Ultrasonic diagnosis of acute appendicitis

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تشخيص التهاب الزائدة الدودية الحادة بواسطة الموجات فوق الصوتية

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المستخلص

خلفية الدراسة: التهاب الزائدة الدودية الحاد هو الحالة الطارئه الأكثر شيوعا في جراحة البطن. والتشخيص يعتمد مبدئياً على الاشتباه في المقام الأول على أساس النتائج السريرية. أحيانا الاعراض غير نمطية لدرجة أن الجراح الأكثر خبرة قد لا يوفق في التشخيص قبل اجراء العملية الجراحية. عدم التوصل إلى نتائج التشخيص في وقت مبكر قد ينتج عنه انفجار الزائدة والمضاعفات الناتجة عن ذلك. على الرغم من أن الفحص بواسطة الموجات فوق الصوتية كثيرا ما يستخدم لتشخيص التهاب الزائدة الدودية الحاد، فان دقة هذا الاختبار التصويري تبقى غير واضحة بسبب التباين الكبير في أداء اطباء السونار.

هدف الدراسة: لتقييم فائدة استعمال الموجات فوق الصوتية في تشخيص التهاب الزائدة الدودية الحاد المواد وطرائق العمل: بين كانون الثاني 2014 وكانون الثاني 2015، تم دراسة 91 مريضاً (ذكور 56، 61.54٪، الإناث 35، 38.46٪) تتراوح أعمار هم 7-50 سنة مع التشخيص السريري لالتهاب الزائدة الدودية تم ارسالهم الى قسم الاشعة في المستشفى. نتائج الدراسة: تم فحصهم بالامواج فوق الصوتية؛ 59 مريضا كان ايجابيا (64.84٪)، وكان 39 من الذكور و 20 من

نتائج الدراسه: تم فحصهم بالأمواج فوق الصوتية؛ 59 مريضا كان ايجابيا (64.84٪)، وكان 39 من الذكور و 20 من الإناث . كان 32 مريضا سلبي (35.16٪)؛ 17 مريضاً من الذكور و 15 مريضا من الإناث (تشخيص التهاب الزائدة الدودية بالامواج فوق الصوتية). كان التحقق ذا حساسية 76.39%، وكانت الخصوصية 78.95٪. والدقة 7.92٪، وبلغت القيمة التنبؤية الإيجابية 93.22٪ وكانت القيمة التنبؤية السلبية 46.87٪.

ا**لاستنتاج:** ينبغي اجراء الفحص بالأمواج فوق الصوتية لكل حالات اشتباه التهاب الزائدة الدودية. الفحص بالأمواج فوق الصوتية غير تداخلي ، رخيص، يمكن أن تتكرر دون ضرر على المريض ومتاحة حتى في السرير، وخصوصا عندما يتم تدريب الجراح للقيام بذلك بشكل جيد.

الكلمات المفتاحية:التهاب الزائدة الدودية الحاد، الأمواج فوق الصوتية، التشخيص.

Abstract

Background: Acute appendicitis is the most common surgical abdominal emergency. The diagnosis is suspected and performed primarily on the basis of clinical findings. Sometimes presentation is so difficult that even the most experienced surgeon may miss the diagnosis. Lack of early diagnosis results in perforation and its complications. Although ultrasound is frequently used to diagnose acute appendicitis, the accuracy of this imaging test remains because of great variability the reported performance. unclear а in Aim of the study: to evaluate the benefit of ultrasonic in diagnosis for acute appendicitis patients and methods: Between Jan. 2014 and Jan. 2015, we collected 91 patients (male 56, 61.54%, female 35, 38.46%) their ages range from 7 to 50 years with clinical diagnosis of

acute appendicitis they were sent to ultrasonic studying in radiological department to confirm diagnosis of acute appendicitis.

Results: Ultrasonic study was performed for a total 91 patients, in 59 patients was positive (64.84%), 39 was male & 20 was female, 32 patients was negative (35.16%), 17 patients were males & 15 patients were females (ultrasonic diagnosis of appendicitis). Sensitivity was 76.39%, specificity was 78.95%. Accuracy rate was 76.92%, the positive predictive value was 93.22% & negative predictive value was 46.87%.

Conclusion: Ultrasonic imaging can be performed before surgery for suspected acute appendicitis. Ultrasonic study is non-invasive, cheep, technical can repeated without harm to the patient and available even at bed, especially when surgeon is well-trained to do it.

Key words: Acute appendicitis, ultrasonic, diagnosis.

Introduction

Acute appendicitis is the most common surgical abdominal emergency (1). The of appendicitis lifetime risk is approximately 8.6% in males and 6.7% in females with the highest incidence is in the second and third decades (2). The overall mortality rate of acute appendicitis is less than 1% but in elderly patient it is higher, ranging from 5 -15%(3-5). Lack of early diagnosis results in perforation and its complications such as abdominal abscess, wound infection, infertility and death (6-8). The diagnosis is suspected and performed primarily on the basis of clinical findings. Classically, these clinical findings consist of periumbilical pain migrating to the right lower quadrant, however, the classic signs are not always present, and symptoms can be nonspecific and overlap with symptoms of other causes of abdominal pain. Diagnosis of acute appendicitis is not always straight forward. Sometimes presentation is so difficult that even the most experienced surgeon may miss the diagnosis (9). Clinical decision to operate leads to removal of 20% of normal appendices; to avoid the complications of missed or delayed diagnosis in equivocal cases (10-12). Atypical clinical findings in children, elderly women or women of reproductive

age usually account for the high negative rate up to 47%. With incorporation of diagnostic modalities, low negative appendicectomy rate can be achieved without increasing the rate of perforation (13). The most widely studied diagnostic modalities are; CT scan, Ultrasonography and Laparoscopy (14-16). Imaging with US or CT has become routine for most patients undergoing diagnostic evaluation for appendicitis, with some belief that appendectomy should not be undertaken without imaging to confirm the clinical suspicion (17). The ultrasound for the diagnosis of acute appendicitis, was first popularized by Puylaert in 1986, one hundred years after the publication of first paper on acute appendicitis by Fitz. (18, 19)

Ultrasound examination Visualization of an incompressible blind-ended appendix measuring more than 6 mm in diameter with additional positive findings, including echogenic periappendicular fat, hyperemic appendiceal walls, appendicolith, pericecal fluid, or abscess, was diagnostic of appendicitis(20,21). The US report was read as positive, but when not visualized read as negative for acute appendicitis (22). Theoretically, advanced imaging performed at the earliest stages of disease, when the disease might be less "macroscopic," could lead to falsenegative results (23). If the accuracy of diagnostic imaging varies by the duration of symptoms, clinicians should determine the optimal timing of advanced imaging with equivocal clinical findings of acute appendicitis and no signs of peritonitis or ill appearance(24).

Patients and methods

Between Jan. 2014 and Jan. 2015, we collected 91 patients (males were 56, 61.54%, females were 35, 38.46%) their ages ranged from 7 to 50 years in AL-Azizyah Hospital, Wasit, Iraq, with clinical diagnosis of acute appendicitis and sent them to US studying in radiological department to confirm of diagnosis acute appendicitis. The result is positive for acute appendicitis if the diameter is greater than 6 mm in the AP diameter. it is aperistaltic, noncompressible, and negative for nonvisualize appendix also negative for other diagnosis (ureteric stone, ovarian cyst, etc.), were confirmed with an operative findings. Criteria of exclusion from this study were; sever tenderness that interfere with ultrasonic examination, appendicular mass treated conservatively and acute appendicitis that was treated conservatively. The study was performed in Al-Al-Aziziyah Hospital, Wasit, Iraq.

Results.

A Total of 91 patients 56 patients were males (61.54%) & 35 patients were

females (38.46%) were included in this study, US study performed for them, in 59(64.84%) patients were positive (appendicitis), 39 were males & 20 were females, 32(35.16%) patients, it was negative (no appendicitis), 17 patients were males & 15 patients were females. BVOperative finding analysis was positive (true US finding) in 70 (76.92%) were patients (55 patients were true positive (appendicitis) & 15 patients were true negative (no appendicitis)), in 21 patients (4 patients with false positive (no appendicitis) & 17 patients with false negative (appendicitis)) (false US finding). Sensitivity was 76.39%, specificity was 78.95%. Accuracy was 76.92%, the positive predictive value was 93.22% & negative predictive value was 46.87% finding of ureteric stone (figure 1) excluded the patient from study, (who presented with clinical finding of acute appendicitis), figures. 2&3 show appendix diameter more than 6 mm. edema of the wall and non-compressibility of inflamed appendix



Figure (1): Ureteric stone Figure (2): An acute appendicitis (Long.). Figure (3): An acute appendicitis (cross.)

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Gender	+ve for appendicitis (%)	-ve for appendicitis (%)	Total (%)	
Male	39(42.86)	17(18.68)	56(61.54)	
Female	20(21.98)	15(16.48)	35(38.64)	
Total	59(64.84)	32(35.16)	91(100.0)	

Table (1): US diagnosis of acute appendicitis

Table (2): Operative diagnosis of acute appendicitis					
Gender	Acute appendicitis (%)	Normal appendix (%)	Total (%)		
Male	48(52.75)	8(8.79)	56(61.54)		
Female	25(27.47)	10(10.99)	35(38.64)		
Total	73(80.21)	18(19.78)	91(100.0)		

Table (2): Operative diagnosis of acute appendicitis

Table (3): Comparison between the US & operative findings

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Gender	True +ve (%)	True –ve (%)	False +ve	False -ve
Male	38(41.76)	7(7.69)	1(1.1)	10(10.99)
Female	17(18.68)	8(8.79)	3(3.3)	7(7.69)
Total	55(60.44)	15(16.48)	4(4.4)	17(18.68)
True=70(76.92)		False=21(23.08)		

False positive finding in male; was primary peritonitis, false positive findings

in females were ovulation in one case and salpengitis in two cases.

The P-value for the results was significant at the level of <0.05%.

Discussion

Imaging study plays an important role in the modern evaluation of acute abdominal pain, although a definitive consensus on the appropriate imaging workup protocol remains elusive. The ideal imaging technique would be readily available, fast, inexpensive, reproducible, safe, and accurate (25). Imaging with US has patients become routine for most undergoing diagnostic evaluation for acute appendicitis, with some believing that appendectomy should not be undertaken without imaging to confirm the clinical

suspicion (17). It is not always necessary to identify a normal appendix to consider

the findings negative (26). If there are no secondary signs as mentioned above, and

clinical suspicion is moderately low for appendicitis. Many institutions stop the evaluation and consider the sonographic findings negative for appendicitis. In our study, in 17 (18.68%) patients US was false negative. This may because of early US examination, clinicians should not rely on ultrasonography early in the course of illness. When an ultrasonography result is obtained and negative, clinicians might choose a period of observation, potentially followed by repeated ultrasonography if

clinical suspicion (24). In study performed by Schwerk WB et al. routine use of ultrasonography has significantly improved the diagnostic accuracy in patients with suspected appendicitis and has reduced the negative laparotomy rate from 22.9% to 13.2%.(27). In a study performed by Jefferey RB et al (28), acute appendicitis was more frequent in females, while in our study we had male preponderance (1.6:1). In our study, the sensitivity and specificity, were equal or inferior to other studies (table 4).

 Table (4): Comparison between our results and other studies results

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Auther	sensitivity	Specificity	PPV	NPV
Singh et al. (13)	84.0	50.0	80.0	57.0
Mittal et al. (14)	72.5	97.0	92.5	87.5
Reich (15)	64.4	-	94.5	10.2
Pinto et al. (20)	86.0	81.0	84.0	85.0
Mardan et al. (29)	93.0	44.0	75.0	80.0
Pickuth et al. (30)	87.0	74.0	92.0	63.0
Balthazar et al. (31)	76.0	91.0	95.0	76.0
Kaiser et al. (32)	97.0	93.0	92.0	98.0
Trout et al. (33)	66.5	95.5	75.5	93.0
Our study	76.36	78.95	93.22	47.87

PPV= positive predictive value, NPV= negative predictive value

Limitation

Our study was limited by there was no pathological examination to proof positive or negative appendicitis and our diagnosis was on clinical finding only.

Conclusion

There is little doubt that the use of routine imaging in patients with suspected acute appendicitis would result in fewer unneeded laparotomies. Routine imaging is result in less delay before proper This imaging diagnostic treatment. technique will almost always be done before surgery suspected for acute appendicitis.

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