of lymphoid tissues were seen microscopically in the apical part of caecum of cat and dog with mixed to carnivorous diet, simulating as the structure of human vermiform appendix. With respect to the characteristic histological features, rich vascular supply and selectively present in herbivorous animal like rabbit only, the vermiform appendix is in no way a vestigial organ but a specialized structure without any definitely known function. However, the appendix appears to be strategically placed and structurally composed of tissues vital in establishing and maintaining the body defenses or immunity of the body.

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