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ORIGINAL RESEARCH

Morphological variation in the anatomy of Vermiform appendix: A cadaveric study

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ABSTRACT

Introduction: Acute appendicitis is the most common cause of acute abdomen. Knowledge of the variations in the position of the vermiform appendix is important because, in appendicitis, its variable positions may produce variable symptoms and signs which mimic other diseases The length of the vermiform appendix is important in influencing the differential diagnosis of acute abdomen Owing to this issue, present study was planned to determine the anatomical locations of the appendix, its length and span, and status of mesoappendix (complete or incomplete), on the cadavers obtained during routine dissection in the department of Anatomy, PIMS, Jalandhar. **Material & Methods:** The present study was done on 30 human cadavers obtained during routine dissection in the department of Anatomy, Punjab institute of medical sciences, Jalandhar. Subjects with any gross abnormalities of abdominal organs, fibrosis, kinking or adhesions was excluded from study. **Result:** The percentage of position of vermiform appendix was 45% pelvic, 40% subcaecal, 10% pre ileal and 5% post ileal. Retrocaecal, paracaecal and subileal varieties were not found. Mean length of appendix was found to be 5.7cm in males and 4.9cm in females in our study. Incidence of mesoappendix extending upto tip was 90% in our study and in 10% cases mesoappendix was not reaching tip of appendix. **Conclusion:** Appendicitis should always be considered as a differential diagnosis in acute abdomen even when pain and tenderness do not originate from right iliac fossa. Location of appendix is important when it comes to clinical presentation of patients with appendicitis.

Keywords: vermiform appendix, mesoappendix, variations, positions, Length

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INTRODUCTION

Vermiform appendix is a part of the digestive tract which lies in right lower quadrant of abdomen. The caecum and its diverticulum, vermiform appendix appear in the 6th week of intrauterine life as an elevation on the antimesenteric border of the caudal limb of the midgut loop. The caecal apex does not grow as rapidly as the remaining portion hence the vermiform appendix initially appears to be a small diverticulum of the caecum. The appendix increases in length so that at birth it is a relatively long tube arising from the distal end of the caecum [1]. After birth due to differential growth of the caecal wall the appendix now comes to lie on the medial aspect.

Developmentally the appendix varies considerably in position. The vermiform appendix is the most variable organ in terms of position, extent, peritoneal and organ relations [2].

Though a remarkably constant structure in man, the appendix is nevertheless occasionally subject to the extremes of variation, that is, total suppression and duplicity. Its length varies from 2 to 20 cm, in average 9 cm. The base of appendix is connected to the caecum, but its head can be placed in different situations. The diversity of situations is categorized into six locations: retrocaecal, pelvic, subcaecal, preileal, postileal ,paracaecal and others [3].

A short triangular mesoappendix extends along the whole length almost up to the appendicular tip. The mesoappendix has a free border which carries the blood supply to the organ by the appendicular artery a branch from the ileocolic artery [4].

Ethnic and geographical variations have been reported regarding the position of the appendix [5].

Acute appendicitis is the most common cause of acute abdomen among young patients. However it may also be seen in any age group [6]. Knowledge of the variations in the position of the vermiform appendix is important because, in appendicitis, its variable

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positions may produce variable symptoms and signs which mimic other diseases [7].

The length of the vermiform appendix is important in influencing the differential diagnosis of acute abdomen [8].

Acute appendicitis is mainly diagnosed by medical examination and clinical evaluation. There is no definitive diagnostic laboratory test or imaging [9].

Knowing common position(s) of the appendix helps on-time diagnosis of acute appendicitis. Variable positions of the appendix may mislead physicians to make a wrong decision or diagnosis of other diseases. Delayed diagnosis of acute appendicitis may lead to its perforation and subsequent abscess or peritonitis. So, accurate information about the anatomical location of appendix can improve prognosis of the disease.

Owing to this issue, present study was planned to determine the anatomical locations of the appendix, its length and span, and status of mesoappendix (complete or incomplete), on the cadavers obtained during routine dissection in the department of Anatomy, PIMS, Jalandhar.

MATERIAL AND METHODS

The present study was done on 30 human cadavers obtained during routine dissection in the department of Anatomy, Punjab institute of medical sciences, Jalandhar.Subjects with any gross abnormalities of abdominal organs, fibrosis, kinking or adhesions was excluded from study.

Procedure of Study

- Following resection of anterior abdominal wall, the position of the base of appendix was determined using the schema adapted from O' Connor and Reed [10].
- Length of the appendix was measured from its base using a string and a ruler.
- Extent of mesoappendix was observed.

Statistical Analysis

The measurements were recorded in the Microsoft Excel Sheet. The data was analysed statistically in SPSS software version 20.

RESULTS

Table 1 and Fig. 2 show incidence of position of vermiform appendix. The percentage of position of vermiform appendix was 45% pelvic, 40% subcaecal, 10% pre ileal and 5% post ileal. Retrocaecal, paracaecal and subileal varieties were not found.

Table 1

Incidence of position of vermiform appendix (n=30)		
Position	**Number (n)**	**Percentage (%)**
Pelvic	13	45
Subcaecal	12	40
Pre-ileal	4	10
Post-ileal	1	5
Paracaecal	0	0
Retrocaecal	0	0
Subileal	0	0

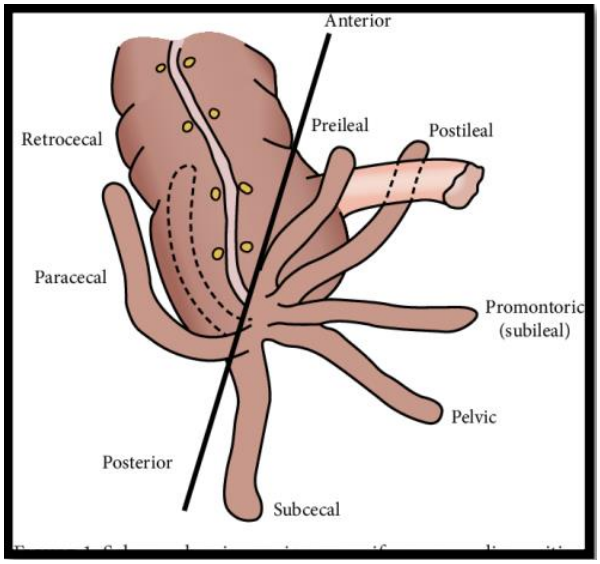

Fig1: Scheme showing various vermiform appendix positions (Adapted from O'Connor and Reed) (10)

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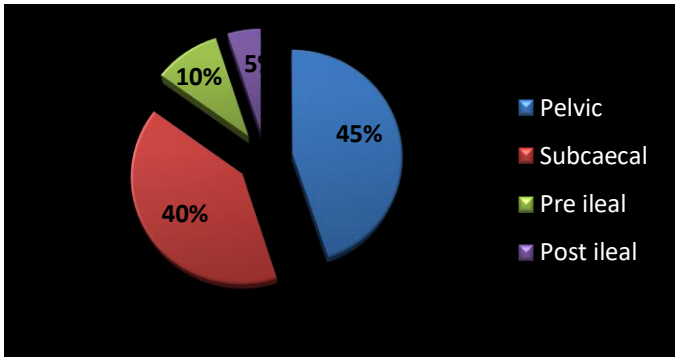

Fig 2

Table 2 show percentage of position of vermiform appendix in males and females. The percentage of position of vermiform appendix was 30% pelvic, 33% subcaecal, 13% pre ileal and 3% post ileal in males. Retrocaecal, paracaecal and subileal varieties were not found.
In females percentage of position of vermiform appendix was 13% pelvic, 6% subcaecal. pre ileal, post ileal, retrocaecal, paracaecal and subileal varieties were not found.

Table 2

Position of appendix males VS females				
Position	**No. of Males (24)**	**Percentage (%)**	**No. of Females (6)**	**Percentage (%)**
Pelvic	9	30	4	13
Subcaecal	10	33	2	6
Pre-ileal	4	13	0	0
Post-ileal	1	3	0	0
Paracaecal	0	0	0	0
Retrocaecal	0	0	0	0
Subileal	0	0	0	0

Table 3

Average length of appendix (cm)	**Males**	**Females**
	5.7 cm	4.9cm

Table 4

	Mesoappendix extending up to tip	**Mesoappendix failing to reach tip**
Males (24)	23 (95%)	1 (5%)
Females (6)	4 (67%)	2 (33%)

Fig. 3 and 4 shows pelvic and subcaecal variety of vermiform appendix found in the present study

Fig 3

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Fig 4

DISCUSSION

In the present study pelvic (45%) position of vermiform appendix was highest followed by subcaecal (40%), preileal (10%) and post ileal (5%). Retrocaecal, paracaecal and subileal varieties were not found.

According to current literature retrocaecal position of appendix is commonest. This has been endorsed in many other studies like Nupur et.al[11], Sudanese study[12], study done is Kosi region of Bihar[13], study from Dhaka[14] and study done on black Kenyan population[15]. Pelvic position of appendix was found to be commonest in study done in Bangladeshi[14] and also in Iranian population[16].

Subcaecal (40%) position of appendix was second commonest in our study after pelvic (45%), this was also seen in south Indian population from Karakonam, Kerala[17], where commonest position of appendix was subcaecal (49.5%) followed by pelvic (28.4%)

Sex variation in position of appendix was found in our study where pelvic position was common as compared to subcaecal in males. Commonest Pelvic position of appendix in females was also confirmed by study done in Lady Hardinge Medical College, Delhi by Nisha Nupur et al[11]. While pelvic position of appendix was found commonest in both males and females but (M>F).

Mean length of appendix was found to be 5.7cm in males and 4.9cm in females in our study, this corresponds with the literature. This finding is corroborated by other studies also like Bihar (M=5.4cm, F=4.02cm) [13], Iranian population (M=9.1cm, F=8.0cm)[16]. Except study done in Delhi where length in females was found slightly more than males (M=8.4cm, F=8.6cm)[11]. Knowledge of length of appendix is important because long appendices may simulate inflammation of other structures such as enteritis, salpingitis, scrotal pains and endometriosis. Therefore, appendicitis should always be considered as a differential diagnosis in acute abdomen even when pattern of pain or tenderness is not at the iliac fossa.

Incidence of mesoappendix extending upto tip was 90% in our study and in 10% cases mesoappendix was not reaching tip of appendix. Understanding of completeness of mesoappendix is important as incomplete mesoappendix may reduce blood supply to the tip of the appendix and make it prone to gangrene and perforation. It may imply poor outcome of acute appendicitis. Incidence of incomplete mesoappendix was shown in age group below 10yrs in study done in Iranian population by Ghorbani[16]; this could be one of the reasons of the severity of appendicitis in childhood.

CONCLUSION

The present study reconfirmed that variations were seen in the position and length of the vermiform appendix. Appendicitis should always be considered as a differential diagnosis in acute abdomen even when pain and tenderness do not originate from right iliac fossa. Location of appendix is important when it comes to clinical presentation of patients with appendicitis. The higher incidence of complete mesoappendix in our study cases suggest that diagnosis could be sooner and easier in our population and its complications, such as perforation and gangrene, might be less than other populations. Also duration of open or laparoscopic surgery and patient's hospitalization are expected to be reduced.

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