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Anatomical variations and microstructural changes in vermiform appendix – a study based on patients of clinically diagnosed acute appendicitis, undergoing appendicectomy, at tertiary care hospital in West Bengal

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Abstract: *Background:* One of the most intriguing questions about human vestiges revolves around the utility of vermiform appendix. Studies have been conducted worldwide since ages immemorial. Reiterating the validation of such works has been the focus of this study. *Objectives:* The present study aims at determining the variations of vermiform appendix in terms of its gross location (position), length and microscopic inflammatory changes (acute or chronic) with age and gender related changes, if any. *Methods and Material:* 100 patients (33 males and 67 females) undergoing appendicectomy for clinically diagnosed acute appendicitis (following proper inclusion and exclusion criteria) were selected and grouped according to their age. Per-operative assessment of the length and gross position of vermiform appendix was done for individual subject. The cut specimen from each patient was then studied under the microscope for inflammatory changes (acute or chronic). The data were analysed statistically. *Results:* Mean length of appendix in males and females were 5.10 cm and 4.99 cm respectively. Males between 31 - 40 years of age showed maximum mean length of appendix as compared to females between 11 - 20 years (5.28 cm and 5.32 cm respectively). Retrocaecal position was found to be the most common location of appendix, irrespective of age or gender. However, the mean length of appendix was maximum among pre-ileal variety (5.43 cm). Acute inflammatory changes were more common in females than males and as well as overall findings of removed appendices. *Conclusions:* Retrocaecal acute appendicitis are more common in females and progressive diminution in its size has been recorded as compared to past studies.

Keywords: Acute appendicitis, Retrocaecal appendix, Catarrhal appendix, Appendicectomy.

Introduction

Vestigial organs are body structures considered to have lost most or all their function and some or most of their structure [1]. Human vermiform appendix is one of the most cited vestigial structures and a disputed one as well. The appendix was probably first noted as early as the Egyptian civilization (3000 BC).The vermiform appendix is a narrow worm like tubular diverticulum which arises from the posteromedial caecal wall, approximately 2cm below the end of ileum. The opening of appendix that is guarded by a semicircular mucous fold known as 'valve of Gerlach. The appendix is felt commonly at the Mc Burney's point [2-3]. Leonardo da Vinci first depicted the appendix in anatomic drawing in 1492 [4-6].

Appendix is the only organ in our body which has no constant anatomical position. Various positions of vermiform appendix are useful to understand the location of site of occurrence of pain during appendicitis. From various positions of vermiform appendix, we can understand the possible site of the pain if the organ becomes inflamed [7].A thorough knowledge of normal anatomy and variations of the caecum and appendix is very important

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to the surgeon performing abdominal operations in adults, children and infants [8]. Though considered by most to be a vestigial organ, its importance in surgery is mainly due to its propensity for inflammation that results in the clinical syndrome known as acute appendicitis, and is the most common cause of ''acute abdomen'' in young individuals [9].

Prompt diagnosis of appendicitis ensures timely treatment and prevents complications [10]. Considering the importance of appendicitis as the commonest diagnosis of acute abdomen and various presentation due to variation in position of appendix, the present study was undertaken to assess various anatomical features of appendix perioperatively in clinically diagnosed acute appendicitis patients undergoing appendicectomy followed by study of histological features of the obtained specimens.

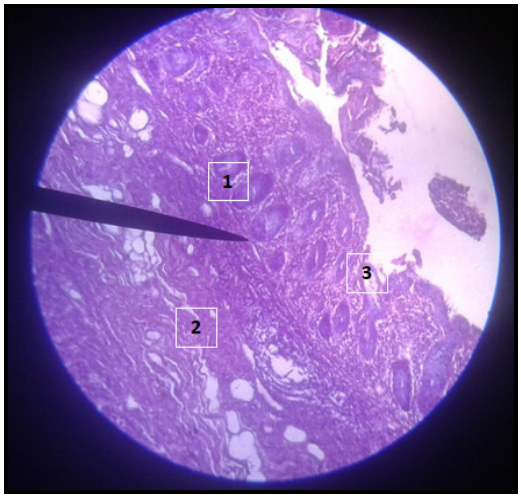
Material and Methods

After maintaining proper sterilization technique, the patient was anaesthetized and after giving grid iron incision peritoneal cavity was opened. The position of appendix in relation to caecum was observed before the organ was displaced by manipulation from right iliac fossa. The direction of tip of appendix was also noted. First, the length of appendix measured by sterile silk in situ and then the length of that silk was measured by measuring scale in centimeter. The specimen was stored in 10% Neutral buffered formalin solution. In the department of Anatomy paraffin block was prepared.

After microtomy, hematoxylin and eosin staining was done and examined under light microscope. The following features were noted/ recorded, to identify the type of inflammatory changes in the dissected appendix. The histological features of *chronic inflammatory changes in appendix* included lymphocytosis in muscular layer along with eosinophilia in mucosa and fibrosis of muscles as shown in figure 1.

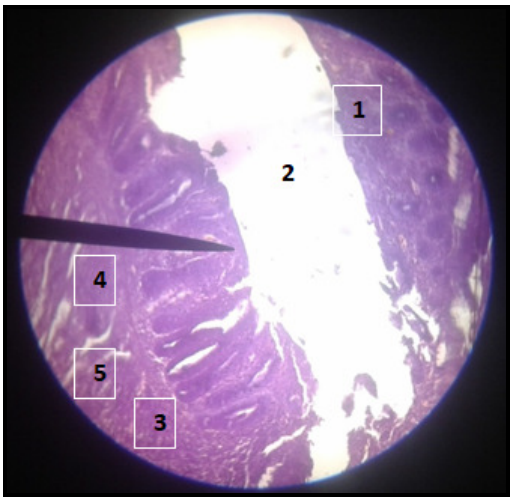
Whereas, specimen of *acute inflammatory changes* showed neutrophilia at crypts with loss of mucosa and associated thrombosed vessels along with lymphoid hyperplasia in serosal vessels as shown in figure 2.

Fig-1: Histological picture of chronic inflammation in appendix by Haematoxylin and Eosin stain under low power microscope



1= lymphoid follicle; 2 = fibrous replacement; 3 = lining epithelium; pointer = lymphocyte

Fig-2: Histological picture of acute inflammation of appendix by Haematoxylin and Eosin stain under low power microscope



1 = lymphatic nodule; 2 = lumen; 3 = lymphocyte 4= neutrophil; 5 = inflammatory cell infiltrate; pointer = lining epithelium

Results

Out of 100 specimens being examined in this study the gender distribution was 33% males and 67% females. The mean length of appendix was more in males as compared to females being 5.1 centimeters and 4.99 centimeters respectively. The age distribution of cases (appendicectomy) is being shown in Figure 3.

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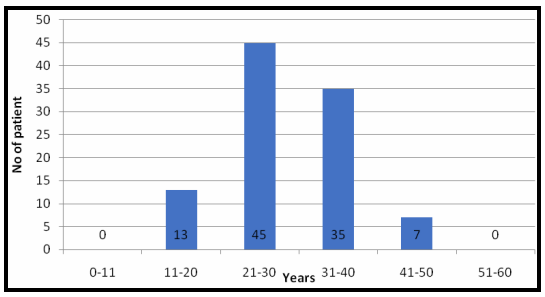
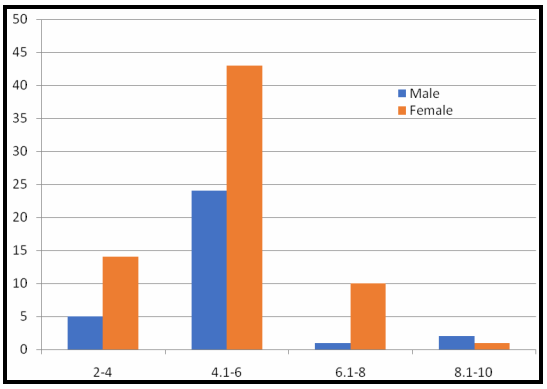
Fig-3: Number of appendicectomy patients according to age group.



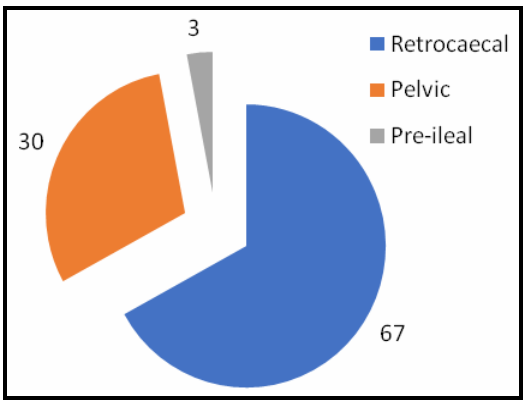
Mean length of appendix was found to vary between 4.1 centimeters to 6 centimeters in most of the males (72.2%) as well as females (64.2%) as shown in Figure 4.

Fig-4: Sexual dimorphism, according to various ranges of lengths of specimens



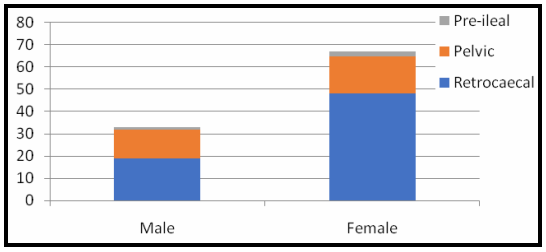
In male patients, maximum mean length of appendix was 5.28 cm in the age group of 31 - 40 yrs and in female patients, maximum mean length was 5.32 cm in the age group of 11 - 20 yrs. Figure 5 indicates the pre-operative position of appendix in present study.

Fig-5: Preoperative position of appendix (n = 100)



Retrocaecal position was most commonly found in both the genders as shown in figure 6.

Fig-6: Position of appendix among the two sexes



Among the various age groups, retrocaecal variety was most prevalent except in 41-60 years group, which showed the Pelvic variant to be more common. To our surprise, no promontory, ectopic or subhepatic position of appendix was noted.

Most (77%) specimen showed acute inflammatory changes and that too being more prevalent among females in most age groups except 41-60 years group, which showed more prevalence among the males. The chronic inflammatory changes also showed similar trend among both genders across various age groups. Demographic data analysis showed the prevalence of appendicitis was more among the non-vegetarians with a positive family history of the disease, as evident from Table 1 and Table 2.

Table-1: Comparison between acute and chronic inflammatory changes with respect to dietary habits

Microanatomical Changes	Vegetarian	Non-Vegetarian
Acute Inflammation	18.18%	81.82%
Chronic Inflammation	21.74%	78.23%

Table-2: Comparison between acute and chronic inflammatory changes with respect to family history of appendicitis

Microanatomical Changes	Positive Family History	Negative Family History
Acute Inflammation	74.3%	25.7%
Chronic Inflammation	68.51%	31.59%

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Discussion

The most common position of appendix was retrocecal followed by pelvic, which is consistent with previous studies as well [7-8, 11-12]. The mean length of appendix was found to be more in males than females in present study which is consistent with previous works [7,9,12-14].

In present study mean length of appendix is highest in pre-ileal position followed by pelvic position. Maximum length of appendix was found in pelvic position in studies done by Philip Mwachaka et al [15], Geethanjali HT [9], Rahaman et al [13] and Golalipur et al [14]. The prevalence of appendicitis (irrespective of the nature – acute/chronic) is maximum in the 2nd decade, which is consistent with the study findings of Ehab I El-Amin et al [16] & Sinha et al [17].

Microanatomical findings shows overall occurrence of chronic appendicitis (23%) is less than acute appendicitis (77%), corroborating with the study done by George sgourakis [18]. Acute appendicitis is more common in females (70.14%) than males (29.86%). Lohar HP et al [19] found acute appendicitis is more common in females (50.7%) than males (49.2%). But in other studies, like – Barlas Sulu [20], Erqul E [21], Noudesh et al [22], Al-omran et al [23] acute appendicitis is commoner in male. Acute appendicitis is more common in female than in male in the age group of 11-20 years, which is corroborating with previous study [19, 22]. Present study shows acute appendicitis decreased in older age which is also corroborates with previous authors [20-21, 23].

As with colonic diverticulitis the incidence of appendicitis is lowest in societies with a high dietary fibre intake. In developing countries that are adopting a more refined western type diet, the incidence continues to rise. Naaeder SB [24] hypothesized that a cellulose depleted diet might causes acute appendicitis which was later substantiated by Siraj F et al [25].

Conclusion

The de novo study substantiates the findings of majority of similar studies regarding the incidence of acute appendicitis being more common in second decade of life with the retro-caecal type being most common. It also reflects that both acute and chronic inflammatory changes in clinically diagnosed acute appendicitis patients are significantly more in non-vegetarian subjects with a definite positive family history. Scopes remain wide open for imaging-based studies regarding the morphometry of appendix and avenues to detect the probability of screening patients for appendicitis on that basis.

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