Orginal Article

Co-Relation between Pre-Operative Ultrasonography Findings and Per-Operative Findings in Acute Appendicitis

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Introduction: Acute appendicitis (AA) is the most common cause of an acute abdomen in young adults. In this study, our aim was to evaluate preoperative ultrasonography for the diagnosis of acute appendicitis.

Methods: Study design was a cross sectional. Record review was done on the clinical records of 125 individuals who had appendices removed between January 2022 and June 2023. The sensitivity and specificity of ultrasonography, and the positive and negative predictive values of ultrasound were analyzed.

Results: A preoperative ultrasonography examination was performed on 125 patients. In our study the USG has 94.8% sensitivity and 80% specificity for diagnosing AA. The predictive value of positive test was 98.2% and negative test was 57.1%.

Conclusions: The pre-operative USG and per-operative finding for acute appendicitis is highly correlated.

Keywords: *Acute Appendicitis, Conventional Appendectomy, Diagnostic Laparoscopy, Laparoscopic Appendectomy Ultrasonography*

Introduction

Acute appendicitis (AA) is the most common cause of abdominal pain in adolescents and young adults requiring surgery, with a 7-9% lifetime risk. In1886, Reginald Fitz gave the official explanation of AA as it exists now, despite the fact that there have been historical records of appendix dating back to the fourteenth century.[1] As we approach 125 years since Fitz first described "Perforating Inflammation of the Vermiform Appendix," it is a sobering fact that issues surrounding AA's diagnosis and treatment persist to this day.[1]

A timely diagnosis is essential to prevent needless procedures and the consequences of a delayed diagnosis, such as the growth of perforations and abscesses.[2] The mystery of appendicitis still poses a diagnostic challenge relatively regularly, despite the deliberate efforts of doctors and surgeons over the years to increase our clinical understanding, which has been aided by technical advancements in laboratory and imaging sciences.[1]

The diagnosis of appendicitis by ultrasonography is becoming more common. Nonetheless, ultrasonography has a broad reported sensitivity range (44% - 100%) because to its considerable operator dependence.[3] CT has several benefits, such as less operator dependency, simpler visualization

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of the retrocecal appendix, reduced interference from intestinal gas, obesity, or patient discomfort and tenderness, and high-quality images. One of the main drawbacks of CT is radiation exposure, which is also its biggest caution and the main reason to avoid the test.[4]

The graded compression technique in ultrasonography introduced by Puylaert in 1986 is apt to better visualize the inflamed appendix.[5] Here the transducer is placed on the right lower quadrant and pressure is applied gradually while imaging, displacing overlying gas filled bowel loops. Ultrasound (US) findings indicative of appendicitis include a thickened wall, a non-compressible blind ending a peristaltic tubular structure, outer appendiceal diameter greater than 6 mm, absence of gas in the lumen, appendicoliths, echogenic inflammatory peri appendiceal wall change and increased blood flow to the appendiceal wall.[5]

The purpose of our study was to correlate preoperative imaging findings and per-operative observations in cases of acute appendicitis

Methods

This hospital based cross-sectional study was conducted at KISTMCTH between January 2022 and December 2023. An analysis was conducted on the medical records of 125 patients who suffered from acute appendicitis and underwent either open or laparoscopic appendectomy. A well-designed proforma was used to record the whole history, which included the current complaint, previous history, drug and treatment history, and other relevant history. Preoperative USG results included a non-compressible blind end, peristaltic tubular structure, appendicoliths, appendicular lump, appendicular perforation, or normal findings.

The surgical findings were also documented, including appendicitis, appendicular mass, appendicolith, appendicular perforation, and various alternative diagnoses.

Our institution's consultant pathologist reported on the specimen's histology after it was removed. Any other histological characteristics, such as serosal congestion or lymphoid hyperplasia, were regarded as negative reports for appendicitis, but acute inflammation inside the appendiceal parenchyma and fecoliths inside the lumen were considered positive features.

Results

Table 1: Demographic characteristics of patients

Sex of the patients	Frequency	Percent
Male	64	51.2
Female	61	48.8
Total	125	100.0
Age of the patients (years)		
Below 15	22	17.6
15-64	99	79.2
65 and more	4	3.2
Age range: (3-88) years Mean =27.21 years and SD =15.7 years		

Among 125 cases, males were found to have a higher prevalence of acute appendicitis (51.2%) than female population (48.8%). The age of the patients varied from 3 to 88 years for appendicitis.

The prevalent age group was 15–64 years old which constitute the 79.2% of the total cases and followed by below 15 years (17.6%) and 3.2% included those over 65 years.

Table 2: Clinical signs and symptoms

S n	Signs and symptoms	Number of patients (n=125)	Percentage
1	Migratory pain	86	68.8
2	Anorexia	83	66.4
3	Nausea	83	66.4
4	Tenderness	124	99.2
5	Rebound tenderness	61	48.8
6	Elevated temperature	61	48.8
7	Leukocytosis	101	80.8

Regarding the pre-operative assessment and variation with in comparison to modified Alvarado Score: 68.8% of the study population had migratory pain, 66.4 % had anorexia, 99.2% had right iliac fossa tenderness, 48.8 % of them had rebound tenderness, elevated temperature was found on 48.8% of the population and leukocytosis was observed among 80.8% of the study group.

Table 3: comparison of USG and per operative findings

S n	Findings	USG findings		Per operative finding	
		No. of patients	Percentage	No. of patients	Percentage
1	Appendicitis	69	55.2	80	64.0
2	Appendicolith	10	8.0	13	10.4
3	Appendicular perforation	7	4.8	12	9.6
4	Appendicular lump	18	13.6	10	8.0
5	Periappendicular collection	7	5.6	NA	NA
6	Appendix not visualized	14	12.8	NA	NA
7.	Normal Appendix	NA	NA	7	5.6
8	Makels diverticulum	NA	NA	3	2.4

Table 3 shows the comparison of USG findings and per operative findings. Of 125 instances with suspected appendicitis, 114 (91.2%) cases had USG features suggestive of acute appendicitis including appendicolith, appendicular perforation and periappendcular collection etc. Per operatively 115(92%) patients had features suggestive of acute appendicitis. The gold standard for diagnosis was histopathological examination (HPE) for those operated upon. The seven cases had normal appendix giving negative appendectomy rate in our study to be 5.6 %. In this study 3(2.4%) cases have Mickels diverticulum. All the cases of appendectomy had hospital stay of average three days and were uneventful. They were followed in OPD with HPE reports and followed up for one month.

Table 4: Positive and Negative Predictive Value for different USG parameters

USG compatible with Acute Appendicitis	Per-Operative Acute appendicitis		Total	Pearson chi-square	P value
	Yes	No			
YES	109	2	111	74	<0.001
NO	6	8	14		
Total	115	10	125		

Table 4 shows USG findings along with per-operative findings with corresponding sensitivity and specificity along with positive and negative predictive value. The USG has 94.8% sensitivity and 80% specificity for diagnosing AA. The predictive value of positive test was 98.2% and negative test was 57.1%. In our study the Pearson chi-square was 74 and p value <0.001 suggest pre operative USG and per-operative findings for acute appendicitis is highly corelated.

Discussion

One of the most frequent surgical disorders to arise in the emergency room is acute appendicitis. Approximately 70% of the patients exhibit the traditional symptoms and indications.[2]There is lot of diagnostic dilemmas due to the inherent anatomic variation in location of the appendix causing diverse clinical presentations and signs which overlap with many other diseases and few of which do not need a surgical intervention.[5]

The overall accuracy for the clinical examination in diagnosing acute appendicitis has been reported to be 70% to 87% (54% to 70% in children and 50% to 70% in women of childbearing age).[6-8] When a patient's clinical observations are unclear, radiological diagnostic modalities can help rule out other possible diagnoses that could be confused for acute appendicitis. For a long time, the two main imaging modalities utilized to diagnose acute appendicitis were computed tomography (CT) and ultrasonography (USG). The normal appendix can be visualized as a blind ended, tubular, compressible intestinal loop; continuous with the cecum with a diameter less than 6 mm High-resolution USG with graded compression has long been considered an important tool in the diagnosis of AA.[9]However absolute diagnosis is only possible at operation and histopathological examination of the specimen.[10-12]

The sensitivity of USG for diagnosing acute appendicitis ranges between 80% - 95%, the specificity from 89% - 100% and the accuracy from 90% - 96%. Regarding imaging studies CT exposes the patients to harmful ionizing radiations and it is costly too favoring the use of USG for the confirmation of the diagnosis of acute appendicitis[13-15]

S Limchareon et al[16] report: sensitivity 71.2% and specificity 97.7%. Adrienne V R et al[15] report: sensitivity 78% and specificity 83%. In our study conducted over two years the sensitivity and specificity of USG was 94.8% and 80% for diagnosing AA which is comparable with literature.

A study, which included 3540 patients, showed that

negative appendectomy rate was 9.8% for patients without preoperative USG exam while it was 8.6% for patients examined with USG preoperatively, and it was 4.5% for patients who undergone a CT scan. The compatibility between imaging methods and histopathological results was 82.4% for US, and 92.3% for CT. Imaging procedures related with statistically significant decrease in negative appendectomy rates.[17]Comparable to these studies in our study fourteen patients have no AA characteristics on USG, a clinical analysis to proceed with surgery was made, and about 50 % instances nearly resulted in a negative appendectomy Fox et al. found 65% sensitivity, 90% specificity, 84% positive predictive value and 76% negative predictive value for US in a prospective study. However, they suggested that USG could be used only in selected cases in spite of these high rates.[18] Gokce et al reported 69% sensitivity, 60% specificity, 89% positive predictive value and 30% negative predictive value for US in a prospective study on reliability of US.[19] In this study, the PPV and NPV is found to be 98.6%and 78.6% respectively for USG, comparable with value in literature. In the study of Demircan et al. sensitivity and specificity found as 61% and 75% consecutively for US like our study.[20]A wide range of sensitivity and specificity rates reported for US in the literature. However, in our study the Pearson chi-square was 74 and p value <0.001 suggest pre operative USG and per-operative findings of acute appendicitis is highly corelated.

Conclusion

Our research indicates that preoperative USG and per-operative findings of acute appendicitis are highly correlated. The USG had an exceptionally high sensitivity and specificity for the preoperative identification of features suggestive of appendicitis.With such high sensitivity and specificity, we would like to conclude that – USG being relatively less costly, free from harmful ionizing radiations and contrast injection should be used as adjunct for clinical management of suspected acute appendicitis.

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