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Оригинальное исследование / Research article

Anatomical deviations in the position of vermiform appendix: the cadaveric study

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Abstract

Vermiform appendix is the only organ in the body that has no constant anatomical position. It is so named because of its worm like appearance. Most common surgical cause of abdominal pain is appendicitis; its diagnosis is affected by anatomical variations of the vermiform appendix, because this is the most variable abdominal organ in terms of position and organ relations. Aim of the study was to examine anatomical features and different positions of the vermiform appendix in human cadavers. **Material and methods.** This study was carried on 45 human cadavers irrespective of sex and age from the Department of Anatomy at Andhra Pradesh over a period of 12 months. **Results.** Mean length of appendix was found to be 3.98 ± 1.27 cm. Mean outer girth was 2.17 ± 0.26 cm. Mean distance of vermiform appendix from ileocaecal junction was found to be 2.11 ± 0.43 cm. Commonest position was retrocaecal (44 %), followed by pelvic (21 %), postileal (9 %), subcaecal (13 %) and midinguinal (10 %). **Conclusions.** Variations in position of vermiform appendix will help the surgeons to make a diagnosis of appendicitis and aware about appendiceal rupture.

Key words: vermiform appendix, cadavers, different position.

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Анатомические отклонения в положении червеобразного отростка: кадаверное исследование

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Резюме

Червеобразный отросток – единственный орган в организме, который не имеет постоянного анатомического положения. Он назван так из-за своего червеобразного вида. Наиболее распространенной хирургической причиной боли в животе является аппендицит; на его диагностику влияют анатомические вариации червеобразного отростка, поскольку это самый изменчивый орган брюшной полости с точки зрения положения и взаимоотно-

шений органов. Целью исследования было изучить анатомические особенности и различные положения червеобразного отростка на трупах людей. **Материал и методы.** Исследование проводилось на 45 человеческих трупах независимо от пола и возраста из отделения анатомии в Андхра-Прадеш в течение 12 месяцев. **Результаты.** Средняя длина аппендикса составила 3,98 ± 1,27 см. Средний наружный обхват составил 2,17 ± 0,26 см. Среднее расстояние отростка от илеоцекального соединения составило 2,11 ± 0,43 см. Наиболее распространенным положением было ретроцекальное (44 %), затем тазовое (21 %), постилеальное (9 %), субцекальное (13 %) и мидуинальное (10 %). **Выводы.** Вариации в положении отростка помогут хирургам поставить диагноз аппендицита и предупредить разрыв аппендикса.

Ключевые слова: червеобразный отросток, трупы, различное положение.

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Introduction

The vermiform appendix is a narrow worm like diverticulum which arise from the posteromedial wall of the caecum about 2cm below the ileocecal junction and has no constant position. The length of appendix varies from 2 to 20 cm with an average of 9 cm [1]. The vermiform appendix is considered as a vestigial organ occupying variable positions. Acute appendicitis is the most common cause of acute abdomen in young adolescents and it is often the first major surgical procedure performed by a surgeon in training [2, 3]. The appendix usually lies in the right iliac fossa. Its base is fixed whereas the remaining part may occupy any of the following positions which indicated with an hour hand of a clock: retrocaecal (12 o'clock), pelvic (4 o'clock), subcaecal (6 o'clock), pre- and postileal (2 o'clock), promonteric (3 o'clock). But there is no definite rule about the position of the vermiform appendix. It is thought that the appendix position is closely related to development of caecum and is highly variable [4]. A thorough knowledge of normal anatomy and variations in the position of appendix is the important for the surgeons while performing surgery such as appendicectomy.

With this rationale in mind, the study has been undertaken to investigate certain anatomical features and different positions of the vermiform appendix and caecum in cadavers.

Material and methods

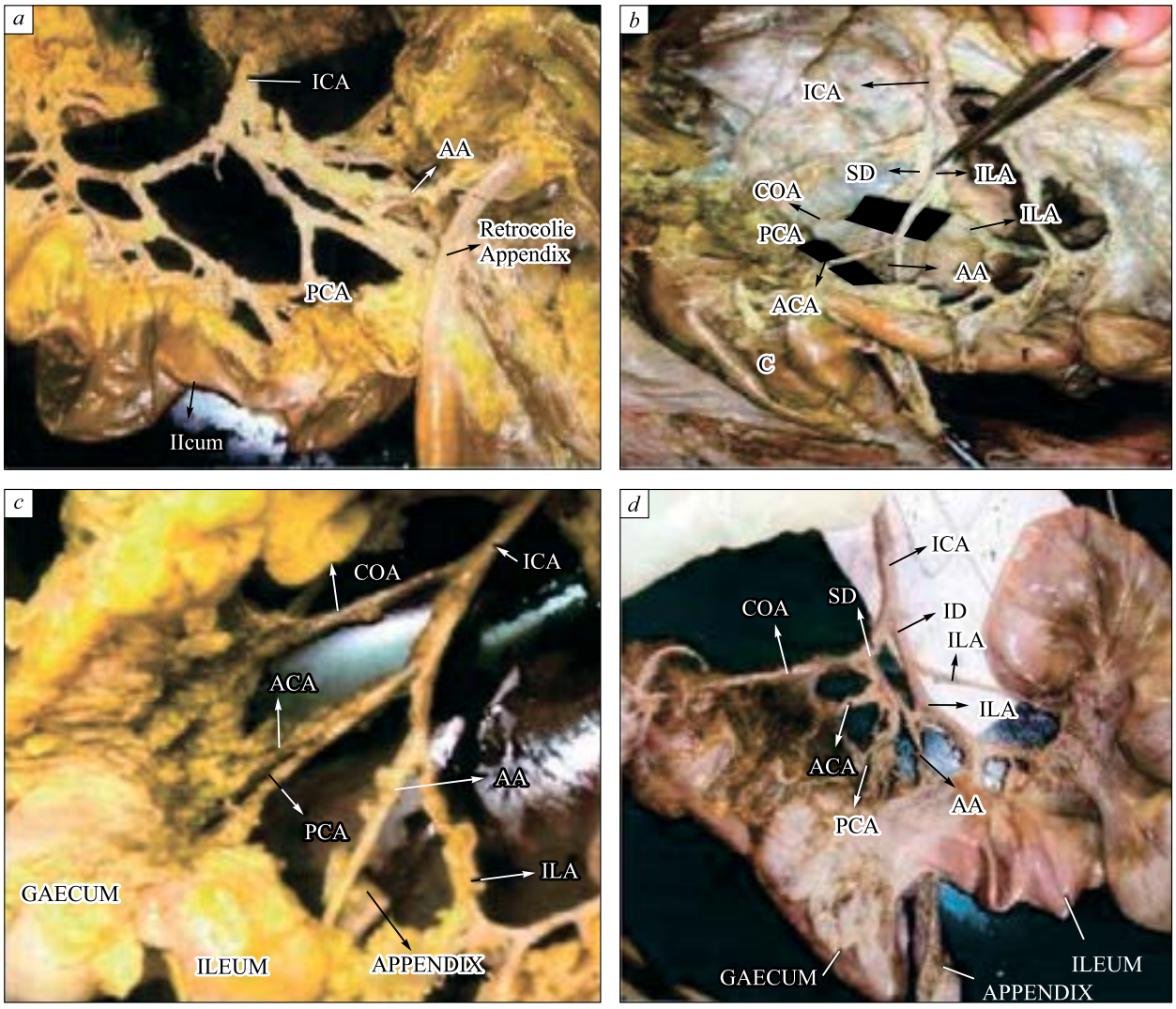
Fourty five cadavers allotted to MBBS (Bachelor of Medicine and Bachelor of Surgery) students were selected. The study was conducted at Department of Anatomy (Narayana Medical College, Nellore, India). Both male and female cadavers were included in the study, which was undertaken from July 2020 to August 2021. Specimen were cleaned by routine dissection method and cleared specimen were brushed with the solution of acetone. Appendices were identified by tracing the taeniae coli on the external surface of colon and caecum and then positions of appendix were noted. Photographs of the selected specimens taken at suitable magnification and specimens preserved in 10 % formalin jars. The vermiform appendix was located by following the anterior taenia coli and its position was determined. Based on position, the appendix was categorized into retrocaecal, pelvic, preileal, postileal, paracolic, subcaecal and paracaecal groups. Photographs were taken of cadaveric appendix specimens. The length of the appendix from the base to the tip was measured with the help of thread. Thread's length was measured by measuring scale and the values were recorded. Data are presented as arithmetic mean ± standard deviation.

Results

The following observations were made in specimens taken from 45 human cadavers irrespective of age and sex. Length of appendix was found to be 3.98 ± 1.27 cm, outer girth – 2.17 ± 0.26 cm, distance of vermiform appendix from ileocaecal junction – 2.11 ± 0.43 cm. Position of appendix: retrocaecal / retrocolic, pelvic, subcaecal, preileal, postileal and midinguinal. Various position of appendix are shown at Figure. Commonest position of appendix noted is retrocaecal / retrocolic followed by pelvic position, postileal, subcaecal and midinguinal. We did not note any preileal position or any ectopic position of appendix (Table).

Discussion

The vermiform appendix has base, body and tip. Base of appendix has constant relationship with caecum, i.e on posteromedial aspect of caecum 2 cm below ileocaecal opening but the tip can point in



Retrocaecal (a), pelvic (b), postileal (c) and subcaecal (d) position of appendix. ICA – ileocolic artery, AA – appendicular artery, ACA – anterior caecal artery, COA – coarctation of the aorta, ICA – ileocolic artery, ID – inferior division, ILA – ileal artery, PCA – posterior caecal artery, SD – superior division

various directions and depending on the position of tip appendix.

Moreover, a retrocaecal appendix may lie behind a caecum distended with gas and thus it may be difficult to elicit tenderness on palpation in the right iliac region. Irritation of the psoas muscle conversely may cause the patient to keep the right hip joint flexed (psoas sign). An appendix hanging down in the pelvis may result in absent abdominal tenderness in the right lower quadrant but deep tenderness may be experienced just above the pubic symphysis. In pelvic appendicitis, diarrhea results from an inflamed appendix being in contact with rectum. Rectal or vaginal examination may reveal tenderness of the peritoneum in the pelvis on the right side. An inflamed appendix when it is in contact with the urinary bladder may cause increased frequency of micturition. If such an inflamed appendix perforates, a localized pelvic peritonitis may result. Long retrocolic inflamed appendix also called subhepatic appendix and it causes confusion with cholecystitis. In retrocaecal and retrocolic variety of appendix, the chances of gangrenous complication are more because in these cases blood vessels get kinked. In preileal position appendix directs towards the spleen and if it becomes inflamed it is liable to result

Displaying the different position of appendix

Position of appendix	Number of cadavers	
	n	%
Retrocaecal / retrocolic	12	34
Pelvic	10	28
Postileal	6	17
Subcaecal	4	11
Midinguinal	3	8
Preileal	0	0
Ectopic	0	0

in general peritonitis and is the most dangerous position. Postileal appendix called missed appendix is common in children and in early adult life. Postileal inflamed appendix may cause diarrhea. Perforation of the appendix or transmigration of bacteria through the inflamed appendicular wall results in infection of the peritoneum of the greater sac. Inflammation of atypically located vermiform appendix may initiate inflammation of other organs which leads to diagnostic errors and life threatening complications [5].

J. Ojeifo et al. [6], R.J. Last [7] described retrocaecal / retrocolic as commonest position with frequency ranging from 58 to 65 %. In the present study retrocaecal/retrocolic is the commonest position with 38% frequency. Katzurskj M.M. et al. [8], M.J. Golalipour et al. [9] mentioned pelvic as common position of appendix. In the present study it is second common position with 28 % frequency. In the present study subcaeal position (10%) was comparable with data obtained by T.F. Solanke (11.2 %) [10] and M.J. Golalipour (12.8 %) [9]. No preileal position of appendix was noted. Midinguinal position described as rare by all authors, but in the present study the occurrence was 4 %.

T.F. Solanke [10] observed ileocaecal position in 29.2 % and in the present study postileal position was 20 %. C.P. Wakeley [11] mentioned ectopic position in 0.05 %, in the present study no such position was noted. K. Buschard and A. Kjaddgaard [12] mentioned anterior positions more frequent i.e. pelvic and ileocolic than posterior positions i.e. retrocaecal and subcaecal type which is comparable with the present study.

Average length of appendix was 5.93 cm with range from 2.8 to 12 cm. Length of the vermiform appendix varies from 2 to 20 cm, with an average length of 9 cm [12]. M.L. Ajmani and K. Ajmani [13] found average length of the appendix as 9.5 cm in male and 8.7 cm in female. Thus, in the present study length of vermiform appendix was comparable to obtained by previous authors.

In our study, average outer girth of appendix was 2.8 cm with range from 1.4 to 5.3 cm. Distance of vermiform appendix from the ileocaecal junction varies from 2 to 3 cm, with an average of 2.5 cm [14]. The origin of appendix is about 2.5 cm below the ileocaecal valve from the posteromedial aspect of caecum [15]. Therefore, both the outer girth and distance of vermiform appendix from the ileocaecal junction in the present study outer girth of appendix was comparable to the study conducted by previous authors. In human beings due to lack of definition of its true function, the vermiform appendix was considered as a rudimentary and vestigial organ. But if the position, length, outer girth and distance from ileocaecal junction of vermiform appendix are detected, it will help to decrease the complications of appendicular pathology [5].

Conclusions

This study was carried out in 45 human cadavers irrespective of age and sex. With reference to position of appendix the commonest position was retrocaecal or retrocolic (34 %) followed by pelvic (28 %). It is to be noted that preileal appendix was not observed in the present study. Therefore, it is very important for the surgeons to be aware of the possible variations in the positions of vermiform appendix, which may pose challenging, diagnostic and therapeutic problems while doing many abdominal surgeries.

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References

1. Borley N.R. Vermiform appendix. *In: Gray's anatomy: the anatomical basis of clinical practice, 39th ed.* Editor-in-chief. S. Standing. Edinburgh: Elsevier Churchill Livingstone, 2005; 1189–1190.

2. O'Connell P.R. The vermiform appendix. *In: Bailey and Love's Short Practice of Surgery, 23rd ed*. Eds. R.C.G. Russell, N.S. Williams, C.J.K. Bulstrode. London: Arnold, 2000; 1076–1092.

3. Condon R.E. Appendicitis. *In: Textbook of surgery, 13th ed.* Ed. D.C. Sabiston. Philadelphia: W.B. Saunders, 1986; 967–982.

4. Moore K.L., Dalley A.F. Clinically oriented anatomy, 4th ed. Philadephia: Williams and Wilkins, 1999; 350–354.

5. Rahman M.M., Khalil M., Khalil M., Hussain A., Rahman H.R., Mannan S., Sultana S.Z., Ahamed M.S. Length of human vermiform appendix in Bangladeshi people. *Journal of Bangladesh Society of Physiologist*. 2008;2:13–16. doi: 10.3329/jbsp.v2i0.977

6. Ojeifo J.O., Ejiwunmi A.B., Iklaki J. The position of the vermiform appendix in Nigerians with a review of the literature. *West Afr. J. Med.* 1989;8(3): 98–204.

7. Last R.J. Last's anatomy: regional and applied (MRCS Study Guides), 11th ed. London: Churchill Livinston, 2006; 264–266.

8. Katzarski M., Gopal Rao U.K., Brady K. Blood supply and position of the vermiform appendix in Zambians. *Med. J. Zambia.* 1979;13(2):32–34.

9. Golalipour M.J., 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.

10. Solanke T.F. The position, length, and content of the vermiform appendix in Nigerians. *Br. J. Surg*. 1970;57(2):100–102. doi: 10.1002/bjs.1800570205

11. Wakeley C.P. The position of the vermiform appendix as ascertained by an analysis of 10,000 cases. *J. Anat*. 1933;67(Pt 2):277–283.

12. Buschard K., Kjaeldguard A. Investigation and analysis of the position. length and embryology of the vermiform appendix. *Acta Chir. Scand.* 1973;139 (3):293–298.

13. Ajmani M.L., Ajmani K. The position, length and arterial supply of vermiform appendix. *Anat. Anz.* 1983;153(4):369–374.

14. Paul U.K., Naushaba H., Begum T., Alamq M. J., Alim A.J., Akther J. (2009). Position of vermiform appendix: a postmortem study. *Bangladesh Journal of Anatomy*. 2009;7(1):34–36. doi: 10.3329/bja.v7i1.3015

15. Sabiston's textbook of surgery, the biological basis of modern surgical practice, 16th ed. Eds. C.M. Townsend, R.D. Beauchamp, B.M. Evers, K.L. Mattox. Philadelphia: W.B. Saunders Company, 2001;2:918.

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