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Original Research Article

The role of ultrasonography in acute appendicitis

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ABSTRACT

Background: Acute appendicitis is the most common surgical emergency. Inspite of new investigations, mainstay of diagnosis depends on clinical sign and symptoms, laboratory and USG (ultrasonography) of abdomen. Out all these investigations USG is having a crucial role in a diagnosis of it. Hence this study was undertaken to prove its efficacy.
Methods: This study was conducted in 418 patients with 186 females and 251 males. Patients were of acute appendicitis operated for appendicectomy were included in the study. Data analysis was done by Stata statistic software. Before surgery patients were subjected for necessary investigations including USG.
Results: The mean age was 18.8 (range 8-83) years. Normal appendix found in 22 cases, hence negative appendicectomy rate was 6.6%. Chronic appendicitis was found in 28 patients. Different pathology was found in 1 in the form of carcinoid of appendix (0.24%) but treated by appendicectomy. USG abdomen in present study showed sensitivity of 88.6% and specificity 92% with PPV and NPV was 98% and 52.3%, frequency reports were s/o acute appendicitis in 337 patients and normal in 82 subjects.
Conclusions: It conclude that USG is very important tool to diagnose and rule out appendicitis and its complications like perforation or peritonitis. Its liberal use by expert radiologist can help to reduce negative appendicectomy rate.

Keywords: Appendicitis, Peritonitis, USG

INTRODUCTION

Acute appendicitis is the most common surgical emergency and the decision for appendicectomy is usually based on clinical signs and symptoms of acute appendicitis. Although certain investigations such as C-reactive protein, ultrasonography and spiral computerised tomography (CT) scan abdomen leads to improvement in diagnosis. The gold-standard for diagnosis of acute appendicitis is histopathology.[1]

Appendectomy is the treatment of choice for acute appendicitis (AA) which has a morbidity of 3.1%. If it is associated with complication like perforation, the morbidity is more but can reach up to 47.2%. This morbidity is due to a late presentation and initiation of active treatment, as well as patient factors. AA is dangerous risk due to its life-threatening complications. So, careful assessment is compulsory in a surgery department to curtail preventable complications of AA. Repeated clinical examinations are beneficial to reach to the correct diagnosis.[2]

Acute appendicitis is one of the common and difficult to diagnose disorder in surgical practice. If anyone only depend on clinical examination, then he will be correct up to 70%. That means it results in a high negative appendectomy rate (NAR), morbidity and mortality. Reduction of NAR is highly recommended. In 1986, Puylaert first time described graded compression ultrasonographic technique for the detection of acute appendicitis. It was become more popular as it is non-

invasive, and less expensive than CT scan. It is safe in pregnancy and children as it has no radiation hazard.

The diagnostic sonographic finding in acute appendicitis is the noncompressibility of the appendix with a diameter greater than 6mm. An appendix not visualized by USG is considered normal by many authors. But Abu-Yousef demonstrated visualization of a normal appendix with a hypo echoic wall of 2mm thick in two out of 68 patients. Based on the data presented by Ibrahim M et al (Kuwait) concluded that in his series graded compression ultrasound did not significantly reduce the rate of negative appendectomies.[3] Gilani SI and et al in her series of 1016 appendicectomies, 27 % was the negative appendicectomy rate.[4] In a study done by Wilson J et al also shows pre-operative imaging resulted in significant delays to surgery and had no impact on reducing the rate of negative appendicectomy.[5]

This bad scenario is not present in all studies. Zielke A et al in his studies predicts very nice accuracy of USG, these are PPV 0.762, NPV 0.958.[6] This system gave diagnostic accuracy of 0.940 ($p<0.001$) together with a low rate of negative laparotomies (11%) and a significant reduction in diagnostic errors. Ultrasonography helped them to diagnose acute appendicitis more quickly than clinical evaluation alone, suggesting that USG may give better outcome with very low NAR (11%).

This type of confusing status in literature and in a view of very few studies have been conducted in our part of the country and sufficient data was not available regarding the role of sonography in the evaluation of clinically suspected cases of appendicitis. We conducted this study titled "sonographic evaluation of acute appendicitis" to establish the role of sonography either in diagnosis or in ruling out appendicitis as the cause of acute abdomen, thus enabling in avoiding unnecessary negative laparotomies.

METHODS

This study included 418 consecutive patients (186 female and 251 male) who were admitted under the care of single consultant surgeon between January 2012 up to September 2016 (Figure 1). The clinical diagnosis and the timing of the appendectomy had been made by the surgeon who was not blinded to the preoperative imaging studies like USG abdomen done in all patients. The inclusion criteria were all patients who were admitted with a diagnosis of AA (including complicated appendicitis) regardless of age, gender. The diagnosis of AA and the decision to operate depends mainly on the clinical picture and investigations, such as white cell count, C-reactive protein level, abdominal and pelvic ultrasonography especially in females of childbearing age and in borderline cases. Standard histological examination was conducted for all specimens. Sensitivity and specificity of USG abdomen was calculated by Stata statistic software. Ethical approval from institutional ethics committee was sought before starting of this study.

RESULTS

418 patients were admitted with the diagnosis of AA and underwent appendectomy. A total of 186 women and 251 men were included in this study (Figure 1).

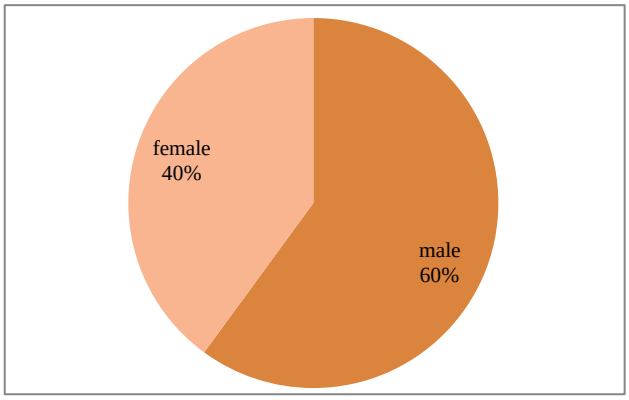

Figure 1: Incidence of sex.

The mean age was 18.8 (range 8-83) years. Normal appendix found in 22 cases, hence negative appendicectomy rate was 6.6%. Chronic appendicitis was found in 28 patients. Different pathology was found in 1 in the form of carcinoid of appendix (0.24%) but treated by appendicectomy. USG abdomen in our study shows sensitivity of 88.6% and specificity 92% with positive predictive value (PPV) and negative predictive value (NPV) was 98% and 52.3%; reports were s/o acute appendicitis in 337 patients and normal in 82 subjects (Figure 2).

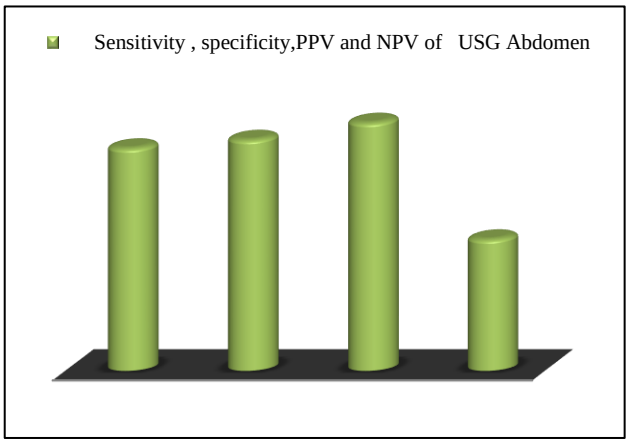

Figure 2: Sensitivity and specificity, negative and positive predictive value of USG abdomen.

DISCUSSION

418 patients were admitted with the diagnosis of AA and underwent appendectomy. A total of 186 women and 251 men were included in this study. The mean age was 18.8

(range 8-83) years. Different pathology was found in 1 in the form of carcinoid of appendix (0.24%) but treated by appendicectomy.

USG abdomen in present study shows sensitivity of 88.6% and specificity 92% with PPV and NPV was 98% and 52.3%, reports were s/o acute appendicitis in 337 patients and normal in 82 subjects (Figure 2). This is comparable with study performed by Ibrahim M et al in Kuwait.[3] Statistical analysis in his study showed that graded compression USG yielded a sensitivity rate of 86.2%, a specificity rate of 90.9%, and an accuracy of 89%. The positive predictability was 86.2% and the negative predictability was 90.9%. Ibrahim M et al, concluded that, graded compression USG provides a highly accurate, specific, and sensitive test (a sensitivity rate of 86.2%, a specificity rate of 90.9%,) for clinically equivocal acute appendicitis, but still in his study did not reduces the rate of negative appendectomies significantly.

Histopathology is considered as a gold standard for diagnosis of acute appendicitis. We found in a present study 50 (11.96%) patients were not having acute appendicitis on histopathological examination. Out these 50 patients 28 were normal appendix and remaining 22 (5.26%) were having diagnosis of chronic appendicitis. The NAR was 6.69%. This negative appendicectomy rate was much lower if compare with study done by Gilani SI et al in her series of 1016 appendicectomies, 27% was the negative appendicectomy rate.[4] We observed one incidental finding of carcinoid of appendix, Gilani SI et al also find one case of adenocarcinoma appendix in her series.

In a study done by Wilson J et al shows significant delay to surgery was caused due to USG and not resulted in reduction of NAR, especially in women.[5] Females actually had a higher rate of negative appendicectomy (40.4%) than adult males (16.7%) or children (27.6%), though they were exposed more for pre-operative USG. This finding is comparable with a recent longitudinal study with use of ultrasound and CT did not improve diagnostic accuracy, NAR. Ultrasound was the most commonly used modality in his study (84.4%) and was demonstrated to have a sensitivity of only 31.8%, much lower than figures quoted in the literature and present study.

A recent meta-analysis has done to verify the role of both clinical features and inflammatory markers to diagnose acute appendicitis. The author Birchley D concluded that: 'elements of the disease history, clinical findings and results of laboratory tests are weak individual discriminators of appendicitis but, in combination, they provide high discriminatory power.' So in combination, white cell count and C-reactive protein can effectively support a clinical diagnosis of acute appendicitis with typical clinical features than in excluding the diagnosis.[7] As we have combined USG with the united force of inflammatory markers, obliviously resulted in reduced NAR of only 6% in present study Zielke A et al[6] in his studies very nice accuracy of USG, with very low NAR (11%), but higher than present study.

Table 1: Age distribution of patients.

Probability	Odds ratio
0.001	0.001001
0.01	0.010101
0.15	0.1764706
0.2	0.25
0.25	0.3333333
0.3	0.4285714
0.35	0.5384616
0.4	0.6666667
0.45	0.8181818
0.5	1
0.55	1.222222
0.6	1.5
0.65	1.857143
0.7	2.333333
0.75	3
0.8	4
0.85	5.666667
0.9	9
0.999	999
0.9999	9999

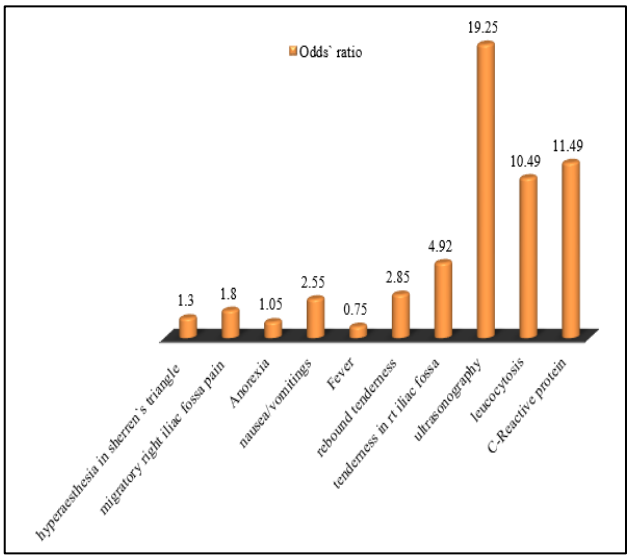

Figure 3: Parameters studied and odds ratio.

USG abdomen gives highest odds ratio and probability (Table 1, Figure 3). USG gives maximum odds ratio followed by CRP and leucocytosis. New scoring system uses patient`s demographics, age and gender, the presenting symptoms (the migration of pain to the RIF, nausea and vomiting, anorexia), clinical signs (RIF tenderness, rebound tenderness, hyperaesthesia in Sherren's tingle and fever), laboratory investigations (white cell count and CRP) and ultrasonography to

reduce ultimate parameter of diagnostic accuracy i.e. NAR. This suggest effective role of USG in reaching correctly to the diagnosis of acute appendicitis.

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Ethical approval: The study was approved by the institutional ethics committee

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