

STUDY ON THE MORPHOMETRIC AND ARTERIAL PATTERN OF APPENDIX IN MADURAI TAMILNADU POPULATION

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Abstract:

The incidence of appendicitis has been reduced steadily since the late 1940s, and the current annual incidence is 10/ 100,000. The vermiform appendix is part of the digestive tract that lies in right iliac fossa of abdomen. It is a worm-like structure and emerges during embryological life from posteromedial aspect of cecum, which has a widely varied position. Depending on the position of vermiform appendix, signs and symptoms of appendicitis may differ and complicate the diagnostic process. The study was conducted in Institute of Anatomy, Madurai Medical College, Madurai, during the post-graduation period. This study was to determine the morphometry and vascular pattern of appendix in cadaver in and around Madurai Tamilnadu. In present study we were able to observe the length of the appendix was higher in the Age group 10-20 was 12.2 cm, Age group 21to 30 was 9.4 cm, Age group 31 to 40 was 9.29 cm, Age group 41 to 50 was 7.92 cm and 51 to 60 was 7.78 cm. The knowledge about varying pattern of vascular pattern of appendicular artery helps not only in proper planning of appendectomy procedure but also it is helpful in conservative management of early acute appendicitis.

Keywords: Study on the Morphometric; Arterial; Appendix.

INTRODUCTION

The incidence of appendicitis has been reduced steadily since the late 1940s, and the current annual incidence is 10/ 100,000 (1). During the embryonic period cecum descends from right upper quadrant to right iliac fossa after the 10th week of foetal life, when the midgut has returned by means of umbilical aperture to abdominal cavity. During its descent, appendix may fold under the cecum, and if peritoneal fixation takes place at this time, the appendix will be fixed in this adherent retro posture. The asymmetrical expansion of cecum during the development of the GIT in the fetus is the true cause of the appendix's position. The caecum mobility or fixation ultimately determined the position of the appendix(2). The vermiform appendix is part of the digestive tract that lies in right iliac fossa of abdomen. It is a worm-like structure and emerges during embryological life from posteromedial aspect of cecum, which has a widely varied position. It is connected to the place where the three taenia coli converge on posteromedial wall of caecum, about 2 cm below ileocecal valve (3,4). In appendicitis surgery there may be a possibility that it will require extra muscle splitting or extension of a transverse incision. This varied anatomy may present difficulties during appendectomy and both of these scenarios may lengthen the surgical procedure and make it more difficult. Planning ahead for surgery requires being aware of these anatomical variances(5,6). Depending on the position of vermiform appendix, signs and symptoms of appendicitis may differ and complicate the diagnostic process.

The peritoneal fold which is housing blood arteries, lymphatics, lymph nodes, nerves, and suspends the appendix within the peritoneum is called mesoappendix. Vermiform appendices range in length from 2 to 20 cm, with 9 cm being average, and the longest to be reported as 28cm(7) The average diameter of appendix is 6mm.(8) Moreover,

morphometry of vermiform appendix is an important diagnostic criterion of an inflammation (3). The aim of this study was to determine the morphometry and vascular pattern of appendix in cadaver in and around Madurai Tamilnadu.

MATERIALS AND METHOD

The study was conducted in Institute of Anatomy, Madurai Medical College, Madurai, during the post-graduation period. A total of 55 cadavers were observed of which 35 male and 20 female with an age group ranging from 20 to 60. The appendix was dissected and observed in the cadaver during the routine dissection of 1st year M.B.B.S students according to the Cunningham's manual of practical Anatomy (Volume-2). The following parameters were observed: 1.Length, 2.Arterial pattern of the appendix and appendicular artery, which was classified by M.A. Shah et al 1946(9) TYPE I PATTERN: The appendicular artery was from the ileocolic artery and supplying the appendix after dividing into three or four subdivisions in the mesoappendix, near the appendicular wall. TYPE II PATTERN: The appendicular artery had its origin from the ileocolic artery, bifurcated immediately in the mesoappendix and supplying the appendix, making free anastomosis with each other. TYPE III PATTERN: The appendicular artery arises from the ileocolic artery, trifurcated immediately in the mesoappendix and supplied the appendix. TYPE IV PATTERN: The appendicular artery was arising from the posterior cecal artery. TYPE V PATTERN: There were two appendicular arteries, one from the anterior cecal and another from posterior cecal artery. There was free anastomosis between each other in the mesoappendix. TYPE VI PATTERN: There were two appendicular arteries. Both were arising from posterior cecal artery. TYPE VII PATTERN: Two appendicular arteries arise from anterior cecal artery. Figure 1&2 (Number of appendicular arteries, its origin, branching pattern & its communications), 3.Extend of the mesoappendix was observed, 4. Age related to length of appendix was calculated. The observation was photographed after the study.

RESULT

(a) Length of appendix

Table 1: Showing length of the appendix in male, female and mean values.

S. No	Morphometry of appendix	Maximum	Minimum	Mean
1.	Length	16 cm	1.5 cm	8.75cm
2.	Male	14.3 cm	1.5 cm	9.41cm
3.	Female	16 cm	4.2 cm	8.85cm

(b). Extend of mesoappendix

In present study, the mesoappendix extended up to the tip of the appendix in 17 cases (34%), failed to reach the tip in 33cases (66%).

(c) Arterial pattern of appendix

In the present study we are able to observe 7 types of arterial pattern.

i] Type I pattern was observed in 13 specimens 26%, 11 male and 2 female. The appendicular artery had its origin from ileocolic as it approached the appendix it divided into 2 or 3 sub divisions.

ii] **Type II pattern** was observed in 9 specimens 18%, 7 male and 2 female. The appendicular artery was from ileocolic artery and divided immediately into 2 trunks which make free anastomosis with each other in the mesoappendix.

iii] **Type III pattern** was observed in 2 specimens 4%, 1 male and 1 female. The appendicular artery originated from ileocolic artery and immediately it trifurcated, which makes free anastomosis between the three divisions in the mesoappendix.

iv] **Type IV Pattern** was observed in 9 specimens 18%, 7 male and 2 female. The appendicular artery was arising from the posterior cecal artery.

v] **Type V Pattern** was observed in 9 specimens 18%, 4 male and 5 female. There were two appendicular arteries, one from anterior cecal artery and another from posterior caecal artery.

vi] **Type VI Pattern** was observed in 7 specimens 14%, 4 male and 3 female. There were two appendicular arteries, both from posterior cecal arteries.

vii] **Type VII Pattern** was observed in 1 specimen 2%, 1 male. There were two appendicular arteries, both from anterior cecal artery.

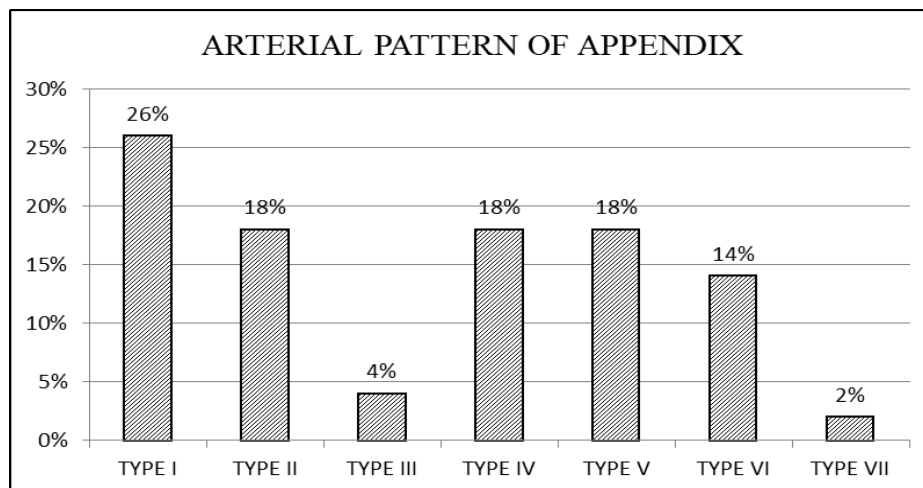


Figure 1: showing the various types of arterial pattern in the study

d) Age related to length of appendix:

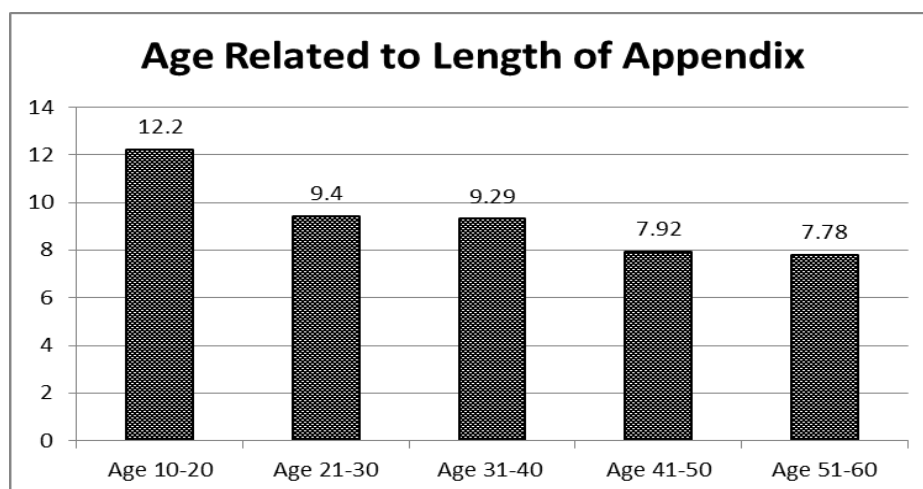


Figure 2: Showing the age related to the length of the appendix.



Figure 3: the shortest appendix of the present study - 1.5 cm in length



Figure 4: The longest appendix of the present study – 16 cm in length, retrocolic in position

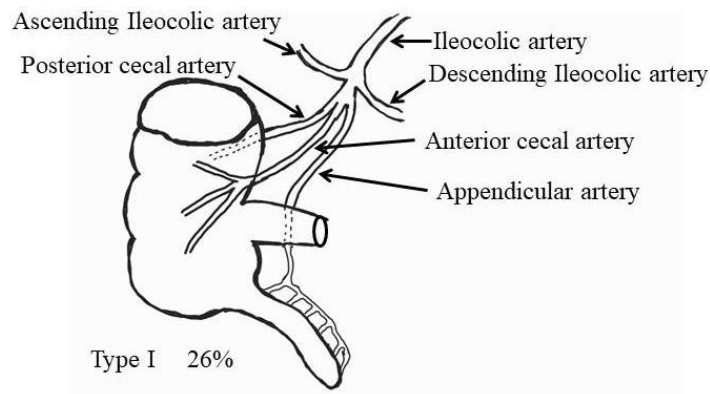


Figure 5: Showing the various types of arterial pattern in the study

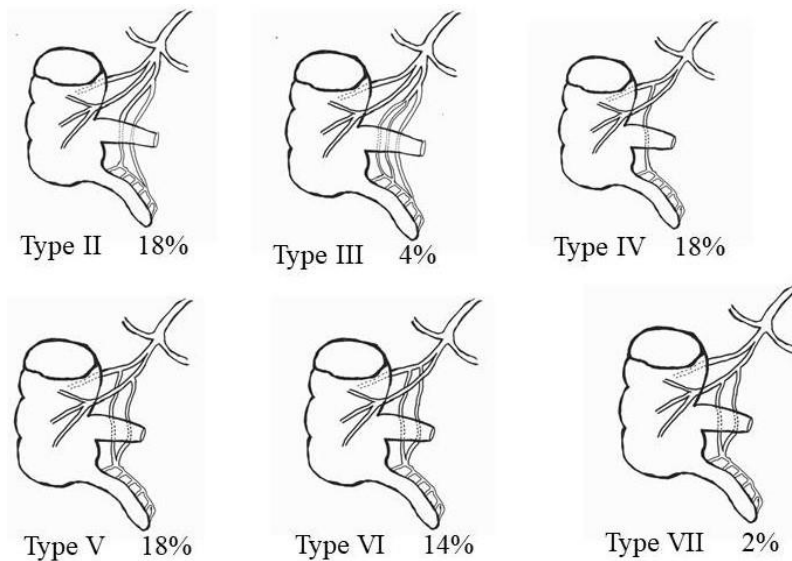


Figure 6: Showing the various types of arterial pattern in the study

DISCUSSION

In present study we were able to observe the length of appendix varies from 1.5 cm to 14.3 cm in male and 4.2cm to 16 cm in female and the mean ranges from 9.14cm in male and 8.85cm in female. Similar type of values are observed in Umamaheswara Rao(8), Asha R. Searle(10), Philip Mwachaka(5) and Ekanayake(11). YUSUF OZGUR CAKMAK et al in his study found that the shorter length of the appendix subjects are more prone to colon cancer whether as a result of congenital or acquired appendicular factors(12). The length and direction of the tip is very essential for the surgeon to understand the relative frequency of the various situations in which the appendix may be found and its relationship to the surrounding pouches and folds of peritoneum. The position of an inflamed or gangrenous appendix and its relationship to adjoining parts frequently determine the site of an abscess(13).

Mesoappendix is the mesentery of the appendix this structure encloses the blood supply to appendix. In our study the mesoappendix was completely covering the appendix till the tip in 34% cases and covers partially in 66% cases similar type of observation was found in Joshi(14) In a study conducted by Ghorbani A the age group below 10 years old has the highest prevalence of incomplete mesoappendixes. The blood supply to the appendix's tip may be decreased if the mesoappendix is incomplete, which increases the risk of gangrene and perforation. It could indicate a dismal prognosis for youngsters with acute appendicitis. One of the potential causes of the severity of pediatric appendicitis is an incomplete mesoappendix(15).

In our study vascular pattern of appendix was higher 26% in Type I Pattern, 18% in Type II, IV & V Pattern, 14% in Type VI Pattern, 4% in Type III Pattern, and 2% in Type VII Pattern. The vascular of appendix was variable, most of the vascular pattern was type I, II, IV, VI & V. Majority of arteries arising directly from ileocolic arteries or from its branches (posterior cecal or anterior cecal or from its branches). The least type of arterial pattern was type VII and artery arising from anterior cecal artery. Similar type of observation was observed by M.A.Shah(9) C. Swathipriyadarshini (16) Solanke TF(17). Palaniappan Gajapriyain his study observed In 64% of samples, a single artery and in 36%, two arteries, supplied the appendices(18). Pitynski and Aridom B, observes in their study that appendix was supplied by a branch from the ileocolic branch of superior mesenteric artery in human fetuses (19,20).

During the surgical procedure, In I, II, III type of vascular patterns during appendectomy procedure, just ligation of appendicular artery close to its origin from ileo colic artery is sufficient. In case of vascular pattern IV the artery arises from posterior cecal artery and it can be ligated at the commencement itself. In vascular pattern V the arteries has to be ligated at the level of commencement of anterior and posterior cecal artery, double ligation and divisions is required in these cases. In vascular pattern VI and VII ligation should be done in origin of posterior and anterior cecal artery and double ligation should be done at the commencement of artery during the appendectomy procedure.

In present study we were able to observe the length of the appendix was higher in the Age group 10-20 was 12.2 cm, Age group 21to 30 was 9.4 cm, Age group 31 to 40 was 9.29 cm, Age group 41 to 50 was 7.92 cm and 51 to 60 was 7.78 cm. From the result were are able to evaluate the length of the appendix was more in the Age group 10 to20 and less in the Age group of 51 to 60. Similar type of finding was observed by Ehab I. El-Amin (21). Our study is disagree with Asha R. Searle (10) which states that

as age advance the length of the appendix increases. Study has already state the length of appendix can also be a causative factor for the cause of colon cancer(22). Palaniappan Gajapriyain his study recorded the Normal appendices were 7.8 to 2.33 cm in length on average, while diseased appendices were 6.05 to 1.83 cm. The length of the mesoappendix from the tip of the appendix was reduced in 77% of the normal appendices and 81.81% of the diseased appendices(18).

CONCLUSION

In appendicitis procedure the varying vascular anatomy pattern may lengthen the surgical procedure and lead into more difficult scenario during appendectomy. Planning ahead for surgery requires being aware of these anatomical variances. Depending on the position, length and attachment of mesoappendix, signs and symptoms of appendicitis may differ and complicate the diagnostic process. The knowledge about varying pattern of vascular pattern of appendicular artery helps not only in proper planning of appendectomy procedure but also it is helpful in conservative management of early acute appendicitis

Reference

- 1) Hanumant P Lohar, Murtuza Ali Asger Calcuttawala, Dakshyani Satish Nirhale, Virendra S Athavale, Manish Malhotra NP. Epidemiological aspects of appendicitis in a rural setup. *Med J Dr DY Patil Vidyapeeth.* 2014;7(6):753–7.
- 2) Williamson WA, Bush RD, Williams LF. Retrocecal appendicitis. *Am J Surg.* 1981;141:507–9.
- 3) Kacprzyk A, Droś J, Stefura T, Krzysztofik M, Jasińska K, Pędziwiatr M, et al. Variations and morphometric features of the vermiform appendix: A systematic review and meta-analysis of 114,080 subjects with clinical implications. *Clin Anat.* 2020;33(1):85–98.
- 4) Sarma M, Dutta M, Doley A. Different Positions of Vermiform Appendix in Human Cadavers: A Cross-sectional Study. *Int J Anat Radiol Surg.* 2022;11(3):29–32.
- 5) Mwachaka P, El-busaidy H, Sinkeet S, Ogeng'o J. Variations in the Position and Length of the Vermiform Appendix in a Black Kenyan Population. *ISRN Anat.* 2014;2014(Figure 1):1–5.
- 6) Khatun S, Thakur D, Shah DK. Prevalence of Retrocaecal Appendix among Patients with Appendicitis in a Tertiary Care Hospital of Nepal. *J Nepal Med Assoc.* 2019;57(217):150–3.
- 7) Boddeti RK, Kulkarni R, Murudkar PKH. Unique 28 Cm Long Vermiform Appendix. *Int J Anat Res.* 2013;1(2):111–4.
- 8) Rao SU, Narasamma KC, Shahajeer B. Vermiform Appendix in Adults. *J Evid Based Med Healthc.* 2015;2(14):2174–9.
- 9) M.A.Shah MS. The Arterial Supply of the Vermiform Appendix. *Anat Rec.* 1946;95(1):457–60.
- 10) Searle AR, Ismail KA, Macgregor D, Hutson JM. Changes in the length and diameter of the normal appendix throughout childhood. *J Pediatr Surg [Internet].* 2013;48(7):1535–9. Available from: <http://dx.doi.org/10.1016/j.jpedsurg.2013.02.035>
- 11) Ekanayake PMNS, Amaratunga HA, Vadisinghe AN, Senasinghe P, Adikari SB. The position and morphology of the vermiform appendix in Sri Lankans: a study on autopsies. *Sri Lanka Anat J.* 2017;1(2):31.
- 12) Cakmak YO, Ergelen R, Ekinci G, Kaspar EC. The short appendix vermiformis as a risk factor for colorectal cancer. *Clin Anat.* 2014 Apr;27(3):498–502.
- 13) Gladstone RJ, Wakeley CPG. The relative frequency of the various positions of the vermiform appendix: As ascertained by an analysis of 3000 cases: With an account of its development. *Br J Surg.* 1924;11(43):503–20.

- 14) Mohini M Joshi SVP. Morphological Variations of Vermiform Appendix : a Cadaveric Study. *Int J Anat Surg head, neck brain.* 2023;9(1):20–4.
- 15) Ghorbani A, Forouzes M, Kazemifar AM. Variation in Anatomical Position of Vermiform Appendix among Iranian Population: An Old Issue Which Has Not Lost Its Importance. *Anat Res Int.* 2014;2014:1–4.
- 16) Swathipriyadarshini C, Rajilarajendran H, Balaji T, Gnanasundaram V. A comprehensive study of mesoappendix and arterial pattern of appendix. *Turkish J Surg.* 2022;38(1):55–9.
- 17) Solanke TF. The blood supply of the vermiform appendix in Nigerians. *J Anat.* 1968 Jan;102(Pt 2):353–61.
- 18) Gajapriya P, Sivaraj S, Prasanna M. Luminal and Extraluminal Factors in Normal and Pathological Appendix- A Cadaveric Study from Central Kerala, India. *Int J Anat Radiol Surg.* 2023;12(1).
- 19) Pityński K, Skawina A, Gorczyca J, Kitliński M, Kitliński Z. Arterial vascularization of the vermiform appendix in human fetus. *Folia Morphol (Warsz).* 1992;51(2):159–64.
- 20) Banerjee A, Kumar Ia, Tapadar A, Pranay M. Morphological variations in the anatomy of caecum and appendix - A cadaveric study. *Natl J Clin Anat.* 2012 Jan 1;1:30.
- 21) I. El-Amin E, Y. Ahmed G, Amen Mohammed Ahmed W, E. Khalid K, M. E. A. Sakran A. Lengths and Positions of the Vermiform Appendix among Sudanese Cadavers. *AIMS Med Sci.* 2015;2(3):222–7.
- 22) Examination MDD, Ekanayake PMNS, Amaratunga HA, Vadisinghe AN, Senasinghe P, Adikari SB, et al. The short appendix vermiformis as a risk factor for colorectal cancer. *J Pediatr Surg* [Internet]. 2017;9(4):1–5. Available from: <http://dx.doi.org/10.1016/j.jpedsurg.2013.02.035>