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Value of Ultrasound in Diagnosis of Acute Appendicitis in Kirkuk General Hospital

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Original Article

ABSTRACT

A prospective study of 370 cases presented with signs and symptoms suspected to have acute appendicitis who were admitted the casualty department in Kirkuk general hospital – Kirkuk city from January 2012 to December to 2016. We had170 male patients (46%) and 200 female patients (54%),their age ranged between 11-63 years with the mean age of 22 years. We scanned all of them be ultrasound (3.5MHz) before any surgical intervention .This study includes only patients who were operated on for appendicitis or for its complications which were seen in 250 patients (67%)(first group)or other pathology mimicking appendicitis observed in 120 patent (33%)(second group), then comparing the operative findings with ultrasound reports to evaluate specificity, sensitivity and accuracy of ultrasound reports to evaluate specificity ,sensitivity and accuracy of ultrasound. Ln the first group, the accuracy of U/S was (40%) for acute appendicitis but (100%) for complications of acute appendicitis (perforation ,mass or abscess), therefore total accuracy of U/S was (65%) for acute appendicitis and its complications. In the second group, total accuracy was (88.46%) for other pathology. Which simulate acute appendicitis. This study conclude that U/S can be used to diagnose acute appendicitis particularly in complicated from with food diagnostic ability in alternative pathology which mimicking appendicitis

Keywords: Appendicitis, Signs and Symptoms, Appendectomy, Ultrasonography, Uses

1.INTRODUCTION

Acute appendicitis is the most common cause of surgical acute abdomen in young adult patients in the 2nd and 3rd decade of life, but no age is exempt, appendicitis is more common in males than in females (1). Appendicitis with its signs and symptoms became the paradigm of clinical teaching and appendectomy is probably the first major surgical procedure to be performed by a trainee in general surgery (1). The term acute abdomen referred to presence of an attack of abdominal pain, that may occur suddenly or gradually over a period of hours, (usually six hours), due to inflammation perforation, obstruction, infarction or rupture of an intra-abdominal organ .

Since 1886 when Reginald Fitz, described appendectomy for acute appendicitis, as an appropriate treatment (2), Muscle splitting incision described by MicEuII1y Title years later filter of making an early diagnosis and treatment of appendicitis (the joint goal of surgical publications) is the primary cause behind the persistent morbidity and mortality (3).

Perforation rate ranging from A% 40 30% in adult (3, 4) and up to 60% in children (3). Mortality rate ranging from 0. 17% (2, 3) up to 7. 5% (3) this will increase to 20% in elderly patients and children (2,3). As a result of this, surgeons created for themselves a (security zone) in which they accepted a range of15 - 20% of negative laparotomies (2, 3), particularly in females that unnecessary laparotomies up to 45% are performed (3), although these patients with negative; laparotomies need no long term follow tip , but this is not without hazards that affect society, health services, with financial drawbacks The patients and to the society with high rate of hospital re- admission up to 30% that might call for another laparotomy (1,2). The difficulty in diagnosis of appendicitis arises from different, clinical presentations, that only 50% of these patients will be presented with classical features that depend on different anatomical of the appendix (1,4). The surgical policy of (when you are in doubt take it out) is an ethically, medically and financially unsatisfactory for the high rate of morbidity and mortality following negative laparotomies various aids emerged to facilitate more accurate pre-operative diagnoses of patients with suspicion of acute appendicitis but most of these investigations are not specific and not conclusive too, as plain abdominal X-ray which has an overall accuracy of less than 8% and should not be used routinely (5) or barium- enema which can be used to establish the diagnosis, with an accuracy rate of 50% and high percentage of negative findings with radiation hazards specially in pregnancy and in childhood (4). Although computerized axial tomography (CAT) scan of abdomen can visualize the appendix especially with complicated cases,

unfortunately it is not popular in our locality and of limited uses therefor we can use U/S as an alternative to them in the diagnosis of CS and acute appendicitis (5,6,7).

Uses of ultra-sound

This examination is safe, non - invasive it can be done in an outpatient and less expensive than CAT scan Or barium- enemas (5,6). ultra-sound is being used since 1953 without any obvious adverse effect to the patients during the last five decades (7,8). Our practice of evaluating patients with suspected appendicitis was by putting a pillow under both knees to relax their abdomen with two views to visualize the appendix in (coronal and sagittal sections) (8,9) , this exam was done with full bladder and with fasting of patients and it done by same radiologist by using an ultra-sound with frequency 3.5MHz . We analyzed our results into three main groups.

In uncomplicated cases of appendicitis the positive diagnostic inflamed appendix will appear as non-compressible blind tube of a diameter equal or more then 6mm (2,7) , Normal appendix will either not be visualized in ultra-sound (6,7) or Appear as a blind tube with a diameter of 5mm or less that is compressible. (7,8) . We en end on the presence of fecolith , that appears in 12 -13 % of Cases of appendicitis (6,7). Presence of atonic dilated loops of terminal ileum which is Seen In some cases of appendicitis (7,8).

In complicated cases of appendicitis the positive U/S findings for perforated were loss oncogenic sub mucosal ring of the appendix with free fluid inside the peritoneal cavity and loops of bowel around inflamed appendix (8,9) might show inflammatory mass without or with fluid content, (appendicular abscess) (7,8).

Ultrasound examination might detect another pathology that may be present with right lower quadrant abdominal pain mimicking appendicitis especially if young women (to study their adnexa) or to detect alternative diagnosis (8,9).

2. PATIENTS and METHODS

During a period from Jan 2012 Dec 2016, we Scanned 450 patients with Suspicion of acute appendicitis in the by casualty Department, Kirkuk General Hospital in Kirkuk city by U/S before any surgical intervention, 180 male patients (40%) and 270female patients (60%). 80 patients (17%) were excluded from this study, including. 35 refused surgery, and were discharged on their responsibility despite having positive results on clinical and ultra-sound examinations, 25patients with normal ultra - sound improved of conservative treatment and were discharged after few hours to 2 days from the hospital were also excluded from the study

because of loss of follow up. In 20 patients ultra - sound shown mass (appendicular mass) treated in our surgical unit conservatively for several days then discharged for interval appendectomy later, but were lost from follow up and excluded from this study. Therefore the net study population included 370 patients 170 male patients (46%) and 200 female patients (54%) their age ranged between 11 - 63 years with mean age (22) years. According to ultrasound results, patients were categorized into two groups:

First group diagnosed as appendicitis or its complications or normal findings in U/S and they were 250/370 patients (67%), Males were 90 (36%) and females were 160 (64%). Second group that was diagnosed as another pathology simulating appendicitis , they were 120 patients (33%), 40 males(33%) and 80 females(67%). The diagnosis confirmed by surgical intervention which depend on clinical finding with aide of US results after that operative findings was compared with U/S results to evaluate sensitivity, specificity, and accuracy of U/S. Our inquiry included: name, age, sex, occupation, address, history, clinical findings, US results, operative findings and complications

Statistical analysis:

Data of 370 patients were entered, managed and analyzed using the statistical package for social sciences (SPSS) for Windows version 25. Descriptive statistics of the variables expressed as mean, standard deviation, frequencies and percentages according to the variable type. Statistical tests and procedures were applied accordingly and when applicable. The validity of ultrasound in diagnosis of appendicitis was assessed by calculation of the validity parameters; sensitivity , specificity, and accuracy calculated according to the following statistical equations :

$$\text{Sensitivity} = \frac{TP}{TP + FN} \times 100\%$$

$$\text{Specificity} = \frac{TN}{TN + FP} \times 100\%$$

$$\text{Accuracy} = \frac{(TP + TN)}{TP+TN + FP+FN} \times 100\%$$

3. RESULTS

A total of 370 patients were completed the study with a mean age of 22 years, males were 130 represented 35.1% of the studied group and the remaining 240 patients (64.9%) were females with an overall male to female ratio of 1: 1.85, (**Table 1**)

In appendicitis group , male to female ratio was [M:F = 1:1.78]. But for non – appendicitis group, male to female ratio was [M: F = 1: 2.0]. The age distribution of patients revealed that among the 250 appendicitis patients (appendicitis group), the age ranged between (11 - 63) years with a mean of 22.9 years, the highest incidence observed in the third decade of life, (20-29) years of age. Among the 120 non-appendicitis patients the age ranged 12 – 43 years with a mean of 22. 1 years. The higher incidence was reported in the third decade of life. However, none of the cases in both group aged 10 years or younger, (**Table 2**)

Regarding the duration of presentations, for the appendicitis patients, 60% of them presented in first 24 hours, while in non - appendicitis patients we had 70 (58.4)% of them presented in first 24, (**Table 3**).

Ultrasound examination revealed that among the 250 appendicitis patients, 130 patients (52%), showed normal findings ; 60 male patients (46%) and 70 female patients (54%), but US diagnosed 120 patients (48%), 30 male patients(25%) and 90 (75%) as inflamed appendix or its complications . In non - appendicitis group (N=120), U/S showed that Gynecological and Obstetrical problems were the most common findings, where (45 patient) had these problems

Operative findings

In appendicitis patients (N = 250) inflamed appendix proved histopathologically seen in 190 patients (86%),but normal appendix were proved by histopathological examination in 30 patients (14%). Among this group, 15 patient treated as acute abdomen and laparotomy was indicated and performed which showed perforated viscus. Other 7 patient with appendicular mass were discharged after conservative treatment for 3 - 5 days then returned back for interval appendectomy and 8 patient with appendicular abscess were drained urgently then discharged after 4 - 7 days and came back for interval appendectomy. Operative findings in non - appendicitis patients (N = 120), patients with Gynecological and Obstetrical problems (65 patient) referred to Gynecological department and treated there except 10 patients according to their request.

Patients with lower ureteric stone (n =30) and 5 patient with pyonephrosis were operated in the department of urology in our hospital. Patients with acute cholecystitis (20 patients), were

conservatively conserved for several days then underwent cholecystectomy later (**Tables 4 and 5**).

Validity parameters of ultrasound: specificity, sensitivity, and accuracy

The specificity, sensitivity and accuracy of U/S in pathological condition of appendix to evaluate total accuracy of U/S, the overall accuracy of U/S in acute appendicitis and its complications was (65%) in appendicitis group and 88.46% in the second group (non-appendicitis group). The details of these parameters and their values in each pathology are summarized in (**Tables 6 and 7**), Moreover, accuracy of U/S (total) for diagnosis of other pathology mimicking appendicitis was (93%),(**Tables 7**),

Table 1. Sex distribution of patients (N = 370)

Sex	No.	%
Male	130	35.1%
Female	240	64.9%
Total	370	100.0%

Table 2. Age and sex distribution in appendicitis and non-appendicitis patients

Variable	Appendicitis patients		No-appendicitis patients	
	No.	%	No.	%
Age (year)				
10 - 19	60	24.0	20	16.7
20 - 29	120	48.0	55	45.8
30 - 39	30	12.0	25	20.8
40 - 49	25	10.0	20	16.7
50 -59	10	4.0	-	-
60 -69	5	2.0	-	-
Total	**250**	**100.0**	**120**	**100.0**
Sex				
Male	90	36.0	40	33.3
Female	160	64.0	80	66.7
Total	**250**	**100.0**	**120**	**100.0**

Table 3. Duration of presentation of pain for appendicitis and non-appendicitis patients

Duration (hours)	Appendicitis patients		No-appendicitis patients	
	No.	%	No.	%
<24	150	60.0%	70	58.3%
25-48	60	24.0%	30	25.0%
More than 48	40	16.0%	20	16.7%
Total	250	100.0%	120	100.0%

Table 4. Sonographic and operative findings in appendicitis patients (N= 250)

	On Ultrasound	Operative
Inflamed appendix	90	190
Perforated appendix	15	15
Appendicular mass	7	7
Appendicular abscess	8	8
Normal appendix	130	30
Total	250	250

Table 5. Sonographic and operative findings in non-appendicitis patients (N= 120)

Findings	On Ultrasound	Operative
Lower ureteric stone(RT)	30	30
Pyonephrosis	5	5
Acute cholecystitis	20	20
Ovarian cyst (torsion- rupture)	45	40
Tubo-ovarian abscess	5	3
Ectopic pregnancy	15	12
Acute appendicitis	-	10

Table 6. Ultrasound specificity, sensitivity and accuracy in appendicitis group

Final diagnosis	Total number of cases	Diagnostic positive	Normal in U/S	Specificity	Sensitivity	Accuracy
Inflamed	200	90	130	40%	41.0%	40.0%
Perforated	15	15	-	100%	100.0%	100.0%
Mass	7	7	-	-	100.0%	100.0%
Abscess	8	8	-	-	100.0%	100.0%
Normal appendix	30	-	-	-	-	-
Total	250	-	-	-	-	65%

Table 7. Ultrasound specificity, sensitivity and accuracy in non-appendicitis group

Final diagnosis	Total number of cases	Diagnostic positive	Normal in U/S	specificity	Sensitivity	Accuracy
Lower Ureteric	30	-	-	-	100%	100%
Stone(Right)	-	-	-	-	-	-
Pyonephrosis	5	5	-	-	100%	100%
Acute	20	20	-	-	100%	100%
Cholecystitis	-	-	-	-	-	-
Ovarian Cyst	40	36	-	-	100%	85.70%
(Torsion-Rupture)	-	-	-	-	-	-
Tubo-Ovarian	3	3	-	-	100%	75%
Abscess	-	-	-	-	-	-
Ectopic Pregnancy	15	14	-	-	100%	83.30%
Acute	3	-	-	-	100%	
Appendicitis	-	-	-	-	-	-
Total	26	23	-	-	100%	88.46%

DISCUSSION

This study was done to evaluate the advantage of U/S exam in patients with suspected acute appendicitis. in first group we had patients250 (67%) as appendicitis or its complication's, male less than female in a ratio of 1 to 1.85, the results are agreed to other studies elsewhere in the world. (8,9,10). In a study conducted by AL - Obaidi (11) similar results were reported where females were more frequent. The highest incidence was in the 3rd decade in 120 patients , this is similar to other studies (8,9,10,11). U/S was positive for acute appendicitis (Not perforated cases) in 90 patients (true positive), and Negative in 130 patients (False negative), there is sensitivity of U/S to diagnosis was (41%) and specificity was (40%) and accuracy was (40%). Tristan R et al. saw appendicitis out of 230 number in 68.7%cases, mark improvement with negative appendectomy rate of 8.7% and with secondary signs increase sensitivity [12,13]. The rate of visualization of the appendix by ultrasound has varied widely in the literature. Lee et al. recorded a rate of visualization of the appendix of 99% among patients in all age groups [12,14]. As in our study, visualization was more frequent in acute appendicitis (86%) than when the appendix was healthy (3.6%). Our result it compared to elsewhere in the world are not encouraging if compared to what is reported by others this probably dune to frequency that used by others from 5 10 7 MHz as Mittal et al. have found a lower rate of visualization of the appendix in the hospitals where US is used less often (25%) compared to hospitals where ultrasound is always available (56%) (15). Fifteen of our patients had perforated appendix, we have low rate of perforation (6%) Fig (5), if compared to what is reported by others (11.9%)) in Al - Obaidi study (11). U/S was positive in 15 of these patients and accuracy (100%),which better than what finding by Al-Obaidi (11). For Complicated cases (Mass of abscess) We had excellent results with U/S that total accuracy was (100%), table (6.1) same as reported by Al - Obaidl (11). In the 2nd group we had 80 female,40 males, male to female ratio M: F = (1: 2),in our results with U/S exam were good with total accuracy to diagnose other pathology which simulate acute appendicitis Was (88.46%) which is similar to other studies (11,13,15).

CONCLUSIONS

Ultrasound had a limited value for diagnosis of acute appendicitis, for which clinical examination and diagnosis still the corner stone, nonetheless, it is a good method to evaluate patients presented with complications of appendicitis. Ultrasound is a good tool for evaluation of patients with other pathologies that presents with right lower quadrant abdominal pain particularly in females.

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