ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasound in the Detection of Acute Appendicitis by taking CT Abdomen as Gold Standard

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ABSTRACT

Objective: To assess the diagnostic accuracy of ultrasound in the detection of acute appendicitis by taking CT abdomen as gold standard at tertiary care Hospital.

Material and Method:

Methods: This was a cross-sectional study and was done at radiology department of Liaquat University of Medical and health Sciences (LUMHS), from July 2020 to December 2020. Clinically suspected patients of the acute appendicitis with all age groups and either of gender were subjected. After taking informed consent all the study participants underwent fresh abdominal ultrasound and CT abdomen. All the information was entered in the self-made study proforma. SPSS version 20 was used for the data analysis

Results: A total of 98 cases of suspected for acute appendicitis were assessed, their mean age was 35.86±6.61 years. Males and females were almost in equal frequency as 51% and 49% respectively. Out of all 71.1% of the cases were diagnosed as appendicitis as per trans-abdominal ultrasound and among 77.6% of the cases were diagnosed as acute appendicitis cases according CT abdominal findings. Overall diagnostic accuracy of ultrasound in the diagnosis of acute appendicitis was 82%, sensitivity 84%, specificity 57% followed by positive predictive value (PPV) 92% and negative predictive value 57%.

Conclusion: Trans-abdominal ultrasonography was found to be the effective, non-invasive, easily available and radiation safe diagnostic tool for acute appendicitis. However experience and expertise of the radiologist are very important.

Keywords: Appendix, Ultrasound, accuracy, sensitivity, specificity

INTRODUCTION

Acute appendicitis (AA) has been documented to be among the most prevalent causative factors of abdominal pain among patients in emergency departments, and appendectomy has been suggested to be among the most prevalent emergency medical procedures performed globally.[1,2] Intra-tubular blockage, lymphoid hyperplasia, fecal matter accumulation, foreign item ingestion, tumors, and parasites are all causes of this condition.[1] Prevalence of acute appendicitis (AA) has been reported around 7% in general population, however, Females have been reported to have a peak prevalence at the age of 10 to 14 years, whereas males have a peak prevalence at the age of 15 to 19 years.[3,4] The presence of McBurney's sign raises the possibility of AA.[5,6] When the presentation is normal, the diagnosis of AA can be made solely on laboratory and clinical findings alone, without any further investigation; but, clinical features remain non-specific and uncertain in 35% to 40% of patients.[5] It is necessary to diagnose appendicitis as soon as possible. [7] Perforation is related with greater mortality and morbidity if a diagnosis is delayed or missed.[7] Preoperative imaging has been found to be essential for detecting appendicitis and lowering the likelihood of negative appendectomy.[7] Imaging modalities have considerably increased diagnostic accuracy for various disorders.[8] The most sensitive and specific method of detecting appendicitis is computed tomography (CT). However, CT makes extensive use of ionizing radiations and a cost effective technique not available mostly in rural basic health units. As an alternative approach, a non-ionizing diagnostic imaging approach can be used, such as ultrasound. However as per recent studies the findings still controversial as some studies observed that the Ultrasound has high diagnostic accuracy in diagnosis of acute appendicitis and helps to reduce negative appendectomy rates,[9,10] while on other hand it was observed that there was a lower level of the diagnostic accuracy of ultrasound in the diagnosis of acute appendicitis.[8] However this study was conducted for the diagnostic accuracy of ultrasound in detection of acute appendicitis by taking CT abdomen as gold standard at tertiary care Hospital.

MATERIAL AND METHODS

This was a cross-sectional study, which was done at radiology department of Liaquat University of Medical and health Sciences, during six months from July 2020 to December 2020. All the clinically suspected patients of the acute appendicitis with all age groups and either of gender were subjected in the study. All the patients who were not agreeing to participant in the study were excluded. After taking informed consent all the study participants underwent fresh abdominal ultrasound and CT abdomen. All the diagnostic imaging techniques were done by the senior radiologist having minimum experience more than 5 years. All the imaging information including demographic information of the patients was entered in the self-made study proforma. SPSS version 20 was used for the data analysis. Categorical variables were computed in the form

of frequency and percentage. Numerical variables were computed in the form of mean and standard deviation. A 2X2 table was used to observe the diagnostic accuracy of ultrasound by taking CT abdomen as gold standard in the form of sensitivity, specificity, PPV, NPV and diagnostic accuracy.

RESULTS

A total of 98 cases of suspected for acute appendicitis were assessed. Mostly patients were young as their mean age was 35.86±6.61 years. Males and females were almost in equal frequency as 51% and 49% respectively. Average VAS was 4.22±01.22. Most of the patients 67(68.4%) were poor followed by middle socioeconomic status cases were 24(24.5%) and 07(07.1%) were of upper class socioeconomically. Table.1

Out of all 71.1% of the cases were diagnosed as appendicitis as per trans-abdominal ultrasound and among 77.6% of the cases were diagnosed as acute appendicitis cases according CT abdominal findings. Table.2

Overall diagnostic accuracy of ultrasound in the diagnosis of acute appendicitis was 82%, sensitivity 84%, specificity 57% followed by positive predictive value (PPV) 92% and negative predictive value 57%. Table.3

Table 1: Descriptive statistics of demographic information n=98

Variables		Statistics
Age (Mean ± SD)		35.86±6.61 years
Severity of pain VAS (Mean ± SD)		4.22±01.22
Sex	Male	50(49.0%)
	Females	48(51.0%)
Socioeconomic status	Poor	67(68.4%)
	Middle	24(24.5%)
	Upper	07(07.1%)

Table 2: Frequency of acute appendicitis according to trans-abdominal ultrasound and CT abdomen, n=98

Variables	Frequency	%
Acute appendicitis as per trans-abdominal ultrasound findings		
Yes	70	71.1%
No	28	28.6%
Acute appendicitis as per CT abdominal findings		
Yes	77	77.6%
No	21	21.4%

Table: 3: Diagnostic accuracy of trans-abdominal ultrasound by taking CT abdomen as gold standard n=98

Trans-abdominal ultrasound findings	CT abdomen		Total
	Positive	Negative	
Positive	65 TP	05 FP	70
Negative	12 FN	16 TN	28
Total	77	21	98

Sensitivity: 84%, Specificity: 57%, PPV: 92%, NPV: 57%

DISCUSSION

Appendicitis is the commonest etiological factor of the abdominal pain, produced via appendix acute inflammation around in 8-10% of population. In this study mean age was 35.86±6.61 years and males were 51% and females were 49%. Similarly Hussain S et al[11] demonstrated mean of the patients of acute appendicitis was 31.41±12.87 years, while they found males in majority 80% and as compared to females. Although Awan SL et al[10] reported that the females were in majority 58% and males were 42%. In another study of Farooq A et al[12] reported that the average age of the study subjects was 22.6±3.1 years and males were most common as 58.5% and felames were 41.5%. While in the study of Ahmed AH et al[13] reported the lower average of age as 21±4 years and males in majority as compared to our study. All the studies showed variation in average age and gender. This difference in findings regarding age gender in acute appendicitis may due to the environmental variations, studies selection criteria and sample size of the studies.

In this study average VAS was 4.22±01.22 and most of the patients 68.4% were poor followed by middle socioeconomic status cases were 24.5% and 07.1% were of upper class socioeconomically.

In this study the diagnostic accuracy of ultrasound in the diagnosis of acute appendicitis was 82%, sensitivity 84%, specificity 57% followed by positive predictive value (PPV) 92% and negative predictive value 57%. These finding were almost similar to the study of Hussain S et al[11] as the diagnostic accuracy of ultrasound was 90%, 88% sensitivity, 92% specificity (92%), 94% PPV and 86% NPV. On other hand Awan SL et al[10] also found comparable findings as sensitivity 85%, accuracy 80%, positive predictive value 85% and false positive rate was 0.32%. Consistently Farooq A et al[12] reported that the found the diagnostic accuracy of ultrasound in the detection acute appendicitis was 77.5% followed by sensitivity 80% and specificity 60%. On other hand Ahmed AH et al[13] also found close findings regarding diagnostic accuracy of ultrasound as overall accuracy was 84%, followed by 86% sensitivity and 80% specificity. However Alelyani M et al[8] inconsistently found lower accuracy of ultrasound as 46.2% in the detection of acute appendicitis with 38.9% sensitivity and 89.5% specificity. Abdominal ultrasonography is still another practiced investigation; its principle advantage is not its highest accuracy but its non-invasive nature. The diagnostic sign of acute appendicitis is visualization of appendix on USG.[13] However it is still unsuccessful to gain the status as the diagnostic pillar of the diseases, because it is the very frequently operator dependent and results vary from operator to operator depending upon their expertise and experience including many patient's factors as; obesity, gas filled bowel loops, appendix position and level of inflammatory fluid around appendix.[13,14]

CONCLUSION

Trans-abdominal ultrasonography was found to be the effective, non-invasive, easily available and radiation safe diagnostic tool for acute appendicitis. However experience and expertise of the radiologist are very important.

REFERENCES

1. Pedram A, Asadian F, Roshan N. Diagnostic accuracy of abdominal ultrasonography in pediatric acute appendicitis. Bulletin of Emergency & Trauma. 2019 Jul;7(3):278.
2. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. *Lancet.*2015;386(10000):1278–1287.

3. Lima AP, Vieira FJ, Oliveira GP, Ramos PD, Avelino ME, Prado FG, et al. Clinical-epidemiological profile of acute appendicitis: retrospective analysis of 638 cases. Revista do Colégio Brasileiro de Cirurgiões. 2016;43(4):248-53.
4. Papandria D, Goldstein SD, Rhee D, Salazar JH, Arlikar J, Gorgy A, et al. Risk of perforation increases with delay in recognition and surgery for acute appendicitis. J Surg Res. 2013;184(2):723-9
5. Ferrarese A, Falcone A, Solej M, Bono D, Moretto P, Dervishi N, et al. Surgeon's clinical valuation and accuracy of ultrasound in the diagnosis of acute appendicitis: A comparison with intraoperative evaluation. Five years' experience. IJS 2016;1;33:S45-50.
6. Yeh B. Does this adult patient have appendicitis?. Annals of emergency medicine. 2008;52(3):301-3.
7. Crocker C, Akl M, Abdolell M, Kamali M, Costa AF. Ultrasound and CT in the Diagnosis of Appendicitis: Accuracy With Consideration of Indeterminate Examinations According to STARD Guidelines. AJR 2020 Sep;215(3):639-44.
8. Alelyani M, Hadadi I, Shubayr N, Alashban Y, Alqahtani M, Adam M, et al. Evaluation of Ultrasound Accuracy in Acute Appendicitis Diagnosis. Applied Sciences. 2021 Jan;11(6):2682.
9. Ahmed AH, Qureshi MN, Bila R, Ahmad I. Acute appendicitis; ultrasonography as pre-operative screening tool. Pakistan Armed Forces Medical Journal. 2016;66(Suppl-3):S178-83.
10. Awan SL, Kiyani ZA, Abbasi MA, Gilani I, Sabir F, Akram N. Role of ultrasound in diagnosis of acute appendicitis. Pakistan Journal of Physiology. 2019 Dec 15;15(4):52-5.
11. Hussain S, Rahman A, Abbasi T, Aziz T. Diagnostic accuracy of ultrasonography in acute appendicitis. Journal of Ayub Medical College Abbottabad. 2014 Jan 1;26(1):12-7.
12. Farooq A, Zameer S, Khadim R. Diagnostic accuracy of ultrasound in acute appendicitis in comparison with alvarado score keeping histopathological correlation as gold standard. Pakistan Armed Forces Medical Journal. 2020 Jun 30;70(3):807-11.
13. Ahmed AH, Qureshi MN, Bila R, Ahmad I. Acute appendicitis; ultrasonography as pre-operative screening tool. Pakistan Armed Forces Medical Journal. 2016;66(Suppl-3):S178-83.
14. Gulzar S, Umar S, Dar GM, Rasheed R. Acute appendicitis role of clinical examination in making a confident diagnosis. Pak J Med Sci 2005; 21(2):125–32