Birjand University of Medical Sciences

Journal of Surgery and Trauma

Original Article

Evaluation of the anatomical position of the appendix in patients underwent appendectomy

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Abstract

Introduction: The appendix is a narrow, worm-shaped tube that separates from the inner wall of the cecum. The length of the appendix varies from 2 to 20 cm, but on average it is 9 cm and can be placed in different positions. It seems essential to determine common positions of the appendix in different populations to reduce the risk of complications associated with surgical treatment. The aim of this study was to evaluate the position of the appendix in appendectomy patients referred to the General Surgery department of Shohada-e-Ashayer Hospital, Khorramabad, Iran, from 2016 to 2019.

Method: This was a retrospective cross-sectional study conducted on patients who underwent an appendectomy at Shohada-e-Ashayer Hospital, from 2016 to 2019. In this study, data including gender, age, appendix position, Body Mass Index (BMI), appendicitis pathology, and length of the appendix were collected from all patients referred to the hospital for an appendectomy. The collected information was entered into SPSS software (Version. 22) and analyzed using Chi-square and One-Way ANOVA tests at a 0.05 significance level.

Results: This study was conducted on 222 appendectomy patients, of whom 128 patients (57.7%) were men and 94 (42.3%) were women. The mean age of the subjects was 28.32±14.84 years. The length of the appendix varied from 4.5 to 25 cm with an average length of 10.41±3.03cm. The most frequent position in the study population was the anterior position, which was observed in 112 subjects (50.45%), followed by the retro-cecal position in 95 (42.79%), and the para-cecal position in 15 patients (6.76%).

Conclusion: In our study population, the anterior position was the most common appendix orientation. Also, a relatively high frequency of retro-cecal position was observed.

Keywords: Vermiform Appendix, Cecal Diseases, Appendicitis, Appendectomy

Citation: Karimi Rouzbahani A, Mahmoudvand G, Nejad Shahrokh Abadi R, Yousofvand F, Mahmoudvand H, Sharifian M. Evaluation of the Aanatomical position of the appendix in patients underwent appendectomy. J Surg Trauma. 2023; 11(3): 96-101.

Received: November 13, 2022 ***Revised: April 28, 2023*** ***Accepted: October 7, 2023***

[Downloaded from jsurgery.bums.ac.ir on 2026-11-15]

[DOI: 10.61186/jsurgtrauma.11.3.96]

Introduction

The appendix is a narrow worm-shaped tube varying from 2 to 20 cm in length, that separates from the inner wall of the cecum around 2 to 3 cm below the ileocecal valve (1, 2).

Although it is located in the cecum, its general position might vary from patient to patient, being classified into two groups; 1) the anterior group which includes: pre-ileal, para-cecal, pre-cecal, para-colic, and pelvic, and 2) the posterior group which includes: retro-colic, sub-cecal, retro-cecal, retro-ileal, and retro-ileocecal (3).

Increased pressure inside the appendix from the buildup of mucus, typically secondary to the accumulation of fecal matter or lymphoid tissue, results in appendicitis.

Obstruction of blood flow leads to the necrosis and rupture of the mucosal wall causing infection within the abdominal cavity and may result in the formation of phlegmon or an inflammatory mass (4, 5).Vague pre-umbilical pain that radiates to the right lower quadrant at the McBurney's point within a few hours of onset, and general signs of anorexia, diarrhea or constipation, nausea and vomiting, and fever, are the classic symptoms of appendicitis. Additionally, different orientations of the appendix can result in different signs, such as the Psoas sign (abdominal pain due to right leg extension) associated with retro-cecal appendicitis, and the Obturator sign (abdominal pain due to internal rotation of the right hip) associated with pelvic appendicitis (6, 7).

Diagnosis of acute appendicitis is based on the classical symptoms along with radiologic and laboratory findings, with the treatment of choice being a surgical approach.Several studies have shown that the common orientation of the appendix in different populations is quite varied (6, 8).

It seems essential to determine common positions of the appendix in different populations to reduce the risk of complications associated with surgical treatment. Therefore, this study was performed to evaluate the frequency of unusual appendix positions in appendectomy patients in Lorestan province, Iran.

Materials and Methods

This was a retrospective cross-sectional study conducted on patients who underwent an appendectomy at Shohada-e-Ashayer Hospital, from 2016 to 2019. The inclusion criteria were as follows: Iranian origin and the indication for appendectomy based on surgical guidelines, while the exclusion criteria were the presence of congenital malformations of the gastrointestinal tract, history of abdominal surgery, history of peritonitis, intestinal distension, or the presence of other factors leading to appendix displacement. The study population consisted of 222 patients who were natives of Lorestan Province.

The medical records of all patients were read. To confirm the diagnosis of appendicitis before surgery, laboratory tests such as cell blood count differentiation, C-reactive protein, ultrasound, and computed tomography scans had been performed according to the 2018 Schwartz classification.

As advised in the literature, the patients had undergone in-hospital appendectomy in the first 24 hours of admission, if their condition allowed (9).

During the surgical procedure and according to the imaging performed (if indicated), appendix had been classified into the anterior or posterior positions, including pelvic, subcecal, retroileal, retrocecal, and preileal, and appendix specimen had been transferred to the Department of Pathology for further evaluation. After reading the patient's medical files, demographic and clinical information including age, gender, type of appendix in terms of histopathology, anatomical location of the appendix, and the length of the appendix were collected and registered into a researcher-made checklist. SPSS software (Version. 22) was used for statistical analysis. Chi-square and One-Way ANOVA tests were used for analysis. $P< 0.05$ was considered statistically significant. In order to keep the patient's personal information confidential, codes were used to identify the individuals. This study was performed with the permission of the Lorestan University of Medical Sciences with the ethical code IR.LUMS.REC.1399.394 and written consent was obtained from all of the participants.

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[DOI: 10.61186/jsurgtrauma.11.3.96]

Results

In this study, 222 patients were included, of whom 128 (57.5%) were males and 94 (42.3%) were females.No negative appendectomy was observed in the patients. The most frequent position in the study population was the anterior position, which was observed in 112 subjects (50.45%), followed by the retro-cecal position in 95 (42.79%), and the para-cecal position in 15 patients (6.76%).As can be seen in Table 1, there was no significant relationship between the appendix position and gender (p-value=0.554).

The age of patients ranged from 20 to 80 years with a mean age of 28.32±14.84 years. The patients were grouped as under 20 years, between 21 and 40 years, from 41 to 60 years, and above 61 years (10). According to the present study, most appendectomy cases were observed in the age group of 21-40 years, as 118 patients (53.15%) were in this age group.It can be seen in Table 1 that the highest frequency of the anterior position was observed in the age group of 21-40 years, as 63 patients (28.37%) in this age group had the anterior position.

Table 2 shows the mean age of patients in different appendix position categories. The mean age of patients with the retro-cecal position was 28.34±14.43 years, while it was 29.73±15.68 and 28.11±1.20 years in the paracecal and anterior positions, respectively. One-Way ANOVA showed no significant difference between the mean age of patients in different appendix position categories (p-value=0.925).

In terms of Body Mass Index (BMI), 83 patients (37.4%) had low, 111 patients (50%) had moderate, and 28 patients (12.6%) had high BMI.

As shown in Table 1, in patients with low and moderate BMI, the anterior position was more common, while in patients with high BMI, the retro-cecal position was more frequent.

The Chi-square test showed no significant relationship between the appendix position and the BMI in this study (p-value=0.545).

As can be seen in Table 3, the highest pathology reported in the patients was acute appendicitis (38%) while the lowest was no specific pathological change (NSPC) with 7%.

Table 1 shows the frequency distribution of the appendix position by pathology of appendicitis. The results indicated that the most common pathology was acute appendicitis in the anterior and retrocecal positions and purulent appendicitis in the paracecal position.

In addition, gangrenous and perforated appendicitis were the most common in the retro-cecal position. The result of Chi-Square test showed that there was a significant relationship between the position and pathology of appendicitis (p-value < 0.05).

The length of the appendix in this study varied from 4.5 to 25 cm with an average size of 10.41±3.03 cm.

Table 4 shows the mean length of the appendix in different appendix position categories. The results showed that the mean length of the appendix in the retro-cecal position was slightly higher than in other positions (10.85±3.16cm).

However, One-Way ANOVA demonstrated no significant difference between the mean length of the appendix in different groups (p-value=0.169).

Table 1. The comparison of the demographic and medical characteristics between the studied groups

Variable of Retro-Cecal		Appendix position Number (%)			*P-V**
		Para-cecal	Anterior	Anterior	
Gender	Male	57 (44.5)	10 (7.8)	61 (47.7)	0.554
	Female	38 (40.4)	5 (5.3)	51 (54.3)	
Age group	≤ 20	34 (49.3)	3 (4.3)	32 (46.4)	0.575
	21-40	46 (39)	9 (7.6)	63 (53.4)	
	41-60	14 (48.3)	2 (6.9)	13 (44.8)	
	≥ 61	1 (5.6)	13 (72.2)	4 (22.2)	
BMI	Low	38 (45.8)	4 (4.8)	41 (49.4)	0.545
	Moderate	43 (38.7)	8 (7.2)	60 (54.1)	
	High	14 (50)	3 (10.7)	11 (39.3)	
Appendicitis Pathology	Acute	30 (37.1)	1 (1.2)	50 (61.7)	0.001
	Purulent	21 (38.9)	7 (13)	26 (48.1)	
	Gangrene	10 (62.5)	2 (12.5)	4 (25)	
	Perforated	15 (83.3)	1 (5.6)	2 (11.1)	
	Congested	14 (36.8)	2 (5.3)	22 (57.9)	
	NSPC	5 (33.3)	2 (13.3)	8 (53.3)	

Chi-square test*

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[DOI: 10.61186/jsurgtrauma.11.3.96]

Table 2: Comparison of the patients' mean age in different appendix position categories

Appendix position	Number	Mean age (years)	Standard Deviation	*p-value
Retro-cecal	95	28.34	14.43	0.925
Para-cecal	15	29.73	15.68	
Anterior	112	28.11	1.20	
Total	222	28.32	14.84	

* One-Way ANOVA

Table 3: Frequency distribution of appendicitis pathology in the entire population

Appendicitis Pathology	Number	Percent (%)
Acute	81	38
Purulent	54	25
Gangrene	16	8
Perforated	18	9
Congested	38	13
NSPC	15	7
Total	222	100

Table 4: Comparison of the appendix mean length in different appendix position categories

Appendix Position	Number	Mean Length (cm)	Standard Deviation	*p*-value*
Retro-cecal	95	10.85	3.16	0.169
Para-cecal	15	10.20	2.40	
Anterior	112	10.06	3.00	
Total	222	10.41	3.03	

* One-Way ANOVA

Discussion

Understanding the variations of the appendix can help diagnose appendicitis more quickly and prevent its subsequent complications such as perforation and peritonitis (3, 7). The most common position of the appendix observed in this study population regardless of age and sex was the anterior position, followed by the retro-cecal position, and the para-cecal position. Previous studies in Iran have reported controversial results. Ghorbani et al. reported a 75% prevalence of anterior position among the Iranian population, which is consistent with other studies in Iran. This can facilitate the timely diagnosis of appendicitis as well as reduce hospital length (11).

A study performed on 60 corpses in Sudan reported that the most frequent orientation of the appendix was the retro-cecal position, followed by pelvic, while post-ileal and pre-ileal had the lowest frequency. They also found that age was an influential factor in appendix position (12). In our

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[DOI: 10.61186/jsurgtrauma.11.3.96]

study, a slight male predominance was observed among patients undergoing appendectomy. This is consistent with the results of previous studies indicating that the incidence of appendicitis was slightly higher in men than in women (13). Furthermore, the highest incidence of appendicitis was observed in the 21-40 age group. A similar age pattern has been reported in previous studies (14). The mean length of the appendix was slightly higher in the retro-cecal position compared with the others. However, the relationship between the orientation of the appendix and its average length was found to be statistically insignificant. It was observed that complex cases of appendicitis such as gangrene and perforation, were less common in anterior orientation, which may be due to a relatively faster and easier diagnosis. This study found no statistically significant relationship between appendix position and age, sex, appendix length, and BMI, but there was a significant relationship between appendicitis pathology and appendix position. In the present study, histopathological findings of the patients showed that acute appendicitis was the most commonly reported pathology constituting 81 of all cases. This was followed by purulent appendicitis, probable appendicitis, perforated and gangrenous appendicitis, respectively, with the least commonly reported pathology being NSPC. These results are in line with a study done in Saudi Arabia on 129 subjects, where the most commonly reported histopathological diagnoses were acute appendicitis, gangrenous perforated appendicitis, and chronic appendicitis. (15).

This was a single-center study, hence its results should be interpreted in this regard. However, different variables were analyzed to aid in understanding the epidemiological and anatomical patterns of appendicitis in the study population.

Conclusion

Although in our study population, the anterior position was the most common appendix orientation, a relatively high frequency of retro-cecal position was observed. Further studies with larger sample sizes and variables are recommended to investigate the patterns of appendix positions among the Iranian population.

Acknowledgments

None.

Funding

The authors received no financial support for the research and/or authorship of this article.

Conflict of Interest

The authors report no conflict of interest.

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[DOI: 10.61186/jsurgtrauma.11.3.96]