Imaging of Acute Appendicitis and Decision-Making for Surgical Intervention

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Abstract:-
Acute Appendicitis represents the most frequent cause of surgical acute abdomen in emergency unit. The presentation is not always typical and late interventions for complicated appendicitis are still very high. Diagnostic adjuncts usually provide the additional information required to make a confident diagnosis.
Aim of the study was to access prospectively the role of ultrasound in diagnosis of acute appendicitis. 100 patients were prospectively included in the study conducted at Misurata Teaching Hospital during 007. Patients were admitted to surgical department with suspicion of acute appendicitis, and then evaluated clinically with laboratory tests and ultrasound. 63% were males and 39% were females, 39% of them were between 11 and 20 years old. Acute appendicitis was diagnosed sonographically in 91.
A total of 89 appendectomies were performed over this time period and in 86 of them the diagnosis was confirmed histologically. The false negative rate of ultrasound was 11.1%. Overall, patients who had preoperative imaging and diagnosed as acute appendicitis showed a low negative appendectomy rate of 3.4%. Ultrasound had a sensitivity of 94.5% and specificity 88.9%.
Abdominal ultrasound for diagnosis and decision-making in acute appendicitis is useful and associated with a low negative appendectomy rate.

Introduction:
Acute appendicitis is the most common surgical emergency constituting 10% of admission to the emergency department.[1] The appendicitis can strike at any age but it is rare in patients under two years of age and most commonly occurs between the ages of 10–30 years.[2,3] The essential clinical features of appendicitis are well known: gradual onset of abdominal pain which classically originates from the periumbilical area and then migrates to the right lower quadrant of the abdomen associated usually with anorexia, nausea, vomiting, localized tenderness and evidence of peritoneal inflammation with guarding and percussion tenderness. Although diagnosis of acute appendicitis may be straight forward in some cases, the misdiagnosis of acute appendicitis results in high costs for patients and national health services with negative appendectomy rate 20-40% of patients.[4] A number of patients with suspected appendicitis are hospitalized but are found to have other diagnosis such as pelvic inflammatory disease, mesenteric adenitis or other gastrointestinal and gynaecological disorders,[5] at the same time missed appendicitis is the most frequently successful malpractice claim against clinician[6] and lead to increased postoperative morbidity and prolonged hospitalization.[7]

Aims of study:
To evaluate the accuracy of preoperative diagnostic imaging by ultrasound on patients with clinically suspected appendicitis

Methods & patients:
In this prospective study, 100 patients presented to surgical out-patients clinic with right iliac fossa pain and admitted to the surgical department with provisional diagnosis of acute appendicitis between April and September 2007. Their demographic and medical data were recorded and analyzed. All patients underwent abdominal ultrasonography (Aloka SSD 4000) by one radiologist looking for the followed findings: transverse diameter of the appendix of 6mm or more, noncompressible dilated appendix and fluid or abscess collection in the appendiceal lumen or in a periappen-diceal area.

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Results:

Out of 100 patients 63 were males and 37 were females. Their age ranged between 5 and 46 years with an average age of 25.5 years, 65% of them were between 11 and 30 years. The peak age group for these patients was that of 11-20 years representing 39% of the total cases. The rarest age group was that of 41 to 50 years representing 5% of appendicitis, as shown in table & Figure 1.

Graded compression ultrasonography was performed in the 100 cases with positive finding in 91 cases and negative finding in 9 cases as shown in Table & Figure 2. Out of 91 cases diagnosed as positive by ultrasound, 88 cases (96.7%) were confirmed as positive intra-operatively and by histological examination, while one case had a normal appendix. Another two patients were not operated and improved clinically giving the false positive diagnosis of ultrasound in three cases, false negative in one case while 8 patients with negative ultrasonography recovered without surgery. Additionally; during the ultrasonographic examination we reported other findings of clinical importance in management of the patients, these findings included perforated appendix and appendicular abscess. On the other hand there one case which was misdiagnosed by ultrasounds and clinically was highly suspected as acute appendicitis and decision taken to be operated and was proved intraoperatively and histopathologically as acute appendicitis, (Table 3).

Of the eight cases, six patients were diagnosed by ultrasound as other different clinical entities (Table 4). The other two cases improved clinically and discharged.

The sensitivity and specificity of ultrasonography for diagnosing appendicitis was 98.9% and 72.2% respectively, as shown in Table 5.

Discussion:

Acute appendicitis is considered as one of the commonest surgical emergencies and its diagnosis is sometimes difficult and an accurate safe, and quickly performed diagnostic test has long been sought to improve preoperative diagnostic accuracy.[8,9] Simple appendicitis can progress to perforation which is associated with higher morbidity and mortality. The sequelae of delayed diagnosis may result from late presentation by the patient but are sometimes due to the initial failure of the clinician to make the correct diagnosis.[10] Various methods have been tried but most of them have limitations including low accuracy rates, high false negative rates and high cost.[11,12] Most of our patients who underwent surgery after a positive result of ultrasonography proved to have appendicitis intraoperatively and histologicaly confirming the high sensitivity of graded compression ultrasonography in diagnosis of appendicitis in spite of that Frank et al found that no clinical benefit when routine ultrasonography was performed in all patients,[13] but repeated clinical assement associated with graded compression ultrasonography may provide the additional information required to determine whether surgery is necessary.[14] Graded ultrasonography performed by experienced ultrasonographers still produced a 5% false negative result,[15] in comparison with the current study in which the false negative result is 1%. We reported comparatively low false positive rate in our study (3%) compared with that reported by Lessin et al in his series of appendicitis as the false positive reached up to 6%.[16]

Conclusion:

Graded ultrasonography is an accurate, safe and low cost procedure and can be used as additional tool to confirm clinical diagnosis of acute appendicitis.

Ultrasonography helps in diagnosis of other medical conditions mimicking acute appendicitis resulting in reducing unnecessary operations.

Table 1: Distribution of appendicitis according patient's age & sex

Age (years)	Female	Male	Total
≤ 10	5 (5%)	9 (9%)	14 (14%)
11 -20	18 (18%)	21 (21%)	39 (39%)
21 -30	11 (11%)	15 (15%)	26 (26%)
31 -40	3 (3%)	13 (13%)	16 (16%)
41 -50	0	5 (5%)	5 (5%)
Total	37 (37%)	63 (63%)	100 (100%)

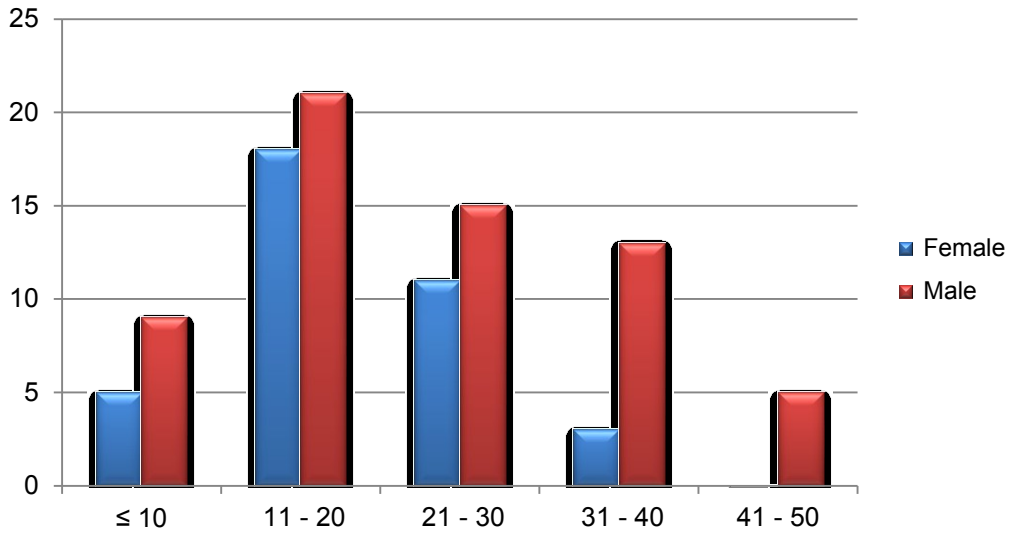


Fig. 1: Distribution of appendicitis according to patient's age & sex.

Table 2: Ultrasonographic diagnosis of appendicitis.

Suspected acute appendicitis		Ultrasonography diagnosis			
Number	Age	Positive		Negative	
14	≤ 10	13	13%	1	1%
39	11-20	36	36%	3	3%
26	21-30	23	23%	3	3%
16	31-40	14	14%	2	2%
5	41-50	5	5%	0	0%
Total = 100		91	91%	9	9%

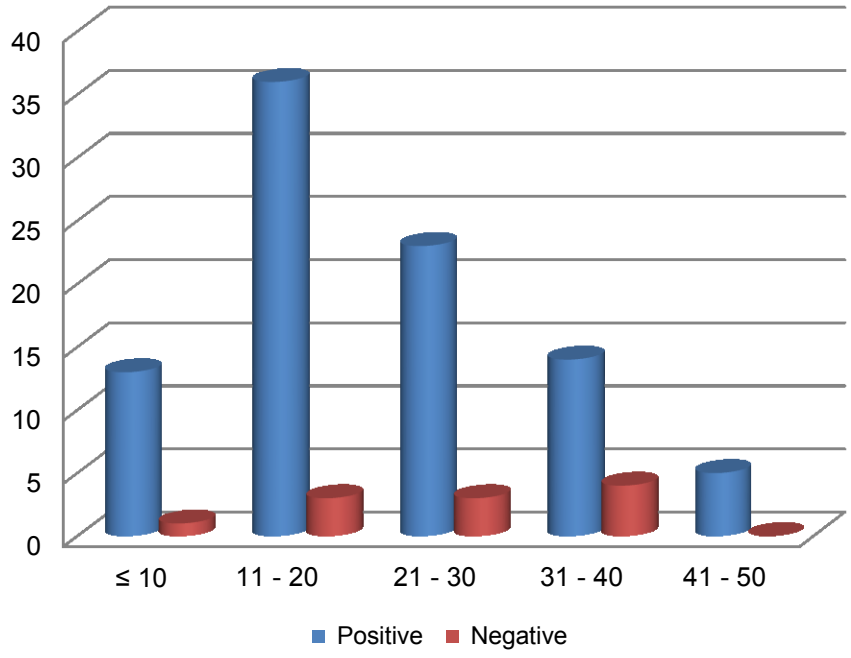


Figure 2: Ultrasonographic diagnosis of appendicitis.

Table 3: Final diagnosis.

Ultrasonographic diagnosis	Number	Frequency	Notes
Positive	88	88%	2 perforated appendices 2 appendicular abscess
False positive	3	3%	1 normal appendix 2 improved clinically
Negative	8	8%	other medical conditions
False negative	1	1%	1 appendicitis missed by USG

Table 4: Ultrasonographic Diagnosis of other medical conditions.

Ultrasonographic Diagnosis	Number	Frequency
Renal diseases	2	2%
Pelvic inflammatory diseases	2	2%
Right ovarian cyst	1	1%
Acute cholecystitis	1	1%
Total	6	6%

Table 5: Sensitivity & specificity of USG.

Results of ultrasound	Appendicitis (histologically confirmed)	Not appendicitis (histologically confirmed)	Not operated	Total
Positive	88	-	-	88
False positive		1	2	3
Negative		-	8	8
False negative	1		-	1
Total	89	1	10	100
Sensitivity – 98.9%, Specificity – 72.7%				

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