

ORIGINAL ARTICLE

Comparison of Sonographic and Pathological Findings of Patients with Appendicitis in Shahid Sadoughi Hospital in the Center of Iran

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ABSTRACT

Introduction: Acute appendicitis is one of the most prevalent differential diagnosis for acute abdomen. Ultrasound is a noninvasive diagnostic procedure that does not expose the patient to ionizing radiation. We intended to compare ultrasound findings as a diagnostic tool with pathology findings in patients with appendicitis who had undergone appendectomy in this study.

Methods and Materials: A total of 150 patients with abdominal pain were studied in this research. Following confirmation of the diagnosis, these patients underwent surgery. SPSS Version 26 software was used to record and evaluate all demographic information, kind of underlying disease (if any), and duration of symptoms, clinical findings, pre-operation sonography findings and type of treatment and surgery.

Results: The study included 150 patients, with 53.3 percent of them being female and the rest being male. Pathologically positive patients made up 78 percent of the cases analyzed. The highest sonographic finding was 6mm Appendix in terms of sonographic data (37.3 percent). The retrocecal type of the appendix was the most frequent anatomical form, accounting for 63.3 percent of all appendixes. Pathology results and sonography observations of peri-appendiceal fluid collection and peri-appendiceal fat inflammation differ significantly. The pathology findings and the ultrasonography observation of 6mm > Appendix were not significantly different.

Conclusion: Inflammation of the appendix wall without necrosis and an increase in the size of the appendix (>6 mm) are the key ultrasound findings in support of a diagnosis of uncomplicated appendicitis.

Keywords: Ultrasonography, Appendicitis, diagnostic imaging, Surgery, pathology

INTRODUCTION

One of the most common differential diagnoses of acute abdomen is acute appendicitis, which has a prevalence of 7% in European countries and about 200,000 appendectomy is performed annually due to acute appendicitis in the United States (1). The main cause of acute appendicitis is obstruction caused by fecalith, parasites, tumors, etc.

The most common bacteria in normal appendix, acute appendicitis and perforated appendicitis are similar and include *Bacteroides fragilis* and *Escherichia coli* (2). In addition to the symptoms of appendicitis such as pain, anorexia, vomiting, constipation, diarrhea, etc., as well as physical examination and laboratory findings, One of the tools that helps in diagnosis is radiographic findings and one of the least harmful of them is ultrasound (3). Ultrasound is a noninvasive intervention and does not expose the patient to ionizing radiation (4). Ultrasound findings that help diagnose appendicitis include Prominent pericecal fat, Increased appendix diameter, Loculated and prominent pericecal fluid, non-compressibility and etc, that apart from helping to diagnose, the lack of these findings is a clue to reject the diagnosis of appendicitis (5). There are several studies around the world about appendicitis and the importance of ultrasound in its diagnosis (3, 6, 7). Since acute with potentially dangerous complications (8), in this study we aimed to compare ultrasound findings as a

diagnostic method with pathological findings in patients with appendicitis that have undergone appendectomy.

METHODS AND MATERIALS

In this study, which is a descriptive-analytical study, 150 patients with abdominal pain who referred to the emergency department of Shahid Sadoughi Hospital in center of Iran in 2021 were studied. These patients were first examined by a physician and after adjusting the clinical symptoms and physical examination with laboratory findings, were sonographed by a radiologist with the suspicion of appendicitis. These patients underwent surgery after confirmation of the diagnosis. The inclusion criteria in this study were patients who were candidates for appendicitis surgery with an initial clinical and laboratorial diagnosis and based on the results of sonography. Also, not having informed consent for participating in the study was the exclusion criteria from this study. All demographic information of patients including age, type of underlying disease (if any) and duration of symptoms, clinical findings and type of treatment and surgery were recorded. Data were analyzed by SPSS Version 26 software. The patients in this study gave their informed consent to take part in the research. Patients are also promised that their information will be kept confidential and utilized only for the goals of the research. It is assured to patients that the secrets of them maintains in accordance with Helsinki Treaty. Furthermore, patients were not charged any additional fees. The ethics

committee of Yazd Shahid Sadoughi University of Medical Sciences has approved the project.

RESULTS

150 eligible patients were included in the study, of which 53.3% were female and the rest were male. 78% of the studied cases were pathologically positive.

In terms of sonographic results, the highest sonographic finding was 6mm <Appendix (37.3%), (Table N.1). The most common anatomical form of the appendix was retrocecal form with 63.3% prevalence and then pelvic form with 18.7%. The subcecal form (18%) had the lowest anatomical pattern observed (Table N.2). Based on the results of the Chi-square test in terms of the relationship between ultrasound and pathology results, Peri-Appendiceal Fluid collection (P-Value = 0.02) and Peri-Appendiceal Fat Inflammation (P-Value = 0.005), were significantly different from the pathology results and Appendicolith (P-Value = 0.09) and Appendix > 6mm (P-Value = 0.591) did not show a significant difference with pathology results.

Table 1: Frequency distribution of ultrasound results in the studied samples

Sonography	Result	Number	Percentage
Peri-Appendiceal Fluid collection	Negative	110	73.3
	Positive	40	26.7
Peri-Appendiceal Fat Inflammation	Negative	114	76
	Positive	36	24
6mm<Appendix	Negative	94	62.7
	Positive	56	37.3
Total		150	100

Table 2: Anatomical frequency distribution of the studied samples

Anatomy	Number	Percentage
Retrocecal	95	63.3
Pelvic	28	18.7
Subcecal	27	18
Total	150	100

Table 3: Determining and comparing the frequency distribution of pathology findings according to the result of ultrasound, based on Peri-Appendiceal Fluid collection

Sonography	Pathology		Total
	Negative	Positive	
Peri-Appendiceal Fluid collection	Negative	91(82.7)	110(100)
	Positive	26(65)	40(100)
Total	33(22)	117(78)	150(100)

Table 4: Determining and comparing the frequency distribution of pathology findings according to the result of ultrasound, based on Peri-Appendiceal Fat Inflammation

Sonography	Pathology		Total
	Negative	Positive	
Peri-Appendiceal Fat Inflammation	Negative	95(83.3)	114(100)
	Positive	14(38.9)	36(100)
Total	33(22)	117(78)	150(100)

Based on (P-Value = 0.02) obtained from the Chi-square test, there is a significant difference in pathology findings and observation of Peri-Appendiceal Fluid collection in sonography. In other words, if the Peri-Appendiceal Fluid collection is not observed on ultrasound,

appendicitis cannot be ruled out (Table N.3). Based on (P-Value = 0.005) obtained from the Chi-square test, there is a significant difference between pathology findings and observation of Peri-Appendiceal Fat Inflammation on ultrasound. In other words, appendicitis cannot be ruled out if Peri-Appendiceal Fat Inflammation is not seen on ultrasound (Table N.4).

Table 5: Determining and comparing the frequency distribution of pathology findings according to the result of ultrasound, based on appendix> 6mm

Sonography	Pathology		Total
	Negative	Positive	
Appendix> 6mm	Negative	72(76.6)	94(100)
	Positive	45(80.4)	56(100)
Total	33(22)	117(78)	150(100)

Table 6: Comparison of diagnostic methods for appendicitis

Physical examination	Sonography	Clinical findings	Pathology
Positive for all the patients	56%	Positive for all the patients	78 %

Based on (P-Value = 0.591) obtained from the Chi-square test, there is no significant difference in pathology findings and observation of appendix> 6mm in ultrasound. However, if an appendix > 6mm is seen on ultrasound, appendicitis can be suspected with more confidence (Table N.5).

And finally, out of 150 patients suspected of appendicitis (using clinical examination), 78% in pathology and 56% in ultrasound had evidence in favor of appendicitis (Table N.6).

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies. This disease can manifest in various forms and mimic the symptoms of other diseases. Therefore, correct and timely diagnosis of the disease requires special experience and skills. In a study by Sattari et al., 56% of patients who underwent appendectomy surgery were male (9).

In a study by Barband et al., 57% were male and the rest were female (10). In a study conducted by Vakili et al., 55.5% were female and the rest were male (11). In the present study, 53% of the patients were female. As can be seen in different studies, the sex ratio of patients with suspected appendicitis varies. This difference can be due to climatic, cultural, etc. differences that will be effective in the occurrence and diagnosis of appendicitis. In the study of Vakili et al. 79.2% of cases of suspected appendicitis after appendectomy were pathologically positive and other cases were negative (11). In the study of Mohebbi et al., The rate of negative appendectomy was 18.2%. This rate in Tepel study was 22% (12).

In the present study, the negative appendectomy rate was 22%. The clinical diagnostic accuracy of acute appendicitis varies between 76-92%, and due to the possibility of multiple complications in case of delay in its diagnosis, surgeons have accepted a rate of 15-25% negative appendectomy. The percentage of negative appendectomy cases in the present study is consistent with similar studies. In the study of Wakeley et al., 65.3% of the

appendix was in the retrocecal position, 31% in the pelvis, and 2.3% in the subcecal position (13).

In our study, consistent with similar studies, retrocecal appendix with 63.3% was the most anatomical type of appendix, followed by pelvic appendix with 18.7% and subcecal appendix with 18%. Many studies were not found in the field of sonographic variables and their relationship with pathological results. Based on the handful of studies found, the results are as follows:

In the study of Kessler et al., the most valuable finding of appendix-related sonography was the appendix with a diameter of more than 6 mm (sensitivity and specificity 98%). This sonographic finding was significantly associated with pathologically positive appendicitis in our study. According to the study of Kessler et al., another finding that was valuable in diagnosing appendicitis was the inflammation of the fat around the appendix (Negative Predictive value 91% and Positive Predictive Value 76%) (14).

In our study also, there was a significant difference between this finding and the pathology results. In the study of Yingding Xu et al., Peri-Appendiceal Fat Inflammation, Peri-Appendiceal Fluid collection, and appendicolith were associated with complicated appendicitis in univariate regression analysis, but in multivariate regression, there was no significant relationship and the results of this study did not associate the variables, with the incidence of complicated appendicitis (15).

In the study of Tomoyuki et al., the presence of fatty inflammation around the appendix was significantly associated with the severity of inflammation (16). In the present study also, there was a significant difference between the pathology findings and the presence of fatty inflammation on ultrasound.

Inflammation of the fat around the appendix is seen in 13-54% of patients with non-perforated appendix and 13-64% of patients with a perforated appendix and as mentioned, in our study, the presence of this finding showed a significant difference with the pathological findings, which can be interpreted as if such a finding is seen on ultrasound, the presence of appendicitis cannot be considered with high confidence. The results of the study on the fluid around the appendix were also similar.

Recommendation: In order to reach an acceptable conclusion, it seems better to design and implement other similar studies by calculating the sensitivity, specificity, positive and negative predictive value to make the comparison easier and more scientific. In future studies, it is recommended to pay attention to gender differences in ultrasound results and also to the relationship between anatomical position and ultrasound results.

CONCLUSION

The results of the present study showed that the main signs in ultrasound in favor of a diagnosis of uncomplicated appendicitis are inflammation in the appendix wall, without necrosis, and an increase in the size of the appendix (>6 mm). Noticing fluid around the appendix and inflammation of the fat around the appendix increases the risk of complications.

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Authors' contribution: MN wrote primary draft, statistical, and designed the study, SK supervised and submitted the study, MZ also supervised the study and helped for statistical, SS helped for writing proposal.

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