The effect of emergency surgeon-performed sonography on diagnostic accuracy of appendicitis

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ABSTRACT

Background: The diagnosis of acute appendicitis, which is highly prevalent surgical emergency, remained mainly a clinical diagnosis with high false negative and false positive rates. Emergency surgeon can play important role in using some modern diagnostic facilities like ultrasonography (US) to improve the diagnosis

Aims: To evaluate the role of ultrasonography performed by emergency surgeon in improving the diagnosis of acute appendicitis.

Patients and methods: A prospective study over two years on 290 patients with acute appendicitis. We allocated the patients into two group depending on the way of their diagnosis whether US used or not in their diagnosis and the operative state of the appendix and the histopathological results were recorded.

Results: The negative appendectomy rate in group 2 patients (US was used in their diagnosis) was lower than in-group 1(US was not used in their diagnosis) 7.2% vs 25%. In group2, the diagnostic accuracy was 79.3%, the sensitivity rate 75.5%, the specificity rate 89.3%, Positive predictive value 95% and the Negative predictive value 57.5%. The results in our study were near or within the results of studies performed by professional sonographer

Conclusions: There are important roles for US as diagnostic tool in patients with clinical diagnosis of acute appendicitis; as it improves the diagnostic accuracy of appendicitis and reduces the negative appendectomy, but non-appendicitis US result is not enough to exclude acute appendicitis. The emergency surgeon with proper US training can perform US examination successfully since the results are similar to that performed by professional sonographers.

تأثير استخدام الفحص بالسونار من قبل جراح الحالات الطارئة على دقة تشخيص التهاب الزائدة الدودية

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الخلاصة:

دراسة مستقبلية في مستشفى الصدر التعليمي في ميسان وخلال سنتين عن تأثير استخدام جهاز السونار من قبل جراح الطوارئ في دقة تشخيص التهاب الزائدة الدودية وتمت الدراسة على ٢٩٠ مريضا، مجموعة منهم اعتمد التشخيص السريري بصورة رئيسية ومجموعة اخرى اضيف استخدام جهاز السونار في تشخيصهم. وأظهرت الدراسة تقليل واضح في نسبة التشخيص الغير صحيح ونسبة عمليات رفع الزائدة الدودية الغير ضرورية في المجموعة الثانية منها في الاولى (٢٥% مقابل ٧,٢%) كما بينت الدراسة نجاح تجربة استخدام جهاز السونار من قبل جراح الطوارئ حيث كانت النتائج مماثلة لنتائج دراسات اخرى من قبل اطباء متخصصين في الفحص بالسونار.

INTRODUCTION:

Acute appendicitis is one of the most common clinical abdominal emergency that encountered by emergency surgeon. It occurs in 7% of the population[1]. The diagnosis of appendicitis is still mainly a clinical diagnosis. When it's diagnosis is made only on clinical assessment this lead to negative appendectomy rates of up to 20% -30%[2]; and removal of normal appendix is frequently not a benign procedure as it carries a definitive post-surgical morbidity (18%) [3]. The wide spectrum of differential diagnosis of appendicitis and some atypical presentation features of appendicitis together with the fact that an increased risk of perforation correlates with the delay in the diagnosis ,all are necessating to improve the diagnostic accuracy of this problem. Different aids were introduced like computer aided programs, different scoring systems, GIT contrast studies, C-T scan, ultrasonograhy(US), MRI and laparoscopy[4] and among these modalities, ultrasonography is simple, easily available, noninvasive, convenient and cost effective[5]. Owing to unavailability of sonography specialists in our hospital in off hours between 2 p.m. and 8 a.m.

and the usual overcrowding in radiology unit, it's a time for emergency surgeon to undertake this task.

KEY WORDS: Surgeon; Appendicitis; Ultrasonography

PATIENTS AND METHODS:

This is a prospective study, was conducted in AL-Sadder General Hospital in Maysan province from May 2010 to March 2012 on 290 patients with a provisional diagnosis of acute appendicitis (Male/Female =134 /156 ; 46.2% vs. 53.7%; Age Range 5-72 years). All those patients presented in duty days of the study author (who had a training course on US with about 3 years US experience) and in all of them medical history was taken, and clinical examination and routine laboratory testing were performed.

Table 1: Age Distribution

Age (years)	No.	%	Male	Female
< 15	64	22%	28	36
15-40	160	55.1%	76	84
40-60	58	20%	25	33
>60	8	2.7%	5	3
Total	290		134	156

We allocated the patients into two groups depended on weather if they had or not US examination:

- Group 1: 116 (40%) patients with a provisional diagnosis of acute appendicitis which depended mainly on the clinical diagnosis (they were not examined by US) and all of them had been treated by appendectomy operation.
- Group 2: 174 (60%) patients with a provisional diagnosis of acute appendicitis and all of them had US examination.

The use of US in second group was aimed to reveal if there were other pathologies and to detect the state of the appendix. The required criteria for diagnosis of acute appendicitis by US were the identification of a

noncompressible, blind-ending tubular structure in the longitudinal axis that measures greater than 6 mm in diameter and lacks peristalsis. The final diagnosis was made from intraoperative surgical findings with the histopathological study results.

RESULTS:

- Regarding the first group, the overall positive appendicitis was in 87 out of 116 patients and the negative appendicitis was in 29 out of 116 patients, so the unnecessary appendectomy rate was (25%).

In the second group (all were examined by US), the results after US examination showed in Table 2 and 3.

Table 2. Group 2 patients results

US Diagnosis		**No. of patients**			**Appendectomy**	**Positive histology**	
		No.		**%**	**No.**	**No.**	**%**
Appendicitis		101		58%	101	96	55.1%
Normal Appendix		16		9.1%	4	3	2.2%
Undetected Appendix		34		19.5%	32	28	18.1%
Other Pathology	**Urinary tract diseases**	8	23	13.2%	0	-	-
	Gynaecological diseases	7			0		
	GIT and Biliary diseases	5			0		
	Miscellaneous	3			0		
Total		174			137	127	73.9%

Table 3. US and final diagnosis (Group 2)

		Proved final result		
		Appendicitis	**non appendicitis**	**Total**
US results	**Appendicitis**	96	5	101
	None appendicitis	31	42	73

- A total of 16 patients in group 2 had normal appendix by US and they were treated medically and followed up and 12 of them their medical problems

were resolved and discharge home and in the remaining 4 patients the appendicitis became more evident and they were treated by appendectomy.

- A total of 34 patients in group 2, their US examination couldn't detect either the appendix or any other pathology but their clinical assessment suggestive of acute appendicitis and (they were added to US none appendicitis group) so they were kept under observation and 2 of them improved and discharged home and the rest needed appendectomy.
- A total of 137 out of 174 patient (the 2nd group) were diagnosed as acute appendicitis and they were treated by appendectomy, and the operative and histopathological results showed that : the positive appendicitis was in 127 out of 137 patients, and the negative appendicitis was in 10 out of 137 patients, so the unnecessary appendectomies was 7.2% (Table 4).
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Table 4. Appendectomy results in group1 and group2

	Group 1	**Group 2**
Total no. of patients	116	174
Total no. of operations	116	137
Total no. of –ve appendicitis	29	10
-ve appendectomy rate	25%	7.2%

The sensitivity rate : 96/127 X100%	= 75.5%
The specificity rate : 42/47 X 100%	= 89.3%
The diagnostic accuracy rate : 96+42/174	= 79.3%
Positive predictive value :96/101 x100%	= 95%
Negative predictive value: 42/73 x 100%	= 57.5%

DISCUSSION:

The rapid advances in US imaging that resulted from continual improvements in equipments and new technologies have led to diagnostic revolution in many fields of medicine. The role of ultrasound in the diagnosis of acute appendicitis was first popularized by Puylaert in1986, one hundred years after the publication of first paper on acute appendicitis by Fitz [6, 7].

In this study, the problem of appendicitis effected mainly young age group , as 77% occurred in ages below 40 years and this in accordance with other studies[1,8,9]. Also the study showed that the female effected more than males and this may be due to some of the gynecological disorders that mimic the acute appendicitis.

Although the diagnosis of appendicitis in most cases is depended on clinical history and physical examination, 30% of clinical cases are atypical and confusing, leading to diagnostic errors and an increase in the number of unnecessary appendectomy[10]and here the need for additional diagnostic aids become necessary and many studies confirmed the important role of US[11,12,13,14].Our study revealed the reduction in unnecessary appendectomy rate following usage of US , as the unnecessary appendectomy rate in Group 2 (they had US examination) was 7.2% in comparison with 25% in Group 1(had no US examination); similar result were obtained in other studies as rate of unnecessary appendectomy without preoperative US assessment was reported between 20%-30%[1,15].

A number of the studies showed significant reduction of unnecessary appendectomy rate with preoperative US assessment,the study by Mardan MA et al[15], by Al-Ajerami Y.[16] , by Pintado Garrido R. et al.[17] and study by Summa et al.[18] reported unnecessary appendectomy of 4.5% , 4.4% , 12% and 2% respectively.

In present study the sensitivity rate was 75.5%, the specificity rate was 89.3% and the diagnostic accuracy rate was 79.3%. The results of the sensitivity and specificity rates of US in acute appendicitis varied among other studies (table 5) and this variation reflects that the accuracy of US is operator dependent; and the overall results in our study are within the limits by other studies by professional ultrasonographers. But, because the low negative predictive value (57.5%) in the present study, we think that the negative US result in patients with clinical suspicion of appendicitis is not enough to exclude appendicitis and we suggest a short period of observation and re-assessment in such cases. A series of literatures also recommended the use of US by emergency surgeon in diagnosis of acute appendicitis [17, 19, and 20]. Furthermore, studies have shown that surgeons can perform and interpret US examinations and can use US successfully in a variety of surgical problems [21-27]. Recognizing the value of US in the hands of surgeons, the American College of Surgeons sponsored its first US course conducted by surgeons for surgeons in April 1996 and recently, the American Board of Surgery redefined the scope of surgical practice to include a "working knowledge of ultra-sonography of head and neck, breast, abdomen (including laparoscopic intra-abdominal) and endorectal US."[28].

Table 5: Result of other studies

The Study	Sensitivity rate	Specificity rate	Accuracy rate	Positive Predictive value	Negative predictive value
Tauro LF, et al	91.3%	88%	90%	91.3%	88%

Pintado R.et al.	83.7%,	97.4%,	96.2%	87.7%	95%
S.HIMENO,et al	97.6 %	82.0 %	91.5 %	89.2 %	95.5 %
Shwerk , et al	75-92%	92-100%	89%	96%	87%

CONCLUSIONS:

1. There are important roles for US as diagnostic tool in patients with clinical diagnosis of acute appendicitis; as it impoves the diagnostic accuracy of appendicitis and reduces the negative appendectomy.

2. None appendicitis US result in patients with suspicion of acute appendicitis is not enough to exclude appendicitis and we recommend a period of observation and re-examination.

2. It is essential for emergency surgeons to have a proper training in US, since the results of US examination by emergency surgeon are similar to that performed by professional sonographers.

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