

Ultrasonography's Accuracy in Diagnosing Acute Appendicitis Compared to Surgical Outcomes

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Abstract

Purpose This work had a specific goal in mind to compare the accuracy of a surgical outcome diagnosis of acute appendicitis with that of an abdominal ultrasonography examination.

Methods A total of 100 patients involved in this study, including children and adults, were examined (37 females and 63 males), with ages ranging from 5 to 45 years. The USG was used to diagnose acute appendicitis in all of the patients.

Results The study involved 100 patients who presented with symptoms and signs suggestive of acute appendicitis in the surgical and emergency departments of the medical city complex. There were 63 males (63%) and 37 females (37%) in the group. The patients ranged in age from 5 to 45 years old, with an average age of 15.36 ± 10.41 . One hundred patients had an abdominal ultrasound, but only 78 had surgery (appendectomy) and 22 did not (conservative treatment), according to surgical opinion. In about $n=70$, 89.7% of patients, the surgery resulted in a positive appendectomy, while in about $n=8$, 10.3% of patients, there was another diagnosis. Table 2 shows that eight of the 78 patients who had a negative appendectomy also had clinical signs and symptoms of acute appendicitis. One of the eight patients had perforated appendicitis, and another had a mild enlargement of the right ovary, two of them had an appendix mass, while the other four had a normal appendix.

Conclusions The accuracy of ultrasound in diagnosing acute appendicitis was found to be low in this study, as a result, acute appendicitis with a diameter of less than 6 mm should be tested with other diagnostic criteria in order to make better management decisions and have better patient care. Finally, When the patient is a female, ultrasound is more useful. If the outcome is negative, however, additional modalities such as a CT scan may be requested into a more diagnostic tool.

Keywords: USG, surgical, surgical outcome, acute appendicitis.

Introduction:

Ultrasonography (USG) is a high-frequency sound wave-based tissue characterization imaging technique. When compared to other imaging modalities such as conventional radiography or computed tomography (CT), it is a valuable and flexible medical imaging modality [1]. Ultrasound is a form of non-ionizing sound wave that hasn't been shown to cause cancer. Ultrasound technology is becoming more widely available in most centers CT or MRI are more complex cross-sectional modalities [2,3,4]. In the pediatric population, these evidence-based recommendations advocate using ultrasound as the first imaging modality [2]. To localize and

classify various tissue types, ultrasound uses acoustic physics properties (compression/rarefaction, reflection, impedance, etc.).

Medical ultrasound uses sound waves with a frequency in the millions of cycles per second range (MHz). Humans, on the other hand, have a maximum audible frequency range of about 20,000 cycles per second (20 kHz) [5]. An ultrasound waves travel pulse through tissue, which is then echoed out. Spatial and contrast details can be contained in the echoes [6]. The principle is similar to that of sonar in nautical applications, but medical ultrasound uses a more advanced technique to gather enough data to create a fast accelerating two-dimensional image information [5,6]. The US has many drawbacks, including reliance on operator ability, restricted assessment for delayed diagnosis and complications, and a low negative predictive value[8]. Furthermore, confirmed Ultrasound sensitivity for acute appendicitis diagnosis varies widely [4,7,8].

Puylaert, was the first to describe the graded compression technique, is used in the examination, gentle pressure removes unwanted gas and shortens the time between the pathologic phase and the patient[9]. Aside from the maximum diameter, a number of other requirements have been identified to help differentiate between an inflamed and a healthy appendix. Children and adults must meet the same standards [10]. Appendicitis can only be treated with surgery, which is often needed to remove appendix tumors. If the tumor is massive, more aggressive surgery may be required, including the removal of a portion of the colon. Surgical appendix removal is called an appendectomy [11]. This work had a specific goal in mind to compare the accuracy of a surgical outcome diagnosis of acute appendicitis with that of an abdominal ultrasonography examination..

Patients and methods:

In total, 100 patients were studied in this research project (37 females and 63 males), with ages ranging from 5 to 45 years. The data was obtained between November 20th, 2020 and March 23rd, 2021. A Samsung ultrasound machine was donated to the City of Medicine (Welfare Hospital Teaching and Baghdad Teaching Hospital).

Place the probe over the ascending colon in the right upper quadrant, with the probe indicator facing the patient's right. The cecum/terminal ileum and, eventually, the appendix can be found by sliding inferiorly down to the right lower quadrant. The most common surgical complication is acute appendicitis. To reduce morbidity, an accurate and timely diagnosis is critical. While patients who present with signs and symptoms can have a simple clinical diagnosis, atypical presentations may lead to diagnostic confusion and treatment delays. In the diagnosis of patients suspected of having acute appendicitis, ultrasound evaluation with graded compression has been identified as a highly accurate modality. However, if the appendix becomes inflamed, ultrasound will reveal it as a blind-ended tubular structure with a laminated wall emerging from the caecum's base. When diagnosing acute appendicitis, a 6 mm threshold diameter is extremely useful. Indirect confirmation of appendicitis is the collection of the right iliac fossa.

Result and Discussion:

The study involved 100 patients who reported to the surgical and emergency departments of the medical city complex with symptoms and signs suggestive of acute appendicitis. Males made up 63 percent of the group, while females made up 37 percent. The patients were between the ages

of 5 and 45 years old, with a mean age of 15.36 ± 10.41 . One hundred patients underwent abdominal ultrasound, but 78 underwent surgery (appendectomy) and 22 did not (conservative treatment), according to surgical opinion in (n=78, 78%) of patients (appendectomy). After operation, approximately (N=70, 89.7%) of patients had a positive appendectomy, whereas approximately (N=8, 10.3%) of patients had a different diagnosis. Table 2 shows the results. Eight of the 78 patients who had a negative appendectomy still had clinical signs and symptoms of acute appendicitis. One of the eight patients had a perforated appendix, one had a mild enlargement of the right ovary, two had an appendicular mass, and the other four had a normal appendix. Appendectomy complications include bleeding, wound infection, infection, redness, and swelling if the appendix bursts during surgery of the abdomen (peritonitis), Irritable bowel syndrome (IBS) is a condition that occurs when Organ damage in the region acute appendicitis is one of the most common causes of acute abdomen, which necessitates surgery. [12]. During their lifetime, about 7% of people may have an appendectomy due to a diagnosis of acute appendicitis [13].

Despite the fact that it is a very common pathology, diagnosing it can be difficult since it clinically mimics a variety of other conditions. [14]. Differential diagnoses for acute appendicitis include lymphoma of the mesenteric lymph nodes, gastroenteritis, constipation, pneumonia of the right lower lobe, and a variety of urologic and gynecologic conditions, to identify a few. [15]. AA is also established by the presence of appendicolith in sonography [16]. Pathologic criteria that favor a tissue diagnosis of acute appendicitis include the presence of neutrophils in the appendix mucosa and focal superficial ulceration of the mucosa. They are not, however, conclusive in AA diagnosis [17].

According to some reports, a CT scan can be used to diagnose AA cases that are just not positive [14]. Other reports, on the other hand, suggest that ultrasonography be used first and foremost in the diagnosis of equivocal patients, with CT scans reserved for those who have inconclusive US results [15,18,19]. Ultrasound has a number of advantages: it can be completed easily, it is relatively inexpensive, it does not require patient preparation, it does not require ionizing radiation, and it does not require contrast [21]. Furthermore, due to the high number of patients admitted to the emergency room and the comparatively low number of CT scan machines, In a hospital setting, patients suspected of acute appendicitis do not have access to CT scans, despite the value of time in the diagnosis of AA. As a result, It is only the surgeon's support modality, in patients with equivocal symptoms of AA. According to some reports, ultrasound for the diagnosis of AA has a sensitivity of 49 to 90%, An overall accuracy of 72 to 94%, with a 47 to 100 % accuracy, a ppv of 84 to 93% [21,22]. Table 3 show the sensitivity In our study, 47.1 % of ultrasound findings were used to diagnose acute appendicitis. indicating that ultrasound could correctly diagnose 47.1 % of patients with acute appendicitis. In the diagnosis of acute appendicitis, ultrasound findings had a specificity (12.5 %), indicating that only 12.5 % with diagnoses other than acute appendicitis were correctly identified through ultrasound. Positive predictive value was (82.5%), meaning that those diagnosed as acute appendicitis by the US were (82.5%) diagnosed as acute appendicitis by surgery, and negative predictive value was (2.6%), meaning that only (2.6%) of those diagnosed as other diagnosis rather than acute appendicitis by the US were diagnosed as other diagnosis by surgery, and overall accuracy was (43.58%).

Sensitivity of US= $33/70 * 100 = 47.1\%$

Specificity of US= $1/8 * 100 = 12.5\%$

PPV of US= $33/40 * 100 = 82.5\%$

NPV of US= $1/38 * 100 = 2.6\%$

Overall accuracy of US= $(33+1)/78 * 100 = 43.58\%$

If the ultrasound result is normal, we can rely on medical opinion instead of the study, or we can use another modality like a CT scan if necessary. Nasiri et al. found a significant difference between the positive and negative predictive value of ultrasound in another study, which supports our results (97.4 % for PPV versus 25 % for NPR) [19].

Ultrasound has certain limitations as well, such as the appendix being filled by overlying gas or a boney pelvis overriding it. The location of the appendix can also affect the appendix's ability to be evaluated by ultrasound (e.g. a retrocecal appendix). Another factor that influences the effectiveness of sonography is obesity [14,16,21]. It's important to note that the majority of our patients who were operated on without any additional imaging studies were males. We do not really know if the gender of the patients has any bearing on the incidence of acute appendicitis perforation.

Socio-demographic characteristics		
Age (years)	(15.36 ± 10.41)	(5-45)
Gender		
Male	63	63.0%
Female	37	37.0%
Total	100	100.0%

Table 1: Patient distribution dependent on socio-demographic characteristics (N=100)

Table 1 shows the distribution of patients based on socio-demographic factors such as (age and gender). Mean age was (15.36 ± 10.41) and majority (63.0%) of patients was male

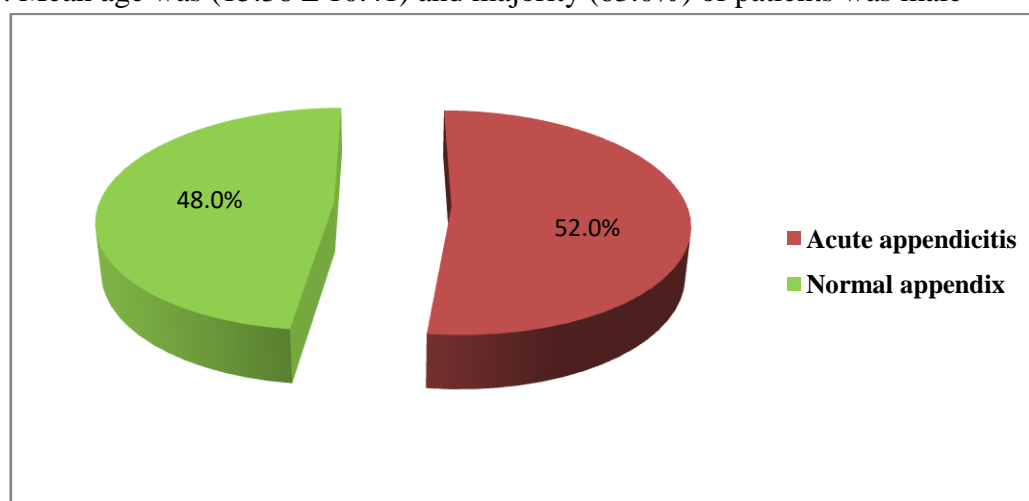


Figure 1: shows distribution of patients according to US diagnosis including (acute appendicitis and normal appendix). Majority (N=52, 52%) of patients diagnosed as acute appendicitis by US.

Study variables	N	%
Surgical opinion		
Appendectomy	78	78.0%
Conservative treatment	22	22.0%
Total	100	100.0%
Post-surgical outcome		
Positive appendectomy	70	89.7%
Negative appendectomy	8	10.3%
Total	78	100.0%
Negative appendectomy		
Normal appendix	4	50.0%
Appendicular mass	2	25.0%
Right ovary mild enlarge	1	12.5%
Perforation	1	12.5%
Total	8	100.0%

Table 2: The Distribution of patients according to surgical opinion and post-surgical outcome. (N=100)

Table 2 shows distribution of patients according to surgical opinion and post-surgical outcome. Surgical opinion in (n=78, 78%) of patients was surgery (appendectomy). After surgery the outcome was positive appendectomy presented in about (N=70, 89.7%) of patients while in about (N=8, 10.3%) of patients there was other diagnosis.

Ultrasound diagnosis	Surgical outcome		Total
	Positive	Negative	
Positive	33	7	40
Negative	37	1	38
Total	70	8	78

Table 3: In relation to surgical outcome, sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy of US results in diagnosing acute appendicitis.

Conclusion:

The accuracy of ultrasound in diagnosing acute appendicitis was found to be low in this study, as a result, acute appendicitis with a diameter of less than 6 mm should be tested with other diagnostic criteria in order to make better management decisions and have better patient care. Finally, When the patient is a female, ultrasound is more useful. If the outcome is negative, however, additional modalities such as a CT scan may be requested into a more diagnostic tool.

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