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Role of Ultrasonography in Diagnosis of Acute Appendicitis

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Abstract: Objective: The vermiform appendix is a worm shaped tubular structure projecting from the blind end of the caecum. Acute appendicitis is the most common surgical abdominal emergency with a life time prevalence of 1 in 7 individuals with the risk of 8.6% for males and 6.7% for females, with the highest incidence in the second and third decades. Because of the clinical diagnosis of acute appendicitis remains a challenge to surgeons, so different aids were introduced like different scoring systems, computer aided programs, ultrasonography, CT scan, MRI, GIT contrast studies and laparoscopy to improve the diagnostic accuracy. Among these modalities, ultrasonography is simple, easily available, non-invasive, convenient and cost effective. The ultrasound diagnosis of acute appendicitis was first introduced by PUYLAERT in 1986, in graded compression technique. **The aim of the study**: to determine the role of ultrasound in diagnosis of the acute appendicitis in those with clinically diagnosed patients. **Methods:** A cross sectional study was carried out in Al- karama teaching hospital for thirty months. **Results:** A total of 435 patients with suspected appendicitis, males 224(51.49%) &females 211(48.50%) were included in present study. Regarding to the validity results of ultrasound in comparison to histopathology findings were as following; accuracy 87.6%, sensitivity 87.8%, specificity 85.3%, positive predictive value 98.6% and negative predictive value 62.8%. **Conclusions:** The ultrasonography had a good accuracy, sensitivity and specificity in diagnosing acute appendicitis cases.

Keywords: Evaluation, Appendicitis, Ultrasonography.

INTRODUCTION

The vermiform appendix is, a worm shaped tubular structure projecting from the blind end of the caecum (Dox, I. *et al*., 2010). At birth, the appendix is short and broad at its junction with the caecum, but differential growth of the caecum produces the typical tubular structure by about the age of two years. During childhood, continued growth of the caecum commonly rotates the appendix and may occupy one of several locations· retrocaecal and retrocolic location in(74%), pelvic in(21%), subcaecal in (1.5%), pre ileal in(1%), pre ileal in (1%), and Paracaecal in (2%). The appendix varies in length from (2-20) cm, the average being about 9cm, it is longer in the child than in the adult and may atrophy and become smaller after mid- adult life (Standring, S. *et al*., 2015). It is connected by a short mesoappendix to the lower part of the mesentery of the ileum. The main artery to the appendix, the appendicular artery, a branch of the ileocolic artery. the terminal part of artery, however, lies actually on the wall of the appendix and may become thrombosed when wall inflamed, which may result in gangrene or necrosis of its distal part. The venous drainage of the appendix is via the superior mesenteric vein (Standring, S. *et al*., 2015).Early reports of perityphlitis and typhlitis in the 19th century appeared to describe clinical features of right sided abdominal pain. Confusion over this right lower quadrant pain existed until Reginald H. Fitz coined the term appendicitis in 1886, and correctly described the appendix as the primary source of inflammation in acute typhlitis (Berry Jr, J. *et al*., 1984). Acute appendicitis is the most common surgical abdominal emergency with a life time prevalence of 1 in 7 individuals (Gwynn, L.K, 2001). The diagnosis is mainly clinical but because of myriad presentation this is true in up to 80% of the patients (Berry Jr, J. *et al*., 1984). As the consequences of missed diagnosis are dire, the common surgical practice has been advocated to operate on doubtful cases rather than to wait and see till the diagnosis is certain. This resulted in negative appendicectomy rate of around 15% has been considered acceptable (Humes, D.J. *et al*., 2006; Shogilev, D.J. *et al*., 2014). The removal of normal appendix is not a simple procedure and carries a definitive morbidity. In order to improve the diagnostic accuracy, different aids were introduced like different scoring systems, computer aided programs, Ultrasonography, CT scan, MRI, GIT contrast studies and laparoscopy (Douglas, C.D. *et al*., 2000). Among these modalities, Ultrasonography is simple, easily available, non-invasive, convenient and cost effective. The ultrasonographic diagnosis of acute appendicitis was first introduced by Puylaert in 1986, one hundred years after the publication of

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first paper on acute appendicitis by Fitz (Puylaert, J.B, 1986). Puylaert reported the sensitivity of 89% and specificity of 100% of his technique in the diagnosis of acute appendicitis. Lim HK and Quillin SP had described the usefulness of ***color Doppler*** in detecting inflamed appendix. The inflamed thick walled, non-compressible appendix fixed in position by compressing transducer will show circumferential color in contrast to the normal gut which is thin walled and compliant with frequent peristalsis transmitting no or minimum signals. Doppler signals disappear when gangrene or perforation occur (Lim, H.K. *et al*., 1996; Quillin, S.P. *et al*., 1994).

Epidemiology:- The lifetime risk of developing appendicitis is 8.6% for males and 6.7% for females, with the highest incidence in the second and third decades (Addiss, D.G. *et al*., 1990; William, N.S. *et al*., 2013). Acute appendicitis is relatively rare in infants, and becomes increasingly common in childhood and early adult life, reaching a peak incidence in the teens and early 20s. The incidence of appendicitis is equal among males and females before puberty, in teenagers and young adults, the male:female ratio increases to 3:2 at age 25; thereafter, the greater incidence in males declines. After middle age, the risk of developing appendicitis among males and females is quite low (William, N.S. *et al*., 2013). The rate of appendectomy for appendicitis has been decreasing since the 1950s in most countries (Brunicardi, F.C. *et al*., 2015). Since then, there has been an increase in the incidence rate of nonperforated appendicitis. The reason for this is not clear, but it has been proposed that the increased use of diagnostic imaging has led to a higher detection rate of mild appendicitis that would otherwise resolve undetected (Brunicardi, F.C. *et al*., 2015).

Pathogenesis:- Obstruction of the appendiceal lumen seems to be essential for the development of acute appendicitis. Yet, in many cases of early appendicitis, the appendix lumen is patent despite the presence of mucosal inflammation and lymphoid hyperplasia. Occasionally among children and young adults an infective agent, possibly viral, which initiates an inflammatory response.Seasonal variation show increase incidence occurring between May and August in Northern Europe than at other times of the year. Lymphoid hyperplasia narrows the lumen of the appendix, leading to luminal obstruction. Once obstruction occurs, mucus secretion and inflammatory exudation increase intraluminal pressure, obstructing lymphatic drainage. Edema and mucosal ulceration develop with bacterial translocation to the submucosa. Resolution may occur at this point either spontaneously or in response to antibiotic therapy (William, N.S. *et al*., 2013). If the condition progresses, further distension of the appendix may cause venous obstruction and ischemia of the appendix wall. With ischemia, bacterial invasion occurs through the muscularis propria and submucosa, producing acute appendicitis. Finally, ischemic necrosis of the appendix wall produces gangrenous appendicitis, with free bacterial contamination of the peritoneal cavity. Alternatively, the greater omentum and loops of small bowel become adherent to the inflamed appendix, walling off the spread of peritoneal contamination, and resulting in a phlegmonous mass or paracaecal abscess. Rarely, appendiceal inflammation resolves, leaving a distended mucus-filled organ termed a 'mucocoele' of the appendix. It is the potential for diffuse peritonitis that is the great threat of acute appendicitis. Peritonitis occurs as a result of free migration of bacteria through an ischemic appendicular wall, frank perforation of a gangrenous appendix or delayed perforation of an appendix abscess (William, N.S. *et al*., 2013). Factors that promote this process include extremes of age, immunosuppression, diabetes mellitus and faecolith obstruction of the appendix lumen, a free-lying pelvic appendix and previous abdominal surgery that limits the ability of the greater omentum to wall off the spread of peritoneal contamination. In these situations, a rapidly deteriorating clinical course is accompanied by signs of diffuse peritonitis and systemic sepsis syndrome [(12)].

Clinical Diagnosis of Appendicitis:- Acute appendicitis can be discerned in two clinical syndromes **acute catarrhal (non-obstructive)** appendicitis and **acute obstructive** appendicitis, the latter characterized by a more acute course**.** The classical features of acute appendicitis begin with poorly localized vague abdominal pain, this is due to mid gut visceral irritation in response to appendiceal inflammation and obstruction. The pain is frequently first noticed in the peri-umbilical region and is similar to, but less intense than, the colic of small bowel obstruction. Central abdominal pain is associated with anorexia, nausea and usually one or two episodes of vomiting follow the onset of pain, these described first by J Murphy in 1904 (Alvarado, A, 1986). Anorexia is important and constant clinical feature, particularly

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in children. The patient often gives a history of similar discomfort that settled spontaneously. A family history is also useful as up to one-third of children with appendicitis have a first-degree relative with a similar history. With progressive inflammation of the appendix, the parietal peritoneum in the right iliac fossa becomes irritated, producing more intense, constant and localized somatic pain that begins to predominate. Patients often report this as an abdominal pain that has shifted and changed in character. Typically, coughing or sudden movement exacerbates the right iliac fossa pain (William, N.S. *et al*., 2013). The classic visceral–somatic sequence of pain is present in only about half of those patients subsequently proven to have acute appendicitis, either due to variation in the anatomic position of the appendix or the age of the patient (William, N.S. *et al*., 2013). An inflamed appendix in the pelvis may cause suprapubic discomfort and tenesmus. In this circumstance, tenderness may be elicited only on rectal examination and is the basis for the recommendation that a rectal examination should be performed on every patient who presents with acute lower abdominal pain. During the first 6 hours, there is rarely any alteration in temperature or pulse rate. After that time, slight pyrexia (37.2–37.7°C) with a corresponding increase in the pulse rate to 80 or 90 is usual. The temperature may be normal and vomiting is common, so that the clinical picture may mimic acute intestinal obstruction (William, N.S. *et al*., 2013).

The Physical Signs of Acute Appendicitis:

- **Pointing sign** (patient usually refer to Mcburny point as a site of maximum pain)
- **Cough sign** (pain is felt at the right iliac fossa when patient asked to cough)
- **Localized tenderness** in the right iliac fossa
- **Rebound tenderness**.
- **Guarding Abdominal wall**.
- **Rovsing's sign** (Deep palpation of the left iliac fossa may cause pain in the right iliac fossa)
- **Psoas sign** (Occasionally, an inflamed appendix lies on the psoas muscle, and the patient, often a young adult, will lie with the right hip flexed for pain relief).
- **Obturator sign** (when the hip is flexed and internally rotated, this maneuver will cause pain in the hypogastrium).

Laboratory markers:- White blood cell elevation, the value of C-reactive protein and proportion of polymorph nuclear cells have very limited diagnostic utility on their own but show promise when used in combination.

Scores:- Many clinical scoring systems (CSS) have been developed to assist clinicians in appropriately stratifying a patient's risk of having appendicitis. The most popular score is the Alvarado score, introduced by Alvarado in 1986 and sometimes referred as the MANTRELS score (acronym of the eight criteria).The Alvarado (MANTRELS) score is a number of clinical and laboratory-based scoring systems have been devised to assist diagnosis of acute appendicitis, the score has(6) clinical items and (2) laboratory measurements with a total of 10 points, the two most important factors are tenderness in the RIF and leukocytosis, are assigned two points, and the six other factors are assigned one point for each, as scheme in **(table 1)**.

Table 1: The Alvarado score

Clinical and laboratory finding	SCORE
Migratory RIF pain	1
Anorexia	1
Nausea and vomiting	1
Tenderness[RIF]	2
Rebound tenderness	1
Elevated temperature	1
Leukocytosis	2
Shift to left	1
Total	10

A score of 7 or more is strongly predictive of acute appendicitis, in patients with an equivocal score (5–6), further abdominal ultrasound or contrast-enhanced CT examination is required to reduce the rate of negative appendectomy (Alvarado, A, 1986).

Imaging:-Acute appendicitis is a common surgical disease and a potentially dangerous condition. If the inflamed appendix is not treated urgently, it

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will proceed to perforation, gangrene and result in peritonitis or abscess formation. With the advent of advancement in imaging techniques an important role in diagnosis of appendicitis without delay or clinically missed patients (Reginelli, A. *et al*., 2012). Ultrasonography is universally available, cheap, and easy to use and doesn't involve the use of radiation that has the potential for highly accurate imaging in patients with suspected acute appendicitis (Gracey, D. *et al*., 2007). Real- time compression US was first introduced by Puylaert in1986 (Puylaert, J.B, 1986; Puylaert, J.B, 1990). Over the last 30 years, this technique has been extensively studied and improved. Although the development of US technique has led to dramatic improvements in contrast, spatial and temporal resolution, US examination technique and US signs of appendicitis in real time US have undergone only slight evolution. Graded compression US is performed in a step-wise approach and aims to optimize visualization of the appendix (Quigley, A.J. *et al*., 2013; Birnbaum, B.A. *et al*., 2000).

In Graded Compression Technique: where a uniform pressure is applied in RIF by a hand held US transducer, normal and gas filled loops of intestine are either displaced from the field of vision or compressed between anterior and posterior abdominal walls. Inflamed appendix being incompressible and thus optimally seen as a blind ended tubular structure with laminated wall arising from the base of caecum, it is a peristaltic, and its diameter should be more than 6mm. Appendicoliths appear as bright echogenic foci with distal acoustic shadowing, and their visualization is another contributory finding. Similarly there may be increased echogenicity of the periappendiceal fat; Ultrasonic probe tenderness can be elicited (Chesbrough, R.M. *et al*., 1993). There is direct and indirect US signs of acute appendicitis are summarized in **(Tables 2)** (Quigley, A.J. *et al*., 2013; Birnbaum, B.A. *et al*., 1993; Incesu, L. *et al*., 2004; Ripollés, T. *et al*., 2013)

Tables 2: Real time US sign of acute appendicitis

Direct signs	Indirect signs
Non –compressibility of the appendix Perforation: appendix might be compressible *Diameter of appendix > 6mm* *Single wall thickness> or = 3mm* *Target sign:* Hypoechoic fluid filled lumen Hyperechoic mucosa/sub mucosa Hyperechoic muscularis layer *Appendicolith:hyperechoic with posterior shadowing* *Colour Doppler and contrast-enhanced US:* Hypervascularity in early stages of acute appendicitis Hypo-to a vascularity in abscess &necrosis	*Free fluid surrounding appendix* *Local abscess formation* *Increased echogenicity of local mesenteric fat* *Enlarged local mesenteric lymph nodes* *Thickening of the peritoneum* *Signs of secondary small bowel obstruction*

Table 2: show direct and indirect (secondary) signs of acute appendicitis in graded compression, real-time US, color Doppler and contrast enhanced US. In the early days of ultrasonic aid for the diagnosis of appendicitis, it was clearly stated that US diagnosis relies on the direct visibility of the appendix and on indirect signs for local inflammation.

AIM OF THE STUDY:- To evaluate the role of ultrasound in diagnosis of the acute appendicitis in those with clinical suspicion patients.

PATIENTS AND METHODS

A cross sectional study was carried out at Al-karama teaching hospital. The study extended for thirty months. All patients who diagnosed and with positive criteria of appendicitis were included in this study and at last the sample size was 435 patients. The patient with appendicular mass was excluded from this study. After full physical examination, GUE, WBC the patients send for the U/S and the diagnosis by ultrasound. To detect the vermiform appendix graded compression technique was used. The Ultrasonography findings were recorded as positive and negative for acute appendicitis. The criteria for positivity-included visualization of non - compressible tubular and blind ended a peristaltic structure with diameter of 6mm or more in right lower quadrant, the demonstration of Appendicoliths, probe tenderness, increased echogenicity of the peri-appendiceal fat and free intraperitoneal fluid particularly in RIF or pelvis. The criteria of negativity were Non-visualization of appendix or

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visualization of normal appendix with or without alternative diagnosis. Positive and negative appendices on histopathology were regarded in accordance to the following criteria: Negative appendectomy was defined as normal looking appendix and absence of acute inflammation on histopathology, while Positive cases included appendices showing acute inflammatory changes.

RESULTS

A total of 435 patients with suspected acute appendicitis were included in this study with age range from (8 – 50) years (mean age as 23.49years) there was 224 male &211 female with M:F ratio was (1.06:1), mean age of male patients was (22.51years) and mean age of female patients was (24.51years); no association between mean age of male and female patients with histopathological result. No. of patients with positive histopathology was 401 patients & that for negative histopathology 34 patients with no association between histopathological result and gender. All these findings shown in **(table 3).**

Table 3: Comparison of mean age of patients according to gender and histopathological results

	Gender	No.	Mean
Total		435	23.49
Gender	Male	224	22.51
	female	211	24.56
Histopathology	Positive	401	23.68
	Negative	34	21.00
Range age (8-50 years)			

Male patients 224(51.49%) were more than female patients 211(48.50%) in most commonly affected age group was 10-19years (20% of total patients).

Table 4: Association between histopathological results and symptoms

Symptoms		Histopathology			
		Positive		Negative	
		No.	%	No.	%
Anorexia	No	63	88.7	8	11.3
	Yes	338	92.85	26	7.15
Vomiting	No	317	93.2	23	6.8
	Yes	64	85.3	11	14.7
Diarrhea	No	381	93.4	27	6.6
	Yes	20	74.1	7	25.9
Relative constipation	No	75	85.2	13	14.8
	Yes	326	93.9	21	6.1
Migratory pain to RIF	No	82	89.1	10	10.9
	Yes	319	93	24	7.0
Generalized abdominal pain	No	243	91.7	22	8.3
	Yes	158	92.9	12	7.1
Peri-umbilical abdominal pain	No	141	93.4	10	6.6
	Yes	260	91.5	24	8.5
Dysuria and frequency	No	197	94.7	11	5.3
	Yes	204	89.8	23	10.1

There was no significant differences between patients with positive and negative histopathology findings regarding presenting symptoms (anorexia, vomiting, diarrhea, relative constipation,

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generalized abdominal pain, migratory pain to RIF, peri-umbilical abdominal pain and fever) as shown in **(table 4)**.

Table 5: association between histopathological results and physical signs

Physical signs		Histopathology			
		Positive		Negative	
		No.	%	No.	%
Fever	No	201	94.8	11	5.2
	Yes	200	93.9	13	6.1
Cough sign	No	106	82.8	22	17.2
	Yes	295	96.1	12	3.9
Localized tenderness	No	44	74.6	15	25.4
	Yes	357	94.9	19	5.1
Rebound tenderness	No	85	89.5	10	10.5
	Yes	316	92.9	24	7.1
Rovsing's sign	No	281	92.4	23	7.6
	Yes	120	91.6	11	8.4
Psoas sign	No	330	91.67	30	8.33
	Yes	71	94.66	4	5.34
Obturator sign	No	364	91.5	34	8.5
	Yes	37	100.0	0	-
Pointing sign	No	163	82.7	34	17.3
	Yes	238	100.0	0	-

There was a significant association between (cough sign, localized tenderness sign,and Pointing sign), and patients with positive histopathology findings.No significant differences between patients with positive histopathological findings and those with negative findings regarding physical signs (fever, rebound tenderness, rovsing's sign, psoas sign and obturator sign). As shown in **(table 5).**

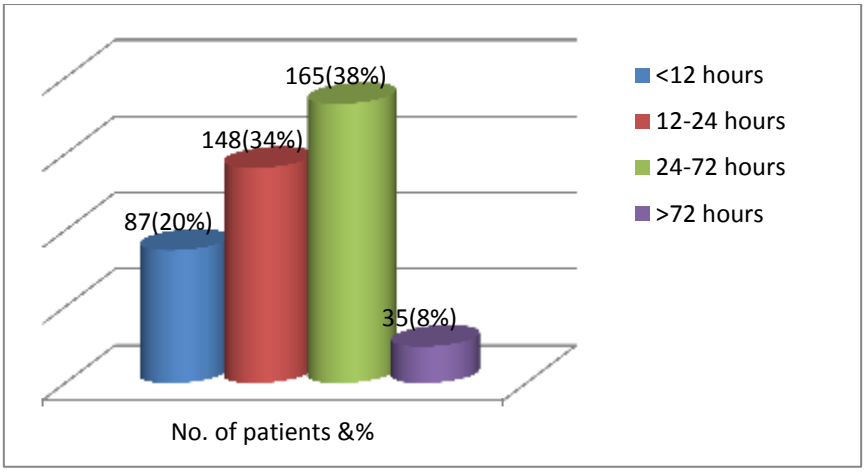

Figure 1: Distribution of patients according to duration of pain

Distribution of patients according to pain duration as show in (figure 1) as following ; 165(38%) of patients in 24-72 hours, 148(34%) of patients in 12-24 hours, 87(20%) of patients in <12 hours and 35(8%) of patients in >72 hours.

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Table 6: Validity of ultrasound diagnosis of acute appendicitis compared with histopathlogical examination as gold standard

		Histopathology		
		Positive	**Negative**	**Total**
Ultrasound	**Positive**	352	5	357
	Negative	49	29	78
Total		401	34	435
Sensitivity = 87.8%				
Specificity = 85.3%				
Accuracy =87.6%				
+ve predictive value = 98.6%				
-ve predictive value = 62.8 %				

Sensitivity; (also called the true positive rate),is the ability of test to identify correctly those who have the disease (true +ve)**.** *Sensitivity =a/a+c×100%*

Specifity; (also called the true negative rate), is the ability of test to identify correctly those who do not have the disease (true -ve). *Specifity=d/b+d×100%*

Positive predictive value ;Is apropability that person have disease actualy has the disease giving that he or she tests positive.*PV+=a/a+b×100%*

Negative predictive value ;Is apropability thatperson have disease actualy has the disease giving that he or she tests negative. *PV-=c/c+d×100%*

Accuracy of test *=(TP+TN)/TOTAL* (TP=True Positive TN=True Negative)

435 cases of suspected acute appendicitis that were included in our study, ultrasounds and histopathlogical examination were done for all cases. Ultrasound results were positive in 357 patients, true positive in 352 patients, and false positive in 5 patients. Ultrasound results were negative in 78 patients' true negative in 49 patients and false negative in 29 patients. Regarding histopathlogical finding, the results were acutely inflamed appendix 401 cases (92.18%) and normal appendix 34 cases (7.82%). Statistical analysis showed that graded compression ultrasound yielded a sensitivity 87.6%, specificity 87.8%, diagnostic accuracy 85.3%, positive predictability power of 99.6% and negative predictability power of 62.8%. All these findings shown in **(table 6).**

DISCUSSION

Even though the diagnosis of acute appendicitis is still thought to be a clinical one, a significant number of patients have normal appendices at surgery. Wrong diagnosis of appendicitis has led to a high rate (around 15 %) of unnecessary removal of the normal appendix. Ultrasound has also been shown to be highly sensitive and specific for the diagnosis of not only acute appendicitis but also other conditions that cause right lower quadrant pain (Subash, K.C. *et al*., 2015). In our study the accuracy rate of US in diagnosing acute appendicitis in comparison to histopathology results was 87.6% with sensitivity and specificity 87.8% and 85.3%, respectively, which is agree with the study done in north of Iraq by Hiwa O. when he mentioned that the accuracy and sensitivity of US was 83.3%, 82.1% but the specifity (100%) was inconsistent with the present study (Hiwa, O, 2006). Moreover these findings are inconsistent with results of other Iraqi study by Hana, *et al*.,. [25] which reported US accuracy of 96.6%, sensitivity 96% and specificity 93%. Our result agree with result of Pinto, *et al*., (2013) study in Italy which showed overall sensitivity of US as 86%, specificity 81% and accuracy of 84%. However our ultrasound accuracy in diagnosing acute appendicitis was better than results of Parsijani, *et al*., (2013) study in Iran which found US accuracy as 73.6%, sensitivity as 75% and specificity as 69.2%. These differences in result of studies were mentioned might be attributed to differences in sample size, US technique and operators experiences. Ultrasound has also some limitations as well, for example appendix can be covered by overlying gas or overriding boney pelvis. The site of the appendix can also influence on the possibility of evaluation of appendix by ultrasound (e.g. a retrocecal appendix). Obesity is another factor influencing the optimality of sonography (Abd Elghany, E. *et al*., 2011; Jeffrey, R.B. *et al*., 1998). Positive predictive and negative predictive values of US in present study were 99.6% and 62.8%, respectively. The negative predictive value inconsistent with previous Iraqi study by Hana, *et al*., (2014), this should lead us to

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the conclusion that when ultrasound report revealed that the appendix was normal, so we should more rely on our clinical judgment than the report or perhaps use another modality such as CT-scan if possible. There were showed a significant difference between positive and negative predictive value of sonography confirming our results by Nasiri, *et al*., (Nasiri, S. *et al*., 2012) (97.4% for PPV in comparison to 25% for NPV) and hiwa O, (2006) (100%for PPV in comparisonto26.6% for NPV). Our results emphasize again that a positive ultrasonography for appendicitis is strongly in favor of a diagnosis of acute appendicitis. However, a negative ultrasound is not sufficient to rule out the diagnosis and discharge the patient. The present study revealed a significant association between dysuria and frequency symptoms with negative histopathology findings of suspected appendicitis patients. This finding is similar to results of Boyd, *et al*., (2012) study in USA which concluded that causes and symptoms of acute abdominal pain are varied, and the diagnosis is not as clear as it may seem, particularly in female patients. Right lower quadrant pain is rarely the major clinical finding of an acute urological illness, but it can nevertheless be the presenting symptom of pyelonephritis, urinary colic, cystitis, or a tumor of the urinary tract. In all of these cases, it is usually accompanied by other symptoms or signs pointing to the urological origin of the problem (Paajanen, H. *et al*., 2012), including macro or micro hematuria, renal angle tenderness, and dysuria, oliguria, pyurea &frequency (Miller, N.L. *et al*., 2007). Pain duration among suspected appendicitis patients in this study was predominately 24-72 hours; followed by duration of 12-24 hours. These findings coincide with reports of Humes, *et al*., review in UK which stated that 50% of acute appendicitis patients had severe abdominal pain in first 24-72 hours. Studying demographic characteristics of suspected appendicitis patients revealed that prevalent age group was 10-19 years with predominance of male gender. These findings are similar to results of Sulu, *et al*., (2010) study in Poland and Lohar, *et al*., (2014) study in India.

CONCLUSIONS

The ultrasonography had a good accuracy, sensitivity and specificity in diagnosing acute appendicitis cases. Encouraging the radiologists and surgeons to relay on ultrasound diagnosis of acute appendicitis among clinically suspected patients to avoid perforation and other complications. Negative with ultrasonography results should be re-examined with different diagnostic technique like CT-scan.

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