

## The Anatomical Position of Appendix in Iranian Cadavers

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### ABSTRACT

**Background:** Vermiform appendix is different in terms of anatomical position, length and mesoappendix. Knowing the anatomical position of vermiform appendix is important for the surgeons in terms of diagnosis and management. The aim of this study is analysis of length, anatomical position and mesoappendix of vermiform appendix.

**Methods:** This is a cross-sectional study on the 400 randomly selected cadavers (306 male and 94 female) who have been referred to the autopsy hall of legal medicine organization of Tehran province to be autopsied between March 21, 2010 and March, 2011. The cause of death was very heterogeneous among autopsied cadavers.

**Results:** According to our results the anatomical positions were pelvic, subcecal, retroileal, retrocaecal, ectopic and preileal in 55.8%, 19%, 12.5%, 7%, 4.2% and 1.5% respectively. The mean length of vermiform appendix was 91.2 mm and 80.3 mm in men and women, respectively. Mesoappendix was complete in 79.5% and incomplete in 20.5%. No association was seen between sex and anatomical position of vermiform appendix.

**Conclusion:** Anterior anatomical position was the most frequent vermiform appendix position in our population which is in discrepancy with most of the reports from western countries. It might be possible that factors such as race, geographical regions and nutritional regiment play roles in determining the position of vermiform appendix.

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► *Implication for health policy/practice/research/medical education:*The Anatomical Position of Appendix

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### 1. Introduction:

Appendix is a part of the digestive tract which lies in right lower quadrant of

abdomen. It has a vermiform structure and arises from the posteromedial wall of the cecum which is about 2 cm below the ileocecal valve (1). Its length varies from 2 to 20 cm, and the average is 9 cm (2). The base of appendix is connected to the cecum, but its head can be placed in different situations. This diversity of situations includes six locations: retrocecal, pelvic, subcecal, preileal, retroileal and ectopic (3- 5).

Appendicitis is the most common cause of acute abdomen in young patients however it may also be seen in any age group (4). Some studies have shown that increasing age, race, sex, geographic region, and the diet can affect on the position of appendix (3). Mortality rate of non-perforated appendicitis is 0.1%, which is slightly higher than the mortality rate due to a general anesthesia. The mortality rate in perforated appendicitis is about 3%; this amounts increase to about 15% in the elderly population (6). Dejanlic A *et al.* in Serbia in 2008, evaluated 65 patients who underwent open appendectomy. They reported pelvic as the most common position with 57.71% and paracecal as the least position with 3.07% (7).

Appendicitis is diagnosed by clinical examination and evaluation, and there is no definitive diagnostic laboratory test or imaging (8). Determination of the exact position of the appendix may be helpful in the diagnosis of appendicitis. Variable positions of the appendix can lead physicians to make a wrong decision in the diagnosis of other diseases and delayed diagnosis may lead to perforation and subsequent abscess or peritonitis; so having accurate information about the anatomical location of appendix can approve the prognosis.

This study was performed to determine the anatomical locations of the appendix, its length and span, and mesoappendix of appendix (complete or incomplete) with considering age and sex on cadavers which referred to forensic dissection of Tehran.

## **2. Materials and Methods:**

This descriptive cross sectional study was conducted in Autopsy hall of Tehran's legal medicine organization in 2011. We recruited 400 Iranian cadavers whose nationality were checked by their identity cards and referred to forensic autopsy center. From this group 306 were male and 94 were female. The study population was randomly assigned to cadavers that would be needed to determine the cause of death on autopsy. The study was performed on the cadavers of different ages and both sexes. Inclusion criteria were Iranian citizen and necessary to perform autopsies on the cadavers to determine cause of death. Also, anonymous cadavers, non-Iranian cadavers, cadavers with severe burns, disintegrated cadavers, advanced mortis-corruption cadavers, cadavers with fetal anomalies, old or new abdominal surgery, peritonitis, intestinal distension, and any reason to change the anatomical position of the appendix were excluded from the study. Anatomical location of the appendix was determined after the cadavers were randomly selected and were sent for autopsy. Appendix length was measured in millimeters with a ruler and complete or incomplete mesoappendix was determined by a trained doctor. Sex was determined based on the observation and phenotype, and age was recorded based on birth certificates. Collected data were entered into software SPSS version 13. We used descriptive statistics for the frequency and Chi<sup>2</sup> test for analytical statistics.

This study was approved by the ethical committee of legal medicine organization. No additional incisions in the skins which make change in the appearance of the dead body were entered, and no costs were imposed to the family of the deceased.

## **3. Results:**

This study was done on 400 cadavers of whom 306 (76.5%) were male and 94 (23.5%) were female. The mean age of the study population was 39.3 years. Female

**Table 1:** Distribution of anatomical location of appendix and sex.

	Position	pelvic	subcecal	retroileal	retrocecal	ectopic	preileal	total
<b>sex</b>								
<b>Male</b>		160	64	39	22	15	6	306
<b>prevalence</b>		(52.3%)	(20.9%)	(12.7%)	(7.2%)	(4.9%)	(2%)	(100%)
<b>Female</b>		63	12	11	6	2	0	94
<b>prevalence</b>		(67%)	(12.8%)	(11.7%)	(6.4%)	(2.1%)	(0%)	(100%)
<b>total</b>		223	76	50	28	17	6	400
		(55.8%)	(19%)	(12.5%)	(7%)	(4.2%)	(1.5%)	(100%)

mean age was 39.9 years and male mean age was 39.7 years.

According to the results, anatomical locations of the appendix were as follows: pelvic type 223 (55.8%), subcecal 76 (19%), retroileal 50 (12.5%), retrocecal 28 (7%), ectopic 17 (4.2%) and preileal 6 (1.5%). The most common anatomical location for both sexes was pelvic, and then in descending order in both sex were subcecal, retroileal, retrocecal, ectopic and preileal. No anatomical position of the preileal was observed in female population. More details are explained in table1.

Minimum length of appendix was 15 millimeters and maximum length of it was 175 millimeters. The average length of appendix for men was 91.2 mm (SD±17.3) and for women was 80.3 mm(SD±22.1). The appendix was classified according to the length of it. Most people were in length from 80 to 119 mm. Table2 shows the distribution of appendix size.

The highest average of appendix size was seen in the age category 11-19 years. Appendix length was significantly greater in men ( $P$  value= 0.01). Also, there was a significant association between length of the appendix and age groups ( $P$  value≤0.001). Details are shown in figure 1.

Mesoappendix of appendix was complete in 318 (79.5%) of total cases and was incomplete in 82 (20.5%)which are shown

in table 3. There was not any significant association between gender and the type of mesoappendix (complete-incomplete) ( $P$  Value= 0.30).

#### 4. Discussion:

In our study, the most common type of appendix position was pelvic with 55.8% and the lowest was preileal position in 1.5% of the total study population. Our findings were similar with the results of Katzurski MM (9), Ojeifo JO (10), Rahman MM (11) and Uttam Kumar (12) studies, who had evaluated the position in the appendix in the cadavers; however there are some different findings in other studies. Ajmani MLin India (13), Ojeifo JO in Bosnia (10) and JNA Clegg in Ghana (14) were reported that the most common type of appendix position are retrocecal and pelvic. It seems that many factors, including race are involved in determining the position of the appendix. Also our finding were similar to Amir denjalic (7) and Gosalipoor (15) study in Iran who evaluated the patients in surgery ward and Yabunaka (16) study who evaluated the size of appendix by sonography and Ahmad Irfan (17) study who estimated the appendix size through therapeutic laparotomy. The most common type of appendix in all of these studies was pelvic appendix.

**Table 2:** Distribution of appendix length.

Length of appendix	< 40mm	40- 79mm	80- 119mm	> 119mm	Total
<b>Frequency (%)</b>	6 (1/5)	126 (31/5)	202 (50/5)	66 (16/5)	400 (100)

**Table 3:** Distribution of different types of mesoappendix in age groups.

Age groups	Complete mesoappendix	Incomplete mesoappendix	total
Less than 10 y/o	10(2.5%)	16(4%)	26(6.5%)
11-19 y/o	13(3.2%)	5(1.2)	18(4.5%)
20-39 y/o	149(37.2)	32(8%)	181(45.2%)
40-54 y/o	61(15.2)	17(4.2%)	78(19.5%)
More than 54 y/o	79(19.8%)	18(4.5%)	97(24.2%)
Total	318(79.5%)	82(20.5%)	400(100%)

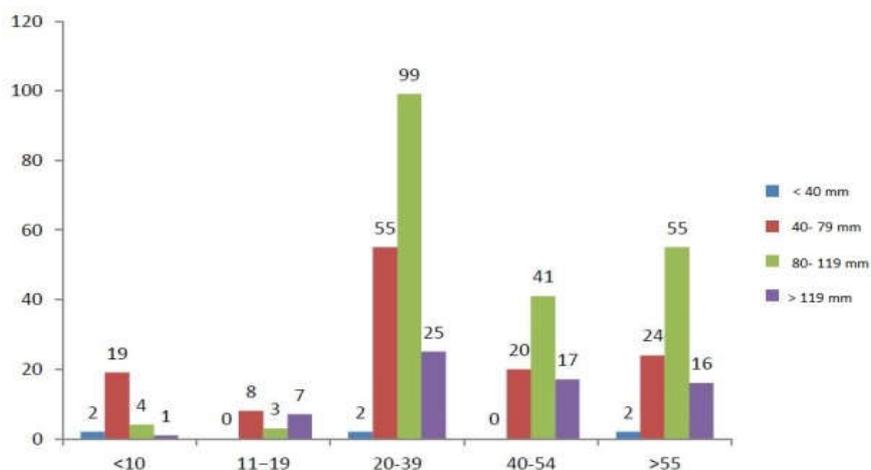
As the anterior location of appendix were more than 75% of our study population, so early diagnosis of appendicitis and shorter duration of surgery and hospitalization time is expected to be seen in our patients. This can reduce the complications of appendicitis surgery.

As our results showed, pelvic position of the appendix is the most common location for both males and females. Frequency of this location in female population was 63 (67%) and in male population was 160 (52.2%) which shows that pelvic location mostly seen in females.

In our study, the average length of the

appendix in men was more than women which is similar to results of Katzurski, (9) Gholalipoor (15) and Ajmani ML (13) studies; but Bakheit MA (18) and Rahman MM (11) reported that length of the appendix in women is more than men, so it could be different in variable races.

Also our results showed that frequency of incomplete mesoappendix in the age group below 10 years is more than this rate in other age groups of study. Incomplete mesoappendix may reduce blood supply to the tip of the appendix and prone it to gangrene and perforation, so this causes poor outcome in children. Therefore,



**Fig. 1.** It shows appendix length in different age groups.

incomplete mesoappendix could be one of the reasons of the severity of appendicitis in childhood.

In conclusion, due to high incidence of anterior position and complete mesoappendix in our population in contrast to the races which posterior positions and incomplete mesoappendix are more common in their population, diagnosis of the appendicitis in our population can be sooner and easier and complications of appendicitis including perforation and gangrene may be less than other societies. Also the duration of open surgery or laparoscopic surgery and also the hospitalization time can be reduced. To confirm our results, it is recommended that further studies be performed to evaluate the prevalence of appendicitis, diagnosis time and hospitalization time and compare them with other societies.

## References

1. Standing S, Ellis H, Healy JC, Johnson D, Williams A, Collins P. Gray's anatomy. In Alimentary system. 39th ed. Churchill Livingstone, New York. 2005;P:1189-1190.
2. Singh I.B. Chaurassia human anatomy, Regional and applied. 3rd ed. Vol. 2. CBC publishers and distributors. New Delhi.1999; P: 223-5.
3. Schwartz SJ, Shires GT, Spencer FC, Daly JM, Fischer JE, Galloway AC. Principles of surgery Schwartz. In: The Appendix 7th edn; Vol 3. MC Graw-Hill. Philadelphia. 1999; P:1383-5.
4. Sabiston DC, Courtney M. Sabiston's textbook of surgery, the biological basis of modern surgical practice in Appendix. 16th ed; Vol 2; W.B. Saunders Company. Philadelphia. 2001; P: 918.
5. Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE. Gray's Anatomy. In : Alimentary system. 38th ed. Churchill Livingstone, New York. 1995;P:1775-6
6. Harrison, Translted by SeyyedMoayedAlavian, Gastrointestinal disease, NooreDanesh, 2007.
7. Denjalid A, Delic J, Delic-Custendil S, Muminagid S. Variations in position and place of formation of appendix vermiformis found in the course of open appendectomy. Med Arh. 2009;63(2):100-1.
8. Zinner MJ, Kumar SL. Maingut's Abdominal Operation 10th ed. Right-Sided low inguinal pain in young woman. 1996;41(2) :93- 94.
9. Katzurskj MM, GopalRao UK, Brady K. Blood supply and position of the vermiform appendix in Zambians Medical Journal of Zambia. 1979;13(2):32-34.
10. Ojeifo JO, Ejiwunmi AB, Iklaki J. The position of the vermiform appendix in Nigerians with a review of the literature. West Afr J Med. 1989;8(3):198-204.
11. Rahman MM, Khalil M, Rahman H, Mannan S, Sultana SZ, Ahmed S. Anatomical Positions of Vermiform Appendix in Bangladeshi People. J Bangladesh Soc Physiol. 2006;1:5-9.
12. Kumar Paul U, Naushaba H, Begum T, Alam J. Position of Vermiform Appendix: A Postmortem Study. Bangladesh Journal of Anatomy. 2009;7(1):34-36.
13. Ajmani ML, Ajmani K. The position, length and arterial supply of vermiform appendix. AnatAnz. 1983;153(4):369-74.
14. lamptey JN, Armah H, Naaeder SB, Aryee NA. Position and susceptibility to inflammation of vermiform appendix in Accra, Ghana. East African Medical Journal. 2006; 83(12):670-3.
15. Golalipour MJ, Arya B, Azarhoosh R, Jahanshahi M. Anatomical variations of vermiform appendix in South-East Caspian Sea (Gorgan – Iran). J. Anat. Soc. India. 2003;52(2):141-143.
16. Yabunaka K, Katsuda T, Sanada Sh, Fukutomi T. Sonographic appearance of the normal appendix in adults. J Ultrasound Med. 2007; 26:37-43.
17. Irfan A, Kristjan A, Ian B, Dileep L. The position of the vermiform appendix at laparoscopy. Surgical and Radiologic Anatomy. 2007; 29 (2):165-168.
18. Bakheit MA, Warille AA. Anomalies of the vermiform appendix and prevalence of acute appendicitis in Khartoum. East Afr Med J. 1999;76(6):338-40.