



HISTOMORPHOMETRIC COMPARISON OF CHARACTERISTICS OF HEALTHY AND INFLAMED HUMAN VERMIFORM APPENDIX WITH A SPECIAL EMPHASIS ON THE LYMPHOID TISSUE.

DR. KEERTI BHARDWAJ ¹, DR. NAND LAL ², DR. PUSHPA POTALIYA ³

¹Lecturer, Department of Anatomy, Jaipur Hospital College of Nursing, Jaipur. Email- keerticheena@gmail.com

²Associate Professor, Department of Anatomy, S.M.S Medical College, Jaipur. Email- drnandlaljp@gmail.com

³Senior Lecturer, All India Institute of Medical Sciences, Jodhpur. Email- ppotaliyaa@gmail.com

ABSTRACT

Appendix is the most highlighted vestigial organ both due to literature concerning it and also due to the frequency of surgical intervention needed. Appendicitis is one of the most common causes for the appendicectomy. It is also a fact that many appendices are excised even without any pathology. This may be due to the fact that appendicitis diagnosis is still to a large extent based on the surgeon's diagnosis. A retrospective study comparing the histomorphometric characteristics of normal and inflamed appendix was conducted to ascertain the changes in the appendix due to the inflammation process. A significant difference in wall thickness and lymphoid follicle size was noted between normal and inflamed appendix.

Key words: Appendix, Appendicitis, Histomorphometric, Appendicectomy

INTRODUCTION

Many biological structures can be considered vestiges given our current evolutionary knowledge of comparative anatomy and phylogenetics. In evolutionary discussions the human vermiform appendix is one of the most commonly cited vestigial structures, and one of the most disputed. The vermiform appendix is a narrow, worm shaped tube, arising from the posteromedial caecal wall, 2 cm or less below the end of the ileum.^{16,17} It is located in the right lower quadrant of the abdomen.^{11,16} Its opening is guarded by a semicircular fold of mucus membrane known as the valve of Gerlach.¹³

Its length varies from 2-20 cm with an average length of 9 cm.² The appendix contains lymphoid nodules which first appear in the appendix about 2 weeks after birth.⁵ The lymphoid tissue is organized in the form of the follicle and has been considered as the part of malt.¹⁴

Appendicitis is the most common acute abdominal condition the surgeon is called on to operate, and acute appendicitis remains the most common indication for emergency operation.⁹ Approximately 7 percent of population suffers from appendicitis in their lifetime, with a peak incidence occurring between 10 to 30 years. This condition does not arise denovo except as a

consequence of interplay of various factors like its wall, length, diameter and position in abdomen or pelvis or its blood supply.^{3, 10} That is the luminal, intraluminal, or extraluminal structures of this organ, far more than anything else is responsible for causation of clinical states.¹⁵ For this reason a definitive understanding of the exact anatomy of appendix with and without pathology is the need of the hour. In this study, a histological, morphological and histomorphometric comparison between normal and inflamed appendix was done to ascertain the differences between the two.

MATERIALS AND METHODS

The present study was carried out in the Department of Pathology, Dr. S N Medical College, Jodhpur. The tissues were obtained from the archives of the department of pathology as well as the fresh tissues obtained during regular pathological procedures. A total of sixty subjects were selected and were separated into 2 groups:

- Group I – Appendix was removed surgically during operation but diagnosed as a negative appendicectomy or appendix removed with adjoining part of intestine for other surgery i.e. normal otherwise. These samples were considered under normal appendix
- Group II – Appendix was removed during the operation with a preoperative diagnosis of acute appendicitis and diagnosed as acute diffuse suppurative appendicitis on histopathology.

Gross measurements of the tissues were recorded before subjecting the tissue for processing. Each specimen was divided into two by cutting a cross section 2cm from the tip of the appendix. Then this distal fragment was divided in two by a longitudinal cut. Proximal fragment was dissected cross-sectionally at base region and at the middle region of the specimen. The sections thus obtained were - one longitudinal section from distal part or close to tip, one cross section from middle one third, one cross-section from base or proximal one third close to surgical margin. The tissues were subjected to routine tissue processing by manual method which included fixation in formaldehyde followed by processing in graded alcohol and embedding. The blocks thus obtained were subjected to microtomy and serial sections of 5nm width were prepared for each segment. Most appropriate section was selected from each set of serial sections and used for measurements. These sections were measured, out of which again one section was then stained in Haematoxylin and Eosin. Each section representing a segment was then examined carefully under microscope for the general histomorphology and following histomorphometric parameters, outer circumference (serosal) of appendix, luminal (mucosal) diameter of appendix, circumference of largest lymphoid follicle at the maximum thickness were calculated and recorded. The measurements were done using micrometer scale attached in the microscopes of department of pathology. Images were observed in the microscopes and the width was calculated from the most convex portions in case of the lymphoid follicle, the widest part in case of the lumen and the thickest portion of the serosal wall of the specimen. For each section 3 readings were taken from 3 different sites and mean of three readings for each appendix was calculated as average measurement. These parameters were - mean luminal diameter, mean lymphoid follicular diameter and mean serosal – mucosal circumference (wall thickness). These calculations and their readings were subjected to statistical analysis and subsequent results were calculated.

OBSERVATIONS AND RESULTS

Out of 60 cases in the study 38 were males and number of females was 22. In group II out of 30 cases of inflamed appendix 18 were males and 12 were females and the Male: Female ratio was 1.5:1 showing a slight male predominance.

OBSERVATIONS (micrometers)						
	Base Measurements		Middle Measurements		Tip Measurements	
	Group I	Group II	Group I	Group II	Group I	Group II
Lymphoid Follicle Size	62.8* (±5.41)	79.16* (±20.23)	63.83* (±6.09)	74.16* (±12.5)	61.35* (±9.67)	77.33* (±10.19)
Luminal Diameter	250.33 (±71.35)	249.76 (±67.33)	246.06 (±75.5)	242.5 (±86.2)	185.1 (±79.26)	179.5 (±59)
Serosal Mucosal Wall Thickness	221.06* (±27.7)	258.83* (±30.76)	183.9* (±29)	244.16* (±14.1)	176.33* (±12.35)	210.33* (±14.4)

‘*’ = statistical significance was seen, $p < .05$

There was no significant difference between average size of lymphoid follicles in different areas when observed within an individual group, however on comparing the two groups, the size of follicles was found to be significantly greater in group II.

The serosal-mucosal thickness or wall thickness in both inflamed and normal groups were showing a significant increase in width of wall moving from tip to base. Group II wall thickness was seen to be significantly greater than group I in all three sections. Wall thickness variation was statistically significant in the all three regions.

The average luminal diameters were seen to be decreasing from base to the tip in both the groups and the lumen was seen to be slightly smaller in inflamed appendix than normal in all three areas. But these differences in diameter were not statistically significant.

DISCUSSION

The present study was aimed at evaluating the parameters of the morphology and histology as well as histomorphometry of healthy and diseased appendicular tissue in order to determine the difference between the healthy and diseased appendices. Thus reducing the possibility of error frequently encountered in diagnosis of acute appendicitis.

In gross measurements it was seen that the length of appendix in children was greater than that in adults as seen in Group I. These average measurements closely resemble the findings of Gupta G. et al, 2005⁷. Also measurements closely resemble those seen in the study by Gopalipour et al⁶, but contradicted in that they reported children appendices to be smaller than the adult males. This finding was also contradicted in studies by Gopalipour et al 2003⁶, Collins 1932¹⁴, Bakheit and Warille 1999¹.

The luminal diameter was seen as general trend to decrease from base to the tip irrespective of the state of the appendix i.e. inflamed or non-inflamed. On the other hand the luminal diameter of normal appendix was seen to be more than in the inflamed appendix. These findings are in accordance with the study conducted by Gupta G. et al 2012⁷ and Gopalipour et al⁶. while shugabu et al¹² did not find any uniform pattern.

Average lymphoid follicle diameter in the study was seen to be significantly greater in inflamed appendices than the normal appendices which are identical to the studies by Gupta G. et al⁷ and Mrozik et al⁸. There was no significant difference between diameters of lymphoid follicles of different areas within a group itself. Although the significant differences between inflamed and normal groups are in accordance with the inflammatory manifestation of the organ.

The average mucosa-serosa thickness (wall thickness) showed a trend of decreasing order from base to tip in GroupII while GroupI showed base wall to be thickest followed by tip and then middle which is similar to findings of Gopalipour et al⁶. Similar to the Group I in our study Group II also showed decrease in mucosa-serosa thickness from base to tip and as can be naturally assumed Group II showed greater wall thickness owing to the inflammation and the difference was found to be statistically significant. This finding in our study was contradicted by the findings of Gupta G. et al⁷. who showed an increase in wall thickness from inflamed to normal appendix.

The use of ocular micrometer in the study and the fact that this kind of study has not been done employing it might explain the cause for differences in the average measurements obtained. Although other factors like socioeconomic and demographic differences in the study subjects may play a role.

CONCLUSION

The results thus obtained were in accordance with the general set parameters for inflammation in a tissue. We may safely assume that the general set parameters for inflammation dictate the prognosis and result of the treatment modalities. These findings may help the surgeon in understanding physiology of the organ during the disease process and help in better treatment planning and hence improved prognostic outcomes and minimize the error quotient arising due to faulty diagnosis.

REFERENCES

1. Bakheit, M.A. and Warille, A.A. Anomalies of the vermiform appendix and prevalence of acute appendicitis in Khartoum. *East African Medical Journal*, 1999, vol.16, p. 338-40.
2. Buschard, K. and Kjaeldgaard, A. Investigation and analysis of the Positron Length and Embryology of the vermiform Appendix. *Acta Chirurgica Scandinavica*, 1973, vol. 139, p. 293-8.
3. Charles, M.A., H.H., Alden, 2002. Surgical Secrets. 2nd Edn: 47 159-162.
4. Collins, D.C. The length and position of the vermiform appendix. *American Journal of Surgery*, 1932, vol. 96, p. 1044-8.

5. Fawcett, DW. and Bloom, W. *A text book of histology*. 12th ed. New York: Chapman Hall, 1994. 636 p.
6. Golalipour, M.J., Arya, B., Azarhoosh, R. and Jahanshatu, M. Anatomical variations of vermiform appendix in south-east Caspian Sea. *Journal of the Anatomical Society of India*, 2003, vol. 52, p. 141-3.
7. Gupta, G., Srivastava, S.K., Mathur, S.K., Gupta, V. Histomorphometric characteristics of human vermiform appendix with special reference to lymphoid tissue. *J. Morphol. Sci.*, 2012, vol. 29, no. 3, p. 135-139.
8. Mrozik, E.R., Hecker, W.C., Wiebecise, B., Hansamann, A. and Trammor, A. New morphological finding in so-called negative appendectomies. *European Journal of Pediatric Surgery*, 1993, vol. 3, p. 79-82.
9. Richard A. Williams and Paul Myers – Monograph- Pathology of the appendix, first ed, Chapman and Hall Inc. 1994.
10. Sabiston, D.C., 1981. Textbook of surgery. 1st Edn. Saunder's. 1:1048-1064.
11. Sabiston, DC. and Townsend, CM. *Sabiston's textbook of Surgery, the biological basis of modern surgical practice*. 16th ed. Philadelphia: W.B. Saunders Company, 2001. vol. 2, 918 p. Appendix.
12. Shugabu, A.I., Umar, M.B.T. and Singh, S.P. Histomorphometric profile of the human vermiteram appendix. *Journal of Medical Sciences*, 2000, vol. 6, p. 445-51.
13. Singh, IB. *Chaurassia's human anatomy: Regional and applied*. 3rd ed. New Delhi: CBS publishers and distributor, 1999. vol. 2, 2235 p.
14. Standring, S. Vermiform appendix. In Standring, S., Ellis, H., Healy, J., Johnson, D., William, A. and Collins, P. *Gray's Anatomy*. 37th ed. Churchill Livingstone: Elsevier, 1989. p. 1366-7.
15. Williams, G.R., 1983. A history of appendicitis. *Ann Surg.*, 197: 495-506.
16. Williams, PL., Bannister, LH., Berry, MM., Collins, P., Dyson, M., Dussek, JE. and Ferguson, MWJ. Alimentary System. In Williams, PL., Bannister, LH., Berry, MM., Collins, P., Dyson, M., Dussek, JE. and Ferguson, MWJ. *Gray's Anatomy*. 38th ed. New York: Churchill Livingstone, 1995. p. 1775-6.
17. Zinner, MJ., Schawrtz, SI. and Ellis, H. Appendix and Appendicectomy. In Zinner, MJ. and Ashley, SW. *Maingot's abdominal operations*. 10th ed. Philadelphia: Appleton & Lange, 1997. p. 1190-3.