MORPHOLOGICAL VARIATIONS OF VERMIFORM APPENDIX AND CAECUM: A CADAVERIC STUDY

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ABSTRACT

Introduction: "Appendicitis" is the one of the most common disease which require emergency Surgery. The aim was to the study morphological variations of vermiform appendix and caecum.

Materials and Methods: Study was carried out on 20 adult cadavers (male – 13, female – 7). The cadavers were obtained from the Department of Anatomy, Krishna Institute of Medical Sciences Deemed University, Karad, Maharashtra. Morphological variations of vermiform appendix and caecum were studied. A "Duplicated appendix" found in a male cadaver was excluded from the study bringing down the total of cadavers to 19 (male – 12 female – 7).

Results and Conclusion: The most common position of vermiform appendix was found in the study was pelvic in 7 cases and most common shape of caecum was of adult type present in 68.4%. Average length of vermiform appendix was 5.42 cm. (in males-5.13 cm and 5.71 cm in female).

KEY WORDS: Variations, Appendix, Caecum, Morphology.

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INTRODUCTION

The vermiform appendix was first described by Leonardo da Vinci in 1492 [1]. The caecum, considered as the commencement of the large intestine, is in the right iliac fossa. It occupies the triangular area bounded by the right lateral plane, the transtubercular plane and the inguinal ligament.

The vermiform appendix is a narrow, worm shaped tube, arising from the postero-medial

wall of the caecum 2cm or less below the end of the ileum [2]. Position of the caecum in the body also differs slightly i.e. the right iliac fossa, left iliac fossa etc.

Its position is also categorized according to the direction of the tip of the appendix like the retrocaecal type (12 O'clock), preileal, postileal (2 O'clock), midinguinal (6 O'clock), subcaecal and paracolic (11 O'clock), pelvic type (4 O'clock) and promontoric type (3 O'clock) [3].

The length of vermiform appendix varies from 2 to 20 cms with an average of 9 cm. Its breadth is about 5mm [4].

Microscopically the vermiform appendix is a muscular tube containing a large amount of lymphoid tissue [5]. Appendicitis in different positions may mimic other diseases as in retrocolic- colitis, post ileal ureteric colic, pelvic inflammatory disease, torsion of ovarian cyst and ruptured tubal gestation, sub hepatic – hepatitis and biliary colic [5].

Despite extraordinary advances in modern radiographic imaging and diagnostic laboratory investigations diagnosis of acute appendicitis remains an enigmatic challenge inclusive of the surgical diagnosis [6].

The size, shape, position etc. of the caecum and appendix vary in males and females. Therefore the knowledge of normal anatomy and variations of the caecum and appendix is very important to the surgeon performing abdominal operations in adults as well as children and infants. A knowledge of the variable positions of the caecum and appendix will help in diagnosing cases of appendicitis. Knowledge of variations will be helpful in localizing the appendix during an emergency appendectomy operation [6].

Aim of the study: To determine the frequency of the various positions of the appendix, the average length, and breadth and extent of mesoappendix. To determine the frequency of shape of caecum in both sex. To find out the average distance of appendicular orifice to ileocaecal orifice and correlate the same with the previous author's.

MATERIALS AND METHODS

This study was done on 19 adult cadavers which were allotted to undergraduate students (Male- 13 female – 7). These were selected from the Department of Anatomy, Krishna Institute of Medical Sciences, Deemed University, Karad, Maharashtra over a period of one year between 2014 and 2015.

During dissection, a “**Duplicated appendix**” was found in a male cadaver which has been excluded.

Following points were studied:

The position of the caecum and vermiform appendix within the abdominal cavity. (right iliac fossa / Left iliac fossa / other).

Direction of the tip of the appendix was categorized into retrocaecal, preileal, postileal, midinguinal, paracolic, pelvic, promontoric group.

The length of the vermiform appendix was measured from base to tip of appendix by using nylon thread.

The breadth of the appendix was measured at its base with the help of divider.

Distance of the appendicular orifice from ileocaecal orifice was measured between the lower lips of ileocaecal orifice to upper border of appendicular orifice with the help of divider.

The shape of the caecum was categorized into fetal, infantile, adult and exaggerated.

The length of the thread was measured using a scale and the values were recorded into tables.

RESULTS AND DISCUSSION

In present study the total number of cadavers was 19. The total number of cadavers studied was 20. The pelvic position of the appendix was most dominant (36.8%) followed by Retrocaecal 15.8%, Midinguinal 15.8%, Postileal 10.5%, Promontoric 10.5%, Preileal 5.3% and Subcaecal 5.3% (in males it was Pelvic 33.3%, Retrocaecal 25.0%, Pos-ileal 8.3%, Subcaecal 8.3% and Promontoric type 8.3% and in females it was Pelvic 42.9.3%) % Pre-ileal 14.3%, Postileal 14.3%, Midinguinal 14.3% and Promontoric 14.3%). In 15.7% of cadavers meso-appendix failed to reach appendicular tip. Average distance of appendicular orifice from ileocaecal orifice was 1.80 cm. (In males it was 1.70 cm and in females it was 1.91 cm). Average length of vermiform appendix was 5.42 cm (in males- 5.13 cm and 5.71 cm in female). Average breadth of vermiform appendix at the level of base was 2.1 mm (in males 2.2 mm and in females- it was 2.0 mm).

Most common shape of caecum was adult 68.4% exaggerated 15.8%, fetal 10.5% and infantile 5.3%. (In males it was adult 66.7%, exaggerated 16.7%, fetal 8.3, infantile 8.3% and in

females it was adult 71.4%, exaggerated 14.3%, fetal 14.3 % and none in infantile) . Most common position in male and female was pelvic, founded in 4 cases (33.3%) and 3(42.9%) cases respectively and the least common position in female was preileal (14.3%) and in male subcaecal (8.3%).

Fig. 1: Various position of vermiform appendix.

Table 1: Position of vermiform appendix.

Sr.No.	Posi-tip-appendix	Sex		Total
		Male	Female	
1	Retrocaecal	3 (25.0%)	0	3 (15.8%)
2	Preileal	0	1 (14.3%)	1 (5.3%)
3	Post ileal	1 (8.3%)	1 (14.3%)	2 (5.3%)
4	Mid inguinal	2 (16.7%)	1 (14.3%)	3 (15.8%)
5	Sub caecal	1(8.3%)	0	1 (5.3%)
6	Pelvic	4(33.3%)	3 (42.9%)	7 (36.8%)
7	Promontoric	1(8.3%)	1 (14.3%)	2 (10.5%)
Total		12 (100.0%)	7(100.0%)	19(100.0%)

Table 2: Calculation of length and Breadth of vermiform appendix.

Sex	Appen – length (cm)	Breadth (mm)
Male N	12	12
Minimum	2.3	0.5
Maximum	7	10
Mean	5.1333	2.258
Std. deviation	1.4418	3.619
Female N	7	7
Minimum	2.6	0.6
Maximum	8.8	10
Mean	5.7143	2.057
Std. deviation	1.92824	3.5037
t value (Unpaired t test)	0.749	0.118
P value	0.464	0.907

Table 2 shows average length of vermiform appendix was 5.42 cm with range from 2.1 cm to 5.8 cm (In males it was 5.13 cm with range from 2.1 cm to 5.5 cm and in females it was 5.71 cm with range from 2.7 cm to 5.8 cm) . The breadth of appendix was maximum 10mm in both sexes.

Fig. 2: Ceacum shape.

Table 3: Shape of Caecum in male and female.

Shape – caecum	Sex		Total
	Male	Female	
Fetal	1(8.3%)	1(14.3%)	2 (10.5%)
Infantile	1(8.3%)	0	1(5.3%)
Adult	8(66.7%)	5 (71.4%)	13(68.4%)
Exaggerated	2(16.7%)	1(14.3%)	3 (15.8%)
Total	12	7	19

$$X^2 = 0.763, p = 0.858$$

Our study shows most common shape of caecum was adult 68.4%, exaggerated 15.8%, fetal 10.5% and infantile 5.3% (In males it was adult 66.7% , exaggerated 16.7% fetal 8.3% and infantile 8.3% and in females it was adult 71.4%, exaggerated 14.3% , fetal 14.3% and infantile 0%)

This study show that the comparison of shape of caecum between male and female was statistically not significant (P Value = 0.858)

Table 4: Relation between Position of vermiform appendix and shape of Caecum.

Shape - caecum	Post of tip							Total
	Retrocaecal	Preileal	Post ileal	Mid inguinal	Sub Caecal	Pelvic	Promontoric	
Fetal	1 33.33%	0	0	1 33.33%	0	0	0	2 10.50%
Infantile	0	0	0	0	1 5.30%	0	0	1 5.30%
Adult	2 65.66%	1 100%	2 100%	1 33.30%	0	6 31.60%	1 5.30%	13 68.40%
Exaggerated	0	0	0	1 33.30%	0	1 5.30%	1 5.30%	3 15.80%
Total	3 15.80%	1 5.30%	2 10.50%	3 15.80%	1 5.30%	7 36.80%	2 10.50%	19 100%

Test – Chi-square Degree of freedom chi Square value P - value

Table - 4 shows that out of total retrocaecal appendix (65.6%) were adult caecum and (33.3%) were fetal caecum, and none of them were infantile and exaggerated. Out of total pelvic appendix (85.71%) were with adult caecum and (14.28%) were with exaggerated and none of them were fetal and infantile. Out of total postileal and preileal appendix (100%) were with adult caecum. Out of total midinguinal appendix (33.3%) were with fetal, adult and exaggerated caecum and none of them were infantile. Out of total promontoric appendix (50%) were with adult and exaggerated caecum and none of them were with fetal and infantile Caecum. Out of total subcaecal appendix (100%)

were with infantile caecum and none of them were fetal adult or exaggerated.

Nilesh Salwe [1], Arindom Banerjee [6] reported that in all positions of appendix most common shape of caecum is adult.

Table 5: Distance of appendicular orifice from ileocaecal orifice.

Sex	N	Minimum	Maximum	Mean	Std.deviation
Male	12	40	3	1.8083	0.63311
Female	7	1	3.3	1.9143	0.84741

Unpaired t test: t = 0.605, p = 0.553

Table 5 shows that average distance of appendicular orifice from ileocaecal orifice was 1.8 cm with range from 1.0 cm to 3.3 cm. (In male it was 1.70 cm and in female it was 1.9 cm)

DISCUSSION

Table 6: Comparison of position of vermiform appendix according to previous authors.

Authors (No. of Specimen.)	Percentage Occurrence of various positions.						
	Retro caecal	Pelvic	Post ileal	Preileal	Sub caecal	Mid inguinal	Promontoric
Geethanjali HT 2011 [5] (52)	32.69	36.54	11.53	9.62	5.44	-	-
Nilesh Ashok 2014 [1] (60)	56.67	25	3.33	15	-	-	-
Shah & Shah 2011 [5] (591)	4	16.6	15.8	11.7	4.7	-	-
Chowdhari Manisha 2013 [7] (200)	55.5	23.5	9	-	6.9	5	-
Arindom Banerjee 2012 [6] (25)	68	-	-	8	4	4	16
Gopalpur MJ 2003 [8] 117	32.4	33.4	2.6	18.6	12.8	-	-
Paul, U.K 2009 [9] (60)	39	19	2	0	0	-	-
Present study (19)	15.8	36.8	10.5	5.3	5.3	15.8	10.5

In our study, Most common position of vermiform appendix was pelvic 36.8%, retrocaecal 15.8% midinguinal 15.8%, postileal 10.5%, promontoric 10.5%, preileal 5.3%, and subcaecal 5.3% (In males it was Pelvic 33.3% Retrocaecal 25.0%, midinguinal 16.7%, postileal 8.3%, subcaecal 8.3% and promontoric 8.3%. In females it was pelvic 42.9%, preileal 14.3% postileal 14.3 % , midinguinal 14.3% , promontoric 14.3%. Pelvic position was also commonest in Geethanjali HT et al study. In other studies by Nilesh Ashok and Arindom Banerjee most common position was retro colic.

Table 7: Comparison of average length of appendix according to previous authors.

Author	Shortest (cm)	Longest (cm)	Average (cm)
Chawdhari Manisha 2013 [7]	4	13	6.3
Nilesh Ashok Salwe 2014 [1]	2.8	12	5.93
Geethanjali HT 2011 [5]	42	10.3	9.9
Present Study	2.1	5.8	5.4

CONCLUSION

The dissections was carried out on 20 adult cadaver and studied the most common position

length, mesentery etc of caecum and appendix. This information can help the surgeon to make diagnosis and treatment of appendicitis.

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