

Research Article

A study on length, position, variations in arterial supply and nature of lumen of appendix at different stages of life

Jessy Rose George*

Department of Anatomy, Government Medical College, Kozikode, Kerala, India

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***Correspondence:**

Dr. Jessy Rose George,

E-mail: medicogen.doc@gmail.com

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ABSTRACT

Background: The appendix or vermiform appendix is a blind-ended tube connected to the cecum, from which it develops embryologically. Since, the morphology of human appendix greatly varies at different age groups; the present study was undertaken to record the length, position, variations in arterial supply, nature of lumen of appendix at different stages of life.

Methods: The morphology of human appendix was studied in 100 specimens of varying age groups after the ethical clearance. The length, position, variations in arterial supply, nature of lumen of appendix at different stages of life was recorded.

Results: Present study showed that female appendices were slightly shorter (by around 1 cms) than male appendices of same age group. Also there was a gradual increase in the length of the appendix till the early 4th decade and then showed a gradual decrease. Single appendicular artery was observed in most of the cases whereas double appendicular arteries were observed only in few cases. The origin of the arteries showed variation in both cases.

Conclusions: The lumen of the appendix of a young person often appears somewhat 3 cornered instead of circular but in adults usually rounded and in advancing years it may become obliterated by connective tissue replacing its mucous membrane as well as fitting its lumen.

Keywords: Appendix, Length, Position, Variations in arterial supply, Nature of lumen

INTRODUCTION

The appendix or vermiform appendix is a blind-ended tube connected to the cecum, from which it develops embryologically. The cecum is a pouch like structure of the colon, located at the junction of the small and the large intestines.¹

The human appendix averages 9 cm in length but can range from 2 to 20 cm. The diameter of the appendix is usually between 7 and 8 mm. The appendix is usually located in the lower right quadrant of the abdomen, near the right hip bone. The base of the appendix is located 2 cm beneath the ileocecal valve that separates the large intestine from the small intestine. A vermiform appendix

of some type or other can be found in nearly every mammal. Only the capybara and the lower apes are the two mammals lacking a vermiform appendix. The presence of it in almost all mammals suggests that the appendix is important to mammalian physiology.² It has its own blood supply and an independent mesentery, which indicates that the appendix is not a part of some other organ.

In recent years, doctors have observed that the appendix is a tough soldier against infection, especially in people who have been exposed to some types of radiation. Inside the appendix is lymphoid tissue which helps produce white blood cells that fight disease.³ Also, early in a child's life the appendix is relatively larger than it is in

adults. It is during these early stages of life that the appendix appears to play an even bigger role in guarding the body from infection.

Current theory points to the fact that the vermiform appendix contains a great deal of lymphatic channels. Lymph is the body's primary method for combating infection and foreign bacteria.⁴ The appendix also happens to feed into the cecum at the beginning of the large intestine. The large intestine is the home to many types of bacteria (*E.coli* being the most common). These bacteria are not all "bad" and may play an important role in our digestion processes. However, bacteria populations can get out of control sometimes, and that's when the lymphatic's of the appendix may be important. In effect, the appendix may help to regulate the population of bacteria in our gut.

The morphology of human appendix shows varying features at different age groups. Macphail found the average length of the appendix in 220 consecutive post mortem examinations to be 9,9 cms.⁵ It has been described as tending to be about a centimetre longer in the male than in the female. Its average diameter is about 6mm at its base. Later, Williams and Warwick described that the length of the appendix varies from 2 to 20 cms in length, average being about 9 cm.⁶

Lord Zuckermann was of the opinion that the appendix is very variable in length and averages about 10 cms.⁷ It has got a triangular mesoappendix, which encloses the appendicular artery. Position of appendix is also variable. Lgaku- Shoin' described appendix as a uniformly cylindrical structure and is usually 6 to 12 cms long and about 0.80cm wide and may occupy a great variety of positions.⁸ Since, the morphology of human appendix greatly varies at different age groups; the present study was undertaken to record the length, position, variations in arterial supply, nature of lumen of appendix at different stages of life.

METHODS

The present study was conducted after an institutional ethical clearance. Fifty six human appendices were collected for the gross study from bodies brought for post-mortem examinations to the mortuary of a tertiary care hospital. Forty four foetal specimens were also obtained from labour room of the same hospital. The specimens were grouped according to age. They were from different age groups ranging from still born to eighty seven years. After removing the appendices, they were examined for any congenital abnormalities like cyst, duplication, diverticula, length, width, lumen patency, mesentery attachment, fixity, and entrance of the artery in relation to the mesentery and also for the presence of accessory artery.

RESULTS

Hundred appendices comprising of 44 foetal and of varying ages were examined for the study.

Table 1: Gender and age wise details of number of appendix of various age groups.

Age of specimens	Male	Female	Total specimens
Foetal period	26	18	44
0-10 years	5	3	8
11-20 years	4	3	7
21-30 years	8	6	14
31-40 years	7	5	12
41-50 years	5	3	8
51-60 years	3	1	4
61-70 years	2	0	2
71-80 years	1	0	1
Total	61	39	100

Table 2: Length wise details in centimetres of the appendix of various age groups.

Age of Specimens	Male specimens			Female specimens			Total specimens	
	No.	Mini.	Max.	No.	Mini.	Max.	No.	Average
Foetal period	26	2.5	7.0	18	3.1	6.9	44	5.4
0-10 years	5	6.8	8.2	3	6.8	9.1	8	7.8
11-20 years	4	7.2	9.9	3	7.4	9.4	7	9.4
21-30 years	8	8.5	10.4	6	8.1	9.7	14	9.8
31-40 years	7	9.2	12.1	5	8.9	11.6	12	10.3
41-50 years	5	8.6	9.7	3	8.3	9.4	8	9.1
51-60 years	3	7.5	8.8	1	7.1	7.1	4	7.7
61-70 years	2	6.9	7.3	0	-	-	2	7.1
71-80 years	1	6.7	6.7	0	-	-	1	6.7
Total	61			39			100	

For convenience of description, the cases have been classified according to the age in decades. All the specimens collected were at first looked for congenital anomalies like duplication, atresia of lumen, any diverticulum formation and cysts. The 44 available foetal specimens of both male and female were apparently similar in appearance. Only in 2 cases, the appendix was found in the subhepatic position {failure of descend of caecum} and also the appendix arising from the apex of the caecum. In one foetal specimen, conical caecum with appendix from its apex was observed.

Table 3: Position of appendix of various age groups.

Position of appendix	Number
Retrocaecal	44
Promontoric	29
Pelvic	24
Retroileal	03
Total	100

Table 4: The features of the lumen of appendix at various age groups.

Age	Features of the lumen of Appendix
Foetus	5 mm in diameter
1 st decade	7 mm in diameter
2 nd decade	Lumen appeared as almost Y shaped or irregular and it changed to oval in shape in the later period
3 rd decade	Lumen appeared narrow as the thickness of the wall of the appendix increased due to abundance of lymphoid tissue
4 th decade	Lumen started appearing wider again.
5 th decade	The lumen became oval in shape
6 th decade	The lumen became still more oval in shape
7 th decade and in 8 th decade	Lumen was almost obliterated due to the connective tissue in it

Specimens were measured in relation to length and width. Length of foetal appendices showed a gradual increase towards full term. Minimum length 2.5cm and the maximum 7 cm were at full term.

The maximum length of appendix found was 12.1 cm at an age of 33 years. Average length of foetal appendix was 5.4 cm. The average length was 9.2 cm for all other age groups. Average length of all specimens was 7.5 cm (Table 2).

Out of the 100 cases examined, Retrocaecal position of appendix was found in 44 cases. In 29 cases promontonic position and in 24 cases pelvic position was seen. Only in 3 cases of retroileal position could be found (Table 3).

In this study, retrocaecal was the most common position observed because of the postero medial origin of appendices. The features of the lumen of appendix are shown in the Table 4.

Table 5: Blood supply of appendices.

Single appendicular artery		Double appendicular arteries	
Origin from	Number	Origin from	Number
Lower division of ileocolic	59	One branch from descending branch of ileocolic artery	8
Posterior caecal	15	One branch from posterior caecal artery	5
Ileal branch of ileocolic	5	Both branches from posterior caecal artery	8

In this study, 79 specimens were having only one appendicular artery and 21 specimens were having double appendicular arteries.

Entrance of the artery at the base of mesoappendix was observed in most of the cases. The appendicular artery

passed behind the terminal ileum to enter the mesentery. The appendicular artery passed in the edge of mesentery initially and then along the wall distally. Arterial anastomosis were found in the mesoappendix and between the branches of main appendicular and accessory appendicular artery. In most cases single appendicular

artery ended at the tip of the appendix as an end artery. Tip of the appendix was poorly supplied as compared with the rest (Table 5).

DISCUSSION

In the present study, the length of the appendix showed a gradual increase during foetal period. Minimum length of foetal appendix was 2.5 cm and maximum of 7 cms was attained by full term. The average length of specimens of all age groups measured in this study was 9.2 cm. The length of appendix was again gradually increased up to fourth decade (31-40 years). There was a gradual decrease in the length of the organ and by seventh and eighth decades the length was almost similar to the appendix of foetal period.

Buschard K et al stated that the average length of the appendix at full term delivery was 4.5cm.⁹ Williams and Warwick described that the length of the appendix varies from 2 to 20 cms in length, average being about 9 cm.⁶ It was no longer in the child than in the adult and may atrophy and become smaller after middle age. Garven also stated that appendix is larger in children than in later life.¹⁰ The present Study confirms the decrease in length of appendix in advanced age groups. Lord Zuckermann was of the opinion that the appendix is very variable in length and averages about 10 cms.⁷

The length showed a constant relation with sex. Appendices of female sex were found to be slightly shorter by around 1 cm than that of male sex of same age. According to Macphail, the appendix has a tendency to be about a cm longer in male than in the female.⁵ The study confirms this. The width at the base of appendix did not show any significant relation with the age and sex of the cases. The width at the base of appendix varied between 2mm to 8mm. Chaurassia BD reported that the diameter is about 5 mm in children.¹¹

Position of appendix in the present study was, 44% were in retrocaecal position, 29% in promontoric position, 24% pelvic and only 3% retroileal. H Morsel reported pelvic position of the appendix as the most frequent position.¹² 58% of his foetal specimens and 58% of adult specimens were pelvic in position. The retrocaecal and retrocolic position was encountered in 26% of foetal and 26.70% of adult specimens.

Gray H et al reported that appendix may occupy one of several positions as, it may lie behind the caecum and lower part of ascending colon (retrocaecal and retrocolic) or it may be descend over the brim of the lesser pelvis (Pelvic or descending) in which case it lies in close relation to the right uterine tube and ovary in the female or it may lie below the caecum (subcaecal) or it may lie in front of the terminal part of the ileum and may then be in contact with the anterior abdominal wall or it may lie behind the terminal part of ileum.¹³ Buschard et al classified all positions into 2 groups viz., anterior (pelvic

and ileo caecal) and posterior (retrocaecal and subcaecal).⁹ He made his study in both Danish and Czech populations and he found that in Danish 58.80% of appendices were in posterior position and in Czech only 44.10% where in posterior position. He also noted none of the materials showed any difference in position according to sex.

Peterson in an analysis of 28 foetuses noted that 50% of appendices were pelvic in position, 18% ileocaecal and 32% retrocaecal.¹⁴ Smith recorded 24.20% of 882 infant appendices in the retrocaecal and retrocolic position.¹⁵ Gardner WD et al described the usual position of appendix as towards pelvis directed inferomedially.¹⁶ Wakely suggested that the frequency of the retrocaecal and retrocolic position could be explained on the basis of the embryological development of the caecum and appendix.¹⁷ He noted that during growth the caecum undergoes a helicoidal torsion where by the ceco-appendiceal junction is shifted upwards, backwards. The appendix is similarly displaced and comes to lie retrocaecally. Wakely regards this as the normal position of the appendix.

The size and shape of lumen of all foetal specimens presented with a lumen of minimum 5mm. At full term the size was about 7mm. Geraint T Williams found that the lumen does not usually exceed 2-3mm in diameter and its normal volume is less than 0.5 ml.¹⁸ The lumen was wide in younger age group and towards the 2nd and 3rd decade, the lumen appeared narrow as the thickness of the wall of the appendix increased due to abundance of lymphoid tissue. By 4th decade, the lumen started appearing wider again. By 5th decade, the lumen became oval in shape. Almost the same feature was observed in 6th decade. Towards the end of the 7th decade and in 8th decade, the lumen was almost obliterated due to the connective tissue in it.

Ribbert reported that the lumen to have become obliterated in one half the subjects over 50 years of age.¹⁹ A W Ham and David H Cormack said that, in advancing years, the lumen of the appendix may become obliterated by connective tissue.²⁰ Till the end of the 2nd decade, the lumen was almost Y shaped or irregular and it gradually changed to round or oval in the later period. Sir John Bruce, Robert Walmsley and James A Ross described the lumen as Y shaped in young people, but more round in adults.²¹ They also reported microscopically the lumen of the appendix of a young person often appears somewhat 3 cornered instead of circular but in adults usually rounded and in advancing years it may become obliterated by connective tissue replacing its mucous membrane as well as fitting its lumen.

CONCLUSION

The lumen of the appendix of a young person often appears somewhat 3 cornered instead of circular but in adults usually rounded and in advancing years it may

become obliterated by connective tissue replacing its mucous membrane as well as fitting its lumen.

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