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ULTRASOUND EVALUATION OF NON-PERFORATED AND PERFORATED APPENDICITIS

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Abstract

Background: Ultrasonography (USG) of abdomen remains one of the commonly asked investigations by the surgeon in patients with suspected acute abdomen. The advantage of USG over other radiological investigation is that it is easily available, cost effective, portable, no known side effects, non-invasive and requires minimal patient preparation for carrying out the examination. The present study aimed at evaluating ultrasonography findings of appendicitis and to correlate with operative and histo-pathological findings.

Material and Methods: In our study, USG evaluation was done by the investigators for 61 clinically diagnosed patients, so as to achieve 50 radiologically confirmed appendicitis cases which was the required sample. The study was carried out from December 2013 to September 2015. Data was analysed using the statistical software SPSS version 21.0. Chi Square test was applied to test statistically significant difference in proportion.

Results: In the present study the mean age the study participants was 26.42 years. Majority of the study participants were males 29 (58%) while females represented 42%.The average size of the appendix among the study participants was observed to be 7.08 mm with a standard deviation of ± 1.07 mm. Among all the study participants with acute appendicitis in our study 22% of the patients had perforation of appendix. In our study, we proved that all USG diagnosed appendicitis cases (100%) were histo-pathologically correct but the variations found in diagnosing the perforation status. We found that the USG had 73.33% and 100% sensitivity and specificity in finding the perforation status.

Introduction

Acute appendicitis is one of the most common cause of abdominal pain and one of the most common cause of surgical emergencies, failure to make an early diagnosis and intervention may lead to progression of acute appendicitis to perforated appendicitis.

It was evident from the literature that nearly 20% of the patients operated for appendicitis have normal appendix on histopathological examination. (1) In a recent population-based analysis it was confirmed that the findings of smaller clinical studies are true, that in more than 15% of appendectomies performed there is no pathologic evidence of suggestive of appendicitis. The belief among surgeons shows when conventional wisdom suggests that if there is a question of appendicitis, appendectomy should be performed.(2–4) It is because the intervention may prevent perforation and also because there will be little cost to the patient(5)(4).

Ultrasonography (USG) of abdomen remains one of the commonly asked investigations by the surgeon in patients with suspected acute abdomen. This study is an attempt to study ultrasonography findings of appendicitis and to correlate with operative and histo-pathological findings in patients presenting with perforation and without perforation of appendix.

Methodology:

The study was carried out in a tertiary care teaching hospital in Pondicherry. The study was carried out as a hospital based cross sectional study conducted between December 2013 to September 2015. Patients who are referred to Department of Radiology for Ultrasound evaluation who presented with clinical evidence suggestive of appendicitis were the study population. The sample size was 50, calculated based upon the previous study with a power of 80% and α value as 0.05 with estimation error as 10%. All the patients satisfying the inclusion and exclusion criteria were selected purposively for the study purpose. Inclusion criteria was patients with clinical features suggestive of appendicitis who are referred for ultrasonogram and exclusion criteria was patients in whom appendicectomy was done 3 days after USG evaluation and in patients presenting with appendicitis in whom the cause of appendicitis was Crohn's disease, Tuberculosis and other inflammatory bowel diseases. Recruited participants were followed up after the surgery to collect per-operative findings and subsequently Histo-pathological findings and information was also obtained from the Department of Pathology.

Institute ethical committee clearance was obtained before starting the study. In case of children less than 14 years of age informed written consent was obtained from either of the parents, whereas In case of children aged 14-18 years assent was obtained from the child, in addition to the consent from the parents.

A swift survey scan of the abdomen is done every time before focusing onto the right iliac fossa. Transducer is moved in such a way that it is smooth and free flowing during all the examinations o as to allow proper time for the examiner to view the real time image in the monitor without checking the position of the transducer. Sonographic imaging and visualisation of an appendix with appendicolith and the appendiceal diameter > 6 mm is considered a positive test for appendicitis. Color Doppler imaging was also done to assess the hyperaemia of the appendiceal wall so as to ascertain the inflammation of the appendix. Graded compression, Posterior manual compression technique and Multiple scan planes were the methods applied for scanning.

Data was entered in Microsoft Excel 2013 and analysed using the statistical software SPSS version 21.0. Chi Square test was applied to test statistically significant difference in proportion and a p value of less 0.05 was considered statistically significant.

Results:

Table 1: Distribution of demographic variables among the study participants

Variables	Frequency	Percentage
Age categories (n=61)		
< 20	21	34.43
21-40	35	57.38
> 40	5	8.20
Mean Age	26.42	**11.89 (S.D)**
Gender (n=61)		
Male	32	52.46
Female	29	47.54
Clinical diagnosis (n=61)		
Appendicitis	61	100%
Clinically perforated	15	24.6
Clinically non-perforated	46	75.4
Appendicitis out of 61 clinical cases	50	81.97%
USG diagnosis (n=50)		
Mean size of appendix	7.08 mm	1.07 mm **(S.D)**
USG: Perforated appendix	11	22.0
USG: Non perforated	39	78.0
Histological diagnosis (n=50)		
Perforated appendix	15	30.0
Non perforated appendix	35	70.0

Table 2: Distribution of patients based on USG findings based on perforation status

USG presentation of appendix in patients without perforation (n=39)		
USG Finding	Frequency	Percentage
Increased appendiceal size	39	100.0
Change in peri-appendiceal fat	38	97.4
Appendicolith	13	33.3
USG presentation of appendix in patients with perforation of appendix (n=11)		
USG Finding	Frequency	Percentage
Increased appendiceal size	11	100.0
Presence of free fluid	11	100.0
Presence of Abscess	2	18.2
Pericaecal collection	9	81.8
Break in appendiceal wall	39	100.0

Table 3: Correlation of USG and HPE findings

USG diagnosis	Histo-pathological diagnosis		Total
	Perforated	Non-perforated	
Perforated	11	0	11 (22.0)
Non-perforated	4	35	39 (78.0)
	15 (30.0)	35 (70.0)	50 (100.0)

Sensitivity: 73.33 (44.9%-92.21%)

Specificity: 100% (90%-100%)

PPV: 100%

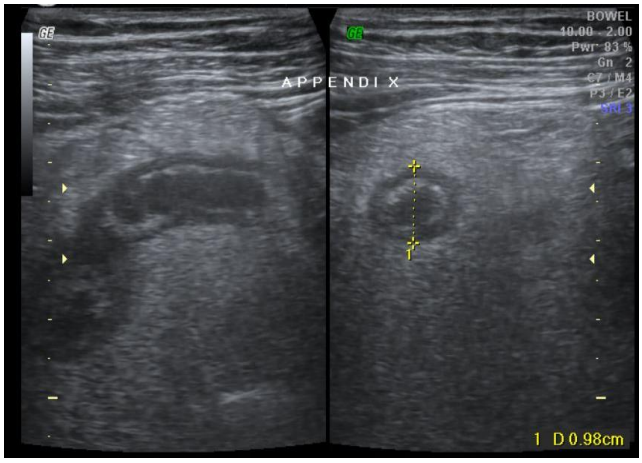

Figure 1: Image showing Acute Appendicitis with increased diameter

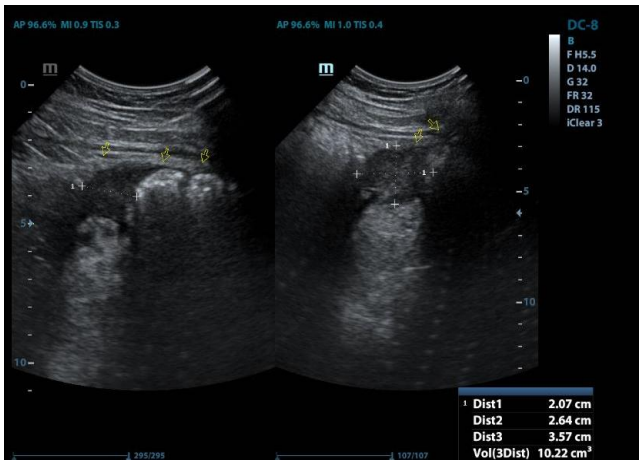

Figure 2: Image showing Acute Appendicitis with perforation

Discussion:

Acute appendicitis is one of the most common cause of abdominal pain and one of the most common cause of surgical emergencies, failure to make an early diagnosis and intervention may lead to progression of acute appendicitis to perforated appendicitis, a disease with potential complications which includes intra-abdominal abscesses, wound infection, septicaemia and death eventually.

The diagnosis of acute appendicitis is usually performed based on the findings of the patient's history, clinical and lab investigation and imaging data. One of the most common diagnostic dilemmas encountered in clinical paediatric practice is suspected acute appendicitis. However the diagnosis is primarily based on clinical findings, the presentation of appendicitis can be confusing, and classic features may be subtle or difficult to elicit in clinical practice. Diagnostic criteria for acute appendicitis by ultra-sonography are well established and reliable tool(5). It was also shown that the most specific sign is the identification of a non-compressible blind-ending structure in the right lower quadrant with an outer diameter of greater than 6 mm, consistent with acute appendicitis.

In the present study (Table 1), the mean age the study participant was 26.42 years, with the Standard deviation of ± 11.887. Majority of the study participants were males 29 (58%) while females represented 42%. This gender distribution was found to be similar to various other studies which reported that appendicitis was higher among males as compared to females(1,2,6).

The mean size of inflamed appendix in the present study was found to be 7.08 mm with a standard deviation of ± 1.07 mm. It was also shown that the most specific sign is the identification of a non-compressible blind-ending structure in the right lower quadrant with an outer diameter of greater than 6 mm, consistent with acute appendicitis. Studies from different parts of the world reported an average appendiceal size ranging from 5.7 mm to 8 mm in case of appendicitis(7–9).

Among all the study participants with acute appendicitis in our study 22% of the patients had perforation of appendix. Studies from other researchers reported a perforation rate ranging from 12% to 16% which is similar to the present study results(10,11).

Ultra-Sonography has various advantages that it can be performed at the bedside, involves a short acquisition time, does not use ionizing radiation, and may show evidence of various other causes of abdominal pain. USG is particularly useful in evaluating young women, among whom the radiation dose to the reproductive organs should be minimized and for whom it is important to exclude ovarian and uterine conditions that might mimic appendicitis in clinical evaluation.(12)

In case of appendicitis when it is enlarged there is increased peri-appendiceal echogenicity, which is due to migration of the greater omentum to arrest the inflammation of the appendix.

Free intra-peritoneal or periappendiceal fluid collection with breached mucosa on USG examination means that there is a perforation and such patients usually have reported to the hospital late. In our study all the perforated appendicitis patients had fluid collection and increased appendicle size (Table 2) in USG.

USG is generally available relatively inexpensive and safe procedure, which doesn't involve the use of ionizing radiation and requires no prior preparation of the patients. One of the major disadvantage of the US is that a negative ultrasound examination does not exclude appendicitis unless a normal appendix in visualised confidentially.

The studies concerning the impact of radiologic imaging on the surgeon's decision making process is suspected appendicitis is relatively small in number. In our study, we found that nearly 18.03% (Table 1) clinical diagnosis were negative for appendicitis which was confirmed by USG. Certain investigators has reported that USG changes the initial treatment plans in about 30% to 46% of the cases.(12,13)

It was evident from the literature that nearly 20% of the patients operated for appendicitis have normal appendix on histopathological examination(1). In our study, we proved that all USG diagnosed appendicitis cases (100%) were histo-pathologically correct but the variations found in diagnosing the perforation status. We found that the USG had 73.33% and 100% sensitivity and specificity in finding the perforation status. One of the possible reasons for this low sensitivity could be the time lag between the radiological diagnosis and the patient reaching the operation table.

Hence from this study we concluded that the possibility of reducing the rate of negative appendicectomy with the help of imaging techniques like ultra sonogram of abdomen there would be a major improvement in the management of patients with appendicitis.

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