

Developmental Histogenesis of Human Foetal Vermiform Appendix at Different Gestational Ages

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Abstract

Introduction: Vermiform appendix is a slender projection from caecum, which is not a vestigial organ but is a specialized structure having immunological function.

Aim: The main aim of this study is to assess detailed microscopic features of human fetal vermiform appendix at different gestational ages.

Materials and Methods: For this present study 25 vermiform appendix specimens were collected from the human aborted fetuses of 17-40 weeks gestational ages and both sexes (12 males and 13 females) were studied and appendix were processed for routine histological tissue processing and sectioning and the slides were stained with haematoxylin and eosin.

Results: The wall of the vermiform appendix presented well differentiated 4 layers mucosa, sub mucosa, muscular coat and serosa from 17th week. At 17th week wider lumen and thick wall were observed.

Conclusion: Further studies are necessary to elucidate the time of appearance of different types of cells in fetal appendix and their immunological functions.

Keywords: Muscularis mucosae; Gestational age; Lymphocyte aggregation; Human foetus; Large intestine

different gestational ages was conducted as no literature was available on these aspects in Indian population.

Introduction

Vermiform appendix is an abdominal organ performing the immunological function. Histological characteristics of this organ show its specialized immunological function [1]. Its opening is guarded by a semicircular fold of mucous membrane known as the valve of Gerlach [2].

Appendix is usually located in the lower right quadrant of the abdomen; the base of the appendix is located 2 cm beneath the ileocecal valve that separates the large intestine from the small intestine. Immune tissue surrounding the appendix and elsewhere in the gut called Gut Associated Lymphoid Tissue (GALT) carries out a number of important functions. The wider base of the appendix from where the 3 taeniae of colon begin, has much lymphoid tissue and communicates with the lumen of caecum [3-5]. The appendix contains lymphoid nodules which first appear in the appendix about 2 weeks after birth [6]. The lymphoid tissue is organized in the form of the follicle and has been considered as the part of Mucosa Associated Lymphatic Tissue (MALT).

With the recent understanding of immunological importance of appendix removal of appendix as a precautionary method to prevent future possibility of appendicitis is stopped during other surgical procedures in the abdomen [7]. The present study Histological features of the vermiform appendix in human fetuses of both sexes and

Materials and Methods

Study design

Total 25 formalin preserved aborted fetuses of 17 weeks to full term obtained from Malla Reddy Narayana Multispecialty Hospital and Malla Reddy Medical College for Women, Department of Anatomy (12 (5 male and 7 female)) Hyderabad and Government Maternity Hospital, Tirupati (13 (6 male and 7 female)) with relevant obstetric records available in the Department of Anatomy, SVMC, Tirupati were utilized for the present study. The collected samples were categorized into 3 gestational age groups, a) <20 weeks, b) 21-30 weeks and c) >31 weeks.

The caecum and vermiform appendix was preserved in 10% formal saline. From each group fresh appendix was selected for histological study. A longitudinal incision was made by a sharp knife along the whole diameter of the appendix. Then 3 pieces of tissues taken from base, middle piece and near the tip of the appendix were processed for routine histological tissue processing and sectioning and the slides were stained with haematoxylin and eosin.

The sections of appendix were observed under photomicrography microscope model DB2-180M for the appearance of various layers, epithelial cell shape and presence of goblet cells, intestinal glands and

lymphoid tissue distribution. The representative fields were photographed by using microscope with photo unit attachment.

Results

Microscopic structure of appendix was similar to that of caecum. At 17th week lumen and wall were well defined. Wall of the appendix was very thick and the lumen was small (Figure 1). Crypts in mucosa were present (Figure 2). Intestinal glands and diffuse lymphocytes were present in lamina propria. In the lymphatic tissue many follicles and vesicles were observed. Lining epithelium was columnar with striated border and the goblet cell population was less. Diffuse Lymphocytic infiltration was present (Figure 3). Muscular coat and serosa were well defined.

At 20th week straight glands with increased lymphocytic infiltration and merging of villi were observed (Figure 4). Mucosal surface is smooth. Long tubular glands and abundant lymphatic tissue in lamina propria were observed (Figure 5). Lymphoid follicles were observed in mucosa and submucosa (Figure 6). At 29th week dense aggregation of lymphocytes were observed in lamina propria (Figure 7). At 34th and 39th weeks clear muscularis mucosae could be identified (Figures 8 and 9). The structure of appendix is close to that observed in adults.

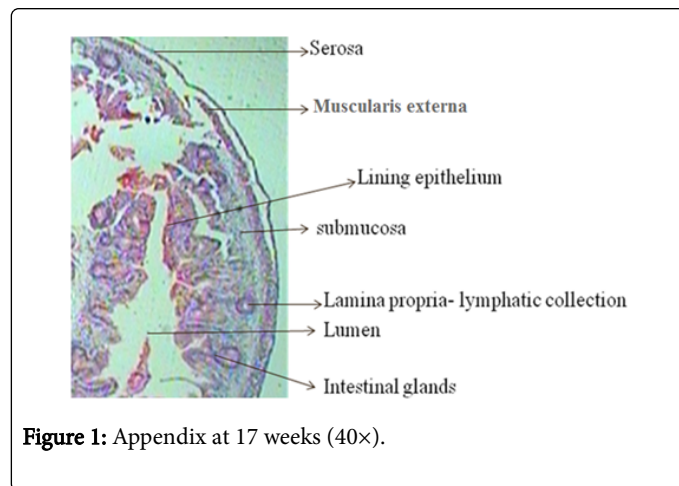


Figure 1: Appendix at 17 weeks (40×).

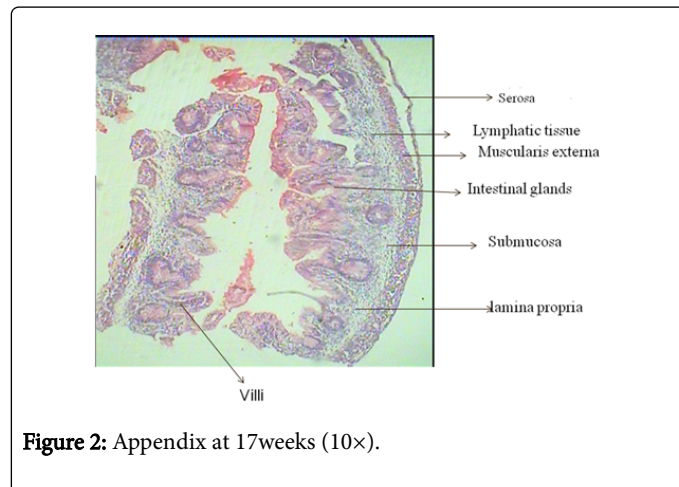


Figure 2: Appendix at 17weeks (10×).

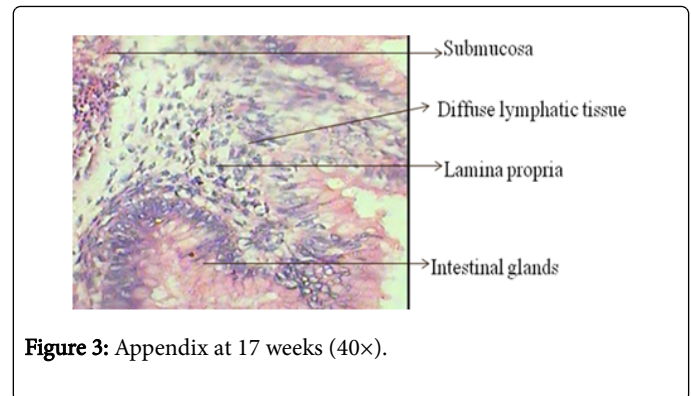


Figure 3: Appendix at 17 weeks (40×).

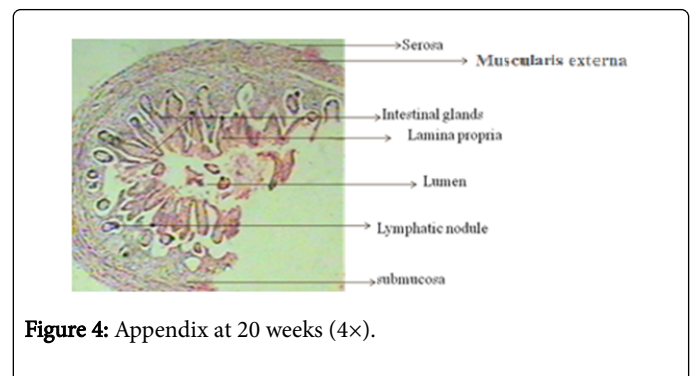


Figure 4: Appendix at 20 weeks (4×).

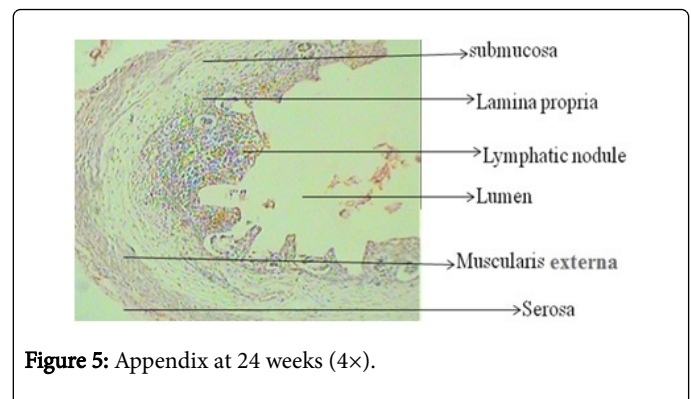


Figure 5: Appendix at 24 weeks (4×).

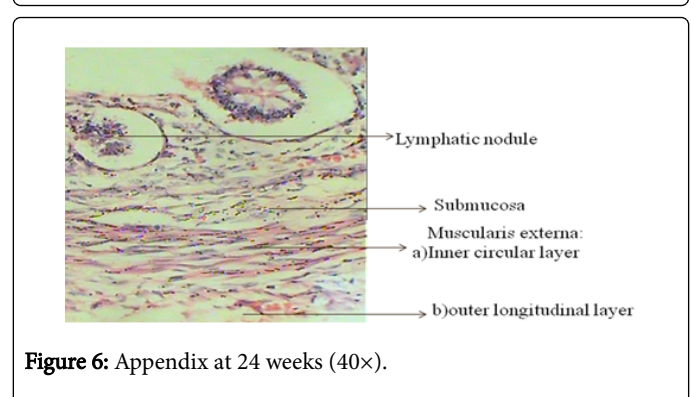


Figure 6: Appendix at 24 weeks (40×).

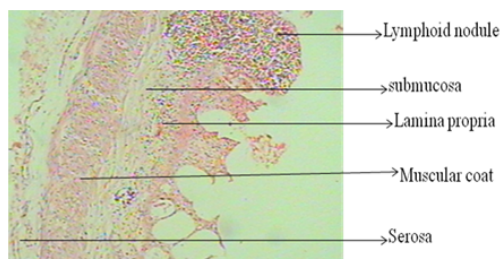


Figure 7: Appendix at 29 weeks (10×).

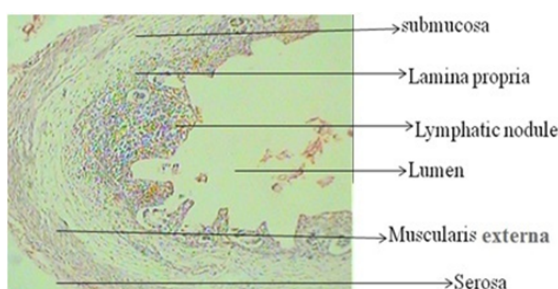


Figure 8: Appendix at 34 weeks (10×).

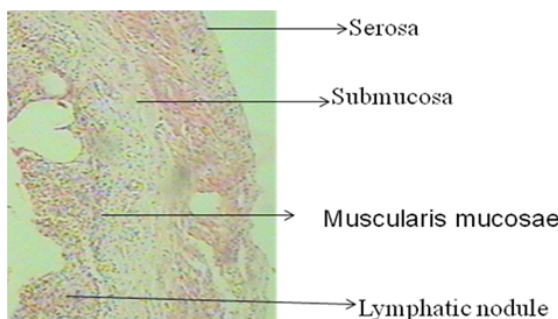


Figure 9: Appendix at 39 weeks (10×).

were observed in lamina propria and scattered muscularis mucosae was also observed (Figures 7 and 8). At 39th week clear muscularis mucosae could be identified (Figure 9). According to Wenmei, et al., [8] the amount of lymphocytes increase with gestational time. Bockman, et al. [9] described as goblet cell population diminished and epithelial cells displaying a morphologically distinct form of differentiation were observed. They were characterized by the presence of irregular microvilli or microfolds and numerous apical micropinocytotic vesicles. Haar, et al. [10] reported as at 7.5th week the epithelium was composed of stratified columnar cells; scattered mesenchymal cells appeared in the lamina propria. By 13.5th week of gestation the epithelium was composed of simple columnar cells with a microvillous surface, goblet cells containing numerous mucinogen granules and argentaffin cells with elongated electron-dense granules. Also at 13.5th weeks of gestation some free lymphocytes were observed within the lamina propria as well as an occasional migrating lymphocyte within the epithelium between the columnar cells. At 18th week of gestation the simple columnar epithelial cells were tightly packed, the goblet cells were secretory and lymphocytes again appeared singly within the epithelium and lamina propria.

Present study lymphoid aggregation was observed at 17th week of gestational age. According to that Rahman, et al. [11] Zhumin, et al. [12] and Wenmei, et al. [8] reported lymphatic tissue before 15th week.

In our present study lymphoid follicles were observed at 24th week. According to Rahman, et al., [11] and Zhumin, et al. [12] 100% appearance of lymphoid follicles were observed after the 28th week of gestational age. Bhide, et al. [13] reported lymphoid follicles appear in the vermiform appendix at 15.5th week of gestation. According to Khylostova, et al. [14] first lymphoid follicles in the appendix occur in a 17-week-old embryo.

In this present study, scattered muscularis mucosae observed at 29th week and clear continuous muscularis mucosae at 39th week of gestation were observed. According to Wenmei, et al., [8] scattered muscularis mucosae was appeared at 18.5th week.

Many follicles and vesicles filling the intercellular space of lymphatic cells were noticed at 17th weeks, whereas Yuezhao, et al. [15] reported at the age of 20-28th week of gestational age. Observations in our study are in agreement with that of Malas, et al. [16] stated that the vermiform appendix matures in the second trimester during the fetal period. Jones, et al. [17] described about the lymphoid development of the fetal and neonatal appendix. Khylostova, et al. [18] reported lymphoid follicles in the organ appear on the 17th week.

Discussion

In this present study primary lymphoid nodules and diffuse lymphoid tissue were observed from 16-20 weeks. At gestational week 21 to 28, the number of primary nodules gradually increased with fetal age, reaching the peak at week 28. Wall of the appendix was very thick and the lumen was small (Figure 1). Crypts in mucosa were present (Figure 2). Intestinal glands and diffuse lymphocyte were present. Lining epithelium is columnar with striated border and the goblet cell population was less. Diffuse Lymphocytic infiltrations were present (Figures 2 and 3). Muscular coat and serosa were well defined. At 20th week straight glands with increased lymphocytic infiltration were observed (Figure 4). Mucosal surface was smooth. Long tubular glands and abundant lymphatic tissue in lamina propria were observed (Figure 5). Lymphoid follicles were observed in mucosa and submucosa (Figures 6). At 29th week dense aggregation of lymphocytes

Conclusion

A review of literature did not show any articles on fetal histogenesis of appendix at different gestational ages. Histological structure of appendix at 17 weeks gestational age presented well differentiated mucosa, sub-mucosa, muscular coat and serosa. In the present study there is delay in the time of appearance and differentiation of muscularis mucosae when compared to the literature. Mucosa of first group fetal appendix showed diffused lymphatic infiltration and this changed to lymphatic aggregation appears in second group later it converted into lymphatic nodular formation in the third group of fetal vermiform appendix along with this changes also observed merging of the villi which is a definite character of the large intestine. At the end all the layers are clearly marked and differentiated and look similar to that of microscopic picture of adult vermiform appendix.

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