

# A Study of Anatomical Positional Variation of Appendix by USG Findings and Analysing with Operative Findings in Patients of Appendicitis at a Tertiary Health Center

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**Abstract:** ***Introduction:** Appendix is a diverticulum of the cecum. It is a wormlike structure. Though a remarkably constant structure, appendix is occasionally subjected to extremes of variation. Appendix is one of the most mobile viscera with positional variation. A strong association has been found between position of appendix and severity of appendicitis, resulting in longer hospital stays and in high incidence of gangrene and perforation. This study aims to determine the position of appendix identification by ultrasound abdomen and analysing with intraoperative findings. **Materials and methods:** This research involved 100 participants. The study group comprised of 100 individuals diagnosed with Acute Appendicitis and posted for surgery in the Department of General Surgery, at Sri Devaraj Urs Medical College. The study was conducted over a one - year period, from October 2022 to October 2023. **Results:** 100 patients of appendectomy were studied. Of the whole group 62% (N = 62) were male and 38% (N = 38) female. Patients of all the age and both sex were studied. The positions of the appendix found were as follows (In descending order): - retrocecal: 66% (N=66), pelvic: 27% (N=27), post - ileal: 3% (N=3), subcecal: 2% (N=2), paracecal: 1% (N=1), pre - ileal: 1% (N=1). **Conclusion:** The study identifies most common position is retrocecal one. Signs and symptoms show discrepancy depending upon the position of the appendix. This will lead to misdiagnosis of appendicitis with other medical or surgical conditions and diagnosis will be delayed. This results in development of an advanced appendicitis, high incidence of gangrene, perforation, peritonitis, which results in longer hospital stay. Therefore, knowledge of various positions of appendix is useful.*

**Keywords:** Acute Appendicitis, Positional variation of Appendix, Ultrasonography Abdomen

## 1. Introduction

Appendix is a diverticulum of the cecum and marks the beginning of the colon at the confluence of teniae. It is a wormlike structure, arises in embryological life from the posteromedial wall of the cecum, about 2 cm below the ileocecal valve. [1-8]

Though a remarkably constant structure, appendix is occasionally subjected to the extremes of variation, that is, total suppression and duplicity. Its length varies from 2 to 20 cms, in average 9cms. [2] The base of appendix is connected to the cecum, but its tip can be placed in different positions.

As stated by Maingot 1938, the appendix is the only organ in the body that has no fixed anatomy. [11]

Appendix is one of the most mobile viscera, although its lack of normal position is not so extraordinary. [12] Taking into account that often the appendix is a mobile structure, the importance of its relative position, some authors describe a significant relationship between its location and acute appendicitis. [13, 14]

In a retrocecal position, the blood vessels may be compressed and folded by the cecum. In case of inflammation of the appendix in this position, its blood supply may be compromised. [10].

A strong association has been found between hidden locations of the appendix (post - ileal, pelvic, retroperitoneal) and the development of an advanced appendicitis, resulting in longer hospital stays and in high incidence of gangrene and perforation. [4, 16, 17]

The current study seeks to identify the positional variation among appendix in appendicitis. The objective is to determine the position of appendix identification by ultrasound abdomen and analysing with intraoperative findings.

The goal is to facilitate the identification of positional variation by Ultrasonography and complications due to positional variation.

## 2. Methods

### Study design, sample size and source of data:

This was a study carried out on 100 participants. A Study group with 100 individuals diagnosed with Acute

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Appendicitis and posted for Surgery in the Department of General Surgery at Sri Devaraj Urs Medical College over period of one year from October 2022 to October 2023. Ethical committee approval was obtained from the Institutional Ethics Committee.

#### Inclusion criteria:

- 1) Both sexes with age between 18 - 65 years
- 2) All patients operated for appendicectomy (open / laparoscopic)
- 3) Those who are willing to give written informed consent

#### Exclusion criteria:

- 1) Pregnancy
- 2) Appendicular mass formation

#### Method of data collection:

After obtaining approval from the Institutional Ethical Committee (IEC), scientific committee and informed written consent from the study participants, the study was conducted in the department of general surgery on 100 patients operated for open /laparoscopic appendicectomy from October 2022 to October 2023 admitted in RLJH, Kolar.

All patients will be evaluated with all pertinent laboratory values. All the demographic details were collected from the participants.

A total of 100 cases of appendicectomy enrolled who are subjected to clinical assessment using signs, symptoms and laboratory criteria, histopathology and also the position of the appendix. All patients underwent ultrasound examination by a qualified radiologist to exclude any other associated pathology and also to confirm the diagnosis and position of Appendix. Surgery was done either under general anesthesia or spinal anesthesia.

Abdomen was opened with Lanz or Mc Burney's, or right lower Para median incision, or Laparoscopic visualisation. At surgery the Position of the appendix will be first identified before disturbing the structures and the position of the appendix recorded together with the length of the appendix and also whether it was fixed or freely mobile in the peritoneal cavity, peri - appendiceal collection, presence of perforation or other complications of appendicitis were noted. Also a note will be made of the status of surrounding organs.

#### Statistical Analysis:

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. Normality of the continuous data was tested by Shapiro-Wilk test. Student t test and repeated measure ANOVA tests were used to compare continuous variables. Chi square test was used to compare categorical variables. Graphical representation of data: MS Excel and MS word were used to obtain various types of graphs such as bar diagram, Pie diagram. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

### 3. Results

100 patients of appendicectomy were studied. Of the whole group 62% ( $N = 62$ ) were male and 38% ( $N = 38$ ) female. Patients of all the age and both sex were studied. The positions of the appendix found were as follows ( - retrocecal: 66% ( $N=66$ ), pelvic: 27% ( $N=27$ ), post - ileal: 3% ( $N=3$ ), subcecal: 2% ( $N=2$ ), paracecal: 1% ( $N=1$ ), pre - ileal: 1% ( $N=1$ ).

Gender	No. of Patients
Male	62
Female	38
Total	100

Position	Number of cases
Retrocecal	66
Pelvic	27
Post Ileal	3
Subcecal	2
Paracecal	1
Preileal	1

### 4. Discussion

In the literature, there were number of studies on the position of the normal, inflamed or post - mortem appendix. The largest series documented in the literature studied were 10, 000 [3] and 40, 000 [15] appendices.

In the study by Wakeley (10, 000 cases), the appendix was in retrocecal (65.28%), pelvic (31.01%), subcecal (2.26%), preileal (1%) and post - ileal (0.4%) position [3] which correlates with our study.

The result of our study correlates with study by Baily 1969, Buschard 1973, Ajmani&Ajmani 1983, Shah & Shah 1945, Bakheit&Warille 1996, Delic 2002 Subsequent anatomical and surgical studies in the literature and data obtained by our group show considerable contradiction with respect to this study.

In most reports the values of the most common positions (retrocecal and pelvic) provide reasonable approximations. [14] In these studies, the position most commonly found has been the retrocecal, range was from 18 to 65% of specimens. [3, 9, 15 - 17] Consistent with these findings, in our study, we observed more often appendices in a retrocecal position (66%), and this finding was correlating the range reported by other researchers (18-65%).

The position of the appendix is closely related to the development of the cecum. Initial location of appendix being under the liver, after the 10th week of intrauterine life the foetal intestine returns to the abdominal cavity, causing the cecum to gradually descend into the right iliac fossa, with a counter - clockwise twisting motion around its longitudinal axis. Simultaneously, the anterolateral wall of the cecum stretches and grows faster than the other parts, result in displacement of the appendix from its original position at the apex of the cecum, to an antero - medial position. During this process of cecal descent, the appendix can bend behind the cecum, and if at that time the development of peritoneal lining

is happening, the appendix will remain fixed in this retrocecal position. On the other hand, if the appendix remains free and directed downward during the descent of the cecum, then the appendix will remain permanently as an organ with free mobility after its fixation to the colon. [3, 4, 12, 17]

In adults, the appendix may be fixed in a retrocecal position by the fibrosis resulting from previous episodes of acute appendicitis. [16, 17] Therefore, in view of the extreme mobility of the appendix, and taking into account the fast and extensive changes in the surrounding parts, and also considering the position changes suffered by the appendix when following the cecal migration, it may be concluded that the appendix is subject to more or less intense accidental circumstances that will modify its final position, which are responsible for the various positions in which this organ is described. [3] Gender, age, body posture changes, and varying degrees of cecal contraction have not been described as determinants of the position of the appendix. [14]

Signs and symptoms may show varying degree of discrepancy with the expected symptomatology, depending on the position of the appendix. For example, a pelvic appendicitis can reach the wall of the ureter and bladder, resulting in urinary symptoms. On the other hand, retrocecal appendicitis can promote inflammation of the psoas major muscle and cause low back pain and pain with hip extension. A periileal appendicitis, in turn, can trigger a diarrheal picture indistinguishable of that from gastroenteritis. Occasionally, the picture is so atypical that one can make a mistake with non - surgical intra - abdominal disorders [13, 14] and taking into account the great anatomical variability of the appendix, in the face of episode of acute abdominal pain, acute appendicitis should be suspected. [13]

In the subcecal position, the appendix is completely intraperitoneal. If inflamed, it can cause diffuse peritonitis. Thus, this position can be regarded as the most susceptible to complications. [10]

During embryonic development, further growth of the right wall of the cecum or a stronger torsion of the cecum and ascending colon can shift the base of appendix towards the ileocecal junction area, resulting in pre - ileal and, in extreme cases, post - ileal appendices. [3, 12]

However, in most of the reviewed studies, the pelvic position appears in the second place, and several authors describe this position as the most prevalent, especially in non - surgical cases and in older individuals. [14] The high frequency of pelvic appendices has been associated with the presence of the genito - mesenteric fold, which is a fold of peritoneum coursing vertically from the posterior face of the terminal ileum to the deep right inguinal ring or, in women, to the right ovary. The appendix, as it follows the cecum and turns up and to the left, must come into close proximity with this fold, and tends to be deflected downward, toward the pelvic cavity. [3, 7] The result of our study is contradicting with study by Wass 1960, Peterson 1934, Liertz 1909, Smith 1911 in which retrocecal position is less common.

## 5. Conclusion

The study identifies most common position as retrocecal. Signs and symptoms show degree of discrepancy depending upon the position of the appendix. This will lead to misdiagnosis of appendicitis with other medical or surgical conditions and diagnosis will be delayed. This will leads to development of an advanced appendicitis, high incidence of gangrene, perforation, peritonitis, which results in longer hospital stay. Therefore, knowledge of various positions of appendix is useful.

### Declarations

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Ethical approval: Taken

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