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Original Research Article.

Diagnostic Modality Accuracy in Suspected Appendicitis in Saudi Arabia: A Retrospective Study

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ABSTRACT

Introduction: Appendicitis is an acute condition that can occur at any age but is quite rare among individuals of extreme age. It is frequently common in teenagers and young adults. Conventional diagnosis was promptly made based on clinical scenario. In this study we aimed to compare the accuracy of CT versus US in diagnosis of acute appendicitis.

Materials and Methodology: Our study was adopted to be conducted as an observational study using a retrospective cohort chart in a secondary hospital in Saudi Arabia. In this study, we have evaluated all files from 3005 patients, but only 220 had fulfilled our inclusion criteria. The various collected data included age, gender, clinical signs and diagnosis, symptoms and laboratory, histopathological and radiological findings which were collected by trained data collectors and reviewed by the primary study supervisors.

Results: A total of 220 patients out of 3005 files merely met the inclusion criteria of the study and had their data collected as described in the methods (Table 1). The average age of the study participants was 26.2 ± 11.3 years with a range of 7–72 years. The majority of the participants were males at a proportion of about 65%. All participants were promptly diagnosed with appendicitis either clinically, histologically or both. When considering the treatment modalities, the majority of the participants underwent laparoscopic appendicectomy (63.7 %) followed by those who had open appendicectomy (30.5%). The remaining 6% underwent conservative management.

Conclusion: It is reported that the common clinical features of acute appendicitis encountered in our practice and the reliability of ultrasonography and CT scans in the diagnosis of this acute condition. We have also reported that the diagnosis of acute appendicitis can still be based relatively on clinical assessment (symptoms and signs) in many experienced hands.

Keywords: Appendicitis, Diagnosis, Computed Tomography, Ultrasound.

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INTRODUCTION

The condition acute appendicitis is reportedly a common surgical emergency situation which needs early diagnosis and ideal surgical intervention to prevent further complications. Hence many surgeons follow this rule to operate even when the diagnosis is provisional and not final or certain.[1] Clinical signs and symptoms are the important tools. Radiological investigations have also been used for its diagnosis. Acute appendicitis was primarily recognised in the 16th century which was earlier named as perityphlitis.[2] Reported prevalence rate of acute appendicitis among the total population is estimated to be around 6% which is more common between 10 and 30 years old.[3] In the United States this condition occurs at a rate of 8.6% in men and 6.7% in women. The lifetime risk of appendicitis shows an annual incidence of 9.38/100,000 persons. In 2007, it is estimated that about 326,000 appendectomies were performed in developing countries and reached up to 7%–8% lifetime risk for appendicitis.[4,5]

The cause of acute appendicitis remains unclear but often occurs with the lumen obstructed by fecolith, tumor, or a foreign body.[6] Most of the typical cases of acute appendicitis are promptly diagnosed with the help of a physical examination through history of shifting central abdominal pain, anorexia, nausea and vomiting. In very few cases, atypical abdominal pain can profoundly delay the diagnosis and certain complications such as abscesses, fluid collection and peritonitis are inevitable. An accurate diagnosis plays a vital role in effective management of appendicitis and can be classified according to non-complicated (inflamed, no perforation) or complicated (perforated, abscess, phlegmon) and can even be applied to minimize the rate of appendectomy if the results directly show a negative pathology.[7,8] The mortality rate associated with uncomplicated appendicitis is less than 1% and may reach 5% or more in elderly patients and children. In these latter age groups, the diagnosis of acute appendicitis is often

delayed as clinical features might often be vague, with an profoundly increased risk of complications.[9] There is a relation of geospatial distribution of the incidence of the disease: with higher rates in low socio-economic changes.[10] This idea has been challenged by those who attribute the higher incidence of appendicitis in urban centres due to the individuals adapted lifestyle changes.[11] Acute appendicitis has been reported as the most common reason for appendicectomy in Northern Saudi Arabia.[11] Some evidence observes that intra-operative normal appendices may have an different incidental result at pathological evaluation and the practice of routine pathological examination of appendectomy specimens that varies between centers.[4,10] In this study we aimed to compare the accuracy of CT versus US in diagnosis of acute appendicitis.

MATERIALS AND METHODOLOGY

Our study was adopted to be conducted as an observational study using a retrospective cohort chart in a hospital in Saudi Arabia. In this study, we have evaluated all files from 3005 patients, but only 220 had fulfilled our inclusion criteria. The various inclusion criteria that were followed in this study consisted of patients suspected to have had appendicitis and who underwent an appendectomy after diagnoses via CT or US and histopathological reports. Exclusion criteria consisted of patients without a radiological investigation, incomplete files. The CT machine was a General Electric GE64 model, and the US equipment was manufactured by GE. All the data were retrospectively collected from all files of patients who had undergone an appendectomy earlier. Their histopathological reports were compared with the radiological reports (CT or US) and evidence and signs of appendicitis in each report were sought clearly. The various collected data included age, gender, clinical signs and diagnosis, symptoms and laboratory, histopathological and radiological findings which were collected by trained data collectors and reviewed by the primary study supervisors.

RESULTS

A total of 220 patients out of 3005 files merely met the inclusion criteria of the study and had their data collected as described in the methods (Table 1).

The average age of the study participants was 26.2 ± 11.3 years with a range of 7–72 years. The majority of the participants were males at a proportion of about 65%.

All participants were promptly diagnosed with appendicitis either clinically, histologically or both. Based on the haematological analysis of blood samples at time of diagnosis, only 16.7% had normal results with the rest having high white blood cell (WBC) counts with or without neutrophilia. When considering the treatment modalities, the majority of the participants underwent laparoscopic appendicectomy (63.5%) followed by those who had open appendicectomy (30.5%). The remaining 6% underwent conservative management.

On histopathological investigation, out of the 220 study participants, 90.7% had findings suggestive of acute appendicitis. A few cases of lymphoid hyperplasia (1.0%), granulomatous appendicitis (0.5%) and fibrous obliteration of the tip of appendix (0.6%) were found. All study participants underwent CT scans as part of their diagnostic workup.

Of these 220 patients, 216 (98.4%) returned with findings suggestive of acute appendicitis. Of the total number of participants, 200 underwent US out of which only 30.0% of them had features on USS suggestive of acute appendicitis. The majority of the patients did not have any complications (84.4%). But, 10.2% had perforations, 4.0% experienced fluid collection, 1.2% had abscess formation, and another 0.8% had other complications. The performance of the two tests, CT and US, based on their sensitivity and specificity results are as presented in Table 2. CT imaging had a sensitivity of 98.4% and a specificity of 16.5%. US imaging had a sensitivity of 29.9% but perfect specificity of 100%.

Table 1: General characteristics of the study population.

Parameters		Frequency	Percentage
Age (years, mean ± SD)		26.2 ± 11.3	
Gender (n=220)	**Male**	141	63.9
	Female	79	36.1
Laboratory findings	**Normal WBC**	37	16.7
	Increased WBC	126	57.1
Treatment modality	**No surgery (conservative management)**	13	6
	Laparoscopic appendicectomy	140	63.5
	Open surgery	67	30.5
Histopathological findings	**No H/P report**	16	7.2
	Acute appendicitis	199	90.7
	Granuloma appendicitis	1	0.5
	Lymphoid hyperplasia	2	1
	Fibrous obliteration of the tip	1	0.6
CT results	**Negative**	5	2.2
	Positive	215	97.8
US results (N=200)	**Negative**	139	69.5
	Positive	60	30.5
Complications	**Non-complicated**	186	84.4
	Perforation	22	10.2
	Abscess	3	1.4
	Fluid collection	9	4

Table 2: Sensitivity and specificity for CT and ultrasonography testing in diagnosing acute appendicitis among study population.

Parameters	Percentage
Computed Tomography tests	
Sensitivity	98.4%
Specificity	16.5%
Ultrasound testing	
Sensitivity	29.9%
Specificity	100.0%

DISCUSSION

In this study, CT was observed to be sensitive in detecting the acute appendicitis and its complications with a sensitivity of 98% when it is compared to ultrasonography. Specificity for CT was 16.5 for assessing the acute appendicitis signs that include appendix lumen dilatation usually more than 6 mm diameter, associated wall thickening (>3 mm) and increased thickening of the caecal apex, fat stranding around appendix (which was most common sign was documented in our study), phlegmon and abscess. All these signs and symptoms were also promptly detected in ultrasonography as the predominant signs of complicated appendicitis.[12] In a study conducted at King Fahad KFSH, was observed the sensitivity of CT scan was reported to be higher than ultrasonography in assessing acute appendicitis with a CT sensitivity of 86% and its specificity 16.7% when diagnosing acute appendicitis.[2] whereas the sensitivity of ultrasonography was 37% and its specificity was 100%, which corroborates to our results and findings.

Appendicitis is often overlooked in 33% of premenopausal females with presumed gynaecological condition which is majorly responsible for 40% misdiagnosis. Negative appendectomy rate is reported in 45%, gynaecological cause is found in more than half of cases observed.[13] In consistence, gynaecological disorders were the sole reason for multiple pathologic conditions and negative appendectomy in our study patients.[14] Conventional view of appendicitis holds that appendiceal perforations are associated with delay in diagnosis and therapy and also non-therapeutic appendectomies are frequently related to diagnostic errors or inadequate judgment.[15] On analysis of the data and literature review showed that most of the delay occurs before patient promptly reported in the hospital. Non-therapeutic appendectomies are majorly performed due to lack of sensitive, specific, accurate diagnostic tools.[19] In this study, incidence of perforated appendix was 10.2% while others were 14 - 40%.[16]

The help of Computed tomography in diagnosing the acute appendicitis had sensitivities of 88 - 100%, specificities 91 - 99% and accuracies observed to be 94 - 98%.[17] *Rao* et al[18] noted that CT use in suspected appendicitis improved patient care and lower costs. Over the time, dramatic increase in CT use in suspected appendicitis was observed.[24] In this study, CT sensitivity was 98.4%, specificity 16.5%, positive and negative predictive values (60% and 100), and accuracy was 66.8%. Our low accuracy could be possibly be explained by very limited number of patients who had CT scan. Most of the researchers applied CT for equivocal cases. *Rosengren* et al[19] observed that the normal CT associated with low incidence of positive appendicectomy, confirming discharge suitability of appendicitis assessment. Computed tomography significantly changes the management in 60- 79% of atypical presentation, but 29% of patients observed with equivocal result still have appendicitis risk (35-40%).[20]

In a prospective study conducted by *Pickuth* with 120 patients, CT was observed to be more sensitive (95%) than US (87%) in patients suspected of acute appendicitis; but, in cases of clinically presence of Acute appendicitis, CT is relatively more accurate pre-operatively in order to exclude the acute appendicitis and reducing the rate of appendectomy which ight explain a CT scan was first to be ordered by the general physicians.[21]

CONCLUSION

This retrospective study was evaluated certain demography characteristics of patients who had observed with appendicectomy in a secondary hospital in Saudi Arabia. It is reported that the common clinical features of acute appendicitis encountered in our practice and the reliability of ultrasonography and CT scans in the diagnosis of this acute condition. We have also reported that the diagnosis of acute appendicitis can still be based relatively on clinical assessment (symptoms and signs) in many experienced hands.

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