Original Research Paper

Volume - 14 | Issue - 06 | June - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

General Surgery

COMPARATIVE STUDY OF SENSITIVITY AND SPECIFICITY OF USG & CT IN CLINICALLY SUSPECTED ACUTE APPENDICITIS AS A DIAGNOSTIC TOOL

Dr D Chandramohan* *Corresponding Author

Dr S Saradha

ABSTRACT **Introduction:** Acute appendicitis is one of the most common surgical emergencies in contemporary medicine. The diagnosis of acute appendicitis is essentially clinical. And advances in radiographic imaging have improved the diagnostic accuracy This prospective study compared the sensitivity and specificity of Ultrasonography and Computed tomography in clinically suspected acute appendicitis as a diagnostic tool and further correlation with histopathological examination. **Study Design:** One hundred and forty nine patients with clinically suspected acute appendicitis, followed the following protocol. Ultrasonography was done to all these patients. When ultrasonography failed to support the diagnosis, the patients were subjected to computed tomography. All the confirmed patients by imaging studies and the clinically suspected acute appendicitis patients were taken up for the surgery. The results of ultrasonography and tomography were correlated with the histopathological examination and the follow up. **Results:** The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for ultrasonography were 63%, 75%, 90%, 36% and 66% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for computed tomography were 91% ,92%, 95%, 85% and 91% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for combined ultrasonography and computed tomography (in inconclusive ultrasonographic cases only) were 97%,69%, 92%, 85% and 91% respectively. **Conclusion:** Computed tomography is better than ultrasonography in diagnosing acute appendicitis. Combined ultrasonography and computed tomography only in ultrasonography inconclusive cases yielded a high diagnostic accuracy for acute appendicitis It saved manpower, time ,cost and radiation.

KEYWORDS :

INTRODUCTION

The vermiform appendix is considered by many as a vestigial organ. But now it is well recognized that the appendix is an immunologic organ. It secretes immunoglobulins, particularly immunoglobulin A. When it gets inflamed it results in a clinical syndrome known as Acute appendicitis. Acute appendicitis is the most common cause of an acute abdomen in young adults. And Appendicectomy is the most frequently performed urgent abdominal operation. It is often the first major procedure performed by any surgeon. Advances in radiographic imaging have improved the diagnostic accuracy. However the diagnosis of acute appendicitis is essentially clinical. It requires a mixture of observation, clinical acumen and surgical science. It remains as an enigmatic challenge and a reminder of the art of the surgical diagnosis. It is a subjective estimate of the probability of appendicitis based on multiple variables that individually are weak discriminators. Therefore when they are used in combination, they possess a high predictive value. But Appendicectomy based on clinical diagnosis alone leads to removal of a normal appendix in 15-30% of cases. The premise that its better to remove a normal appendix than to delay diagnosis does not stand up to close scrutiny, particularly in the elderly.Previous studies conflict whether the negative appendectomy rate can be decreased with the regular use of ultrasonography (USG) and computed tomography(CT). Many authors have advocated the use of USG as a primary imaging modality. It is because of the radiation effects on this generally young patients. So we wanted to compare USG and CT in acute appendicitis. At the same time we wanted to reduce radiation and cost. So CT was taken only when USG was inconclusive. We designed a prospective study to compare the sensitivity and specificity of USG and CT in clinically suspected acute appendicitis as a diagnostic tool and further correlation with the histopathological examination. Here CT was done only when the USG was inconclusive.

Aim

To compare the sensitivity and specificity of Ultrasonography and Computed tomography in clinically suspected acute appendicitis as a diagnostic tool and further correlation with histopathological examination.

MATERIALS AND METHODS

The study was approved by the hospital's ethical committee for human studies. All patients of 13 years and above who presented to the emergency department with symptoms of acute appendicitis were included in this study. All patients were evaluated. Patients with typical signs of acute appendicitis with the ALVARADO score 7 and above were included in the study. Patients who had developed signs and symptoms of acute appendicitis during their clinical observation were also included.

The radiologic procedures and logistics of the study were explained to the patients, and informed consent was obtained from each patient. If other pathology was suspected, patients were referred to other specialists, as necessary.

Between August 2014 and August 2015, 469 patients presented to our surgery department with acute pain in the right lower abdomen. The patients age, sex, ALVARADO score, USG report, CT report, surgical findings and HPE report are noted.

Out of 469 patients with 13 years of age and above with RIF pain, 149 were selected based on the ALVARADO score 7 and above. And the patients who gave acceptance to undergo the study were well explained about the health condition, the treatment options available and it related complications.

All the selected 149 patients underwent imaging studies with ultrasonogram. They were paired into two groups. The First Group Contains visualizing the inflamed appendix. And it is marked as positive (+) /P.

The other group contains both the patients in whom the normal appendix is visualized it is marked as negative (-) / N and in the patients in whom the appendix is not visualized it is marked as inconclusive (IC).

Out of 149 patients scanned with USG,82 were positive. Out of 82 cases Four had mass formation. But they were taken up for interval appendicectomy.

52 were inconclusive and 15 had alternate diagnosis on scanning., totalling to 67. Complimentary CT scan was done to this group.

Scanning was performed with the following parameters : 1 second per rotation time, 1.5 mm collimation,& 32 mm/sec table increment (pitch, 1.33)

All patients received intravenous contrast material (100-120 ml iodixanol,320 mg iodine per milliliter),injected at a rate of 3-4 ml per second with a scanning delay of 70 seconds.Transverse sections were reconstructed with a 5 mm thickness at 2.5 mm intervals.

The results of the CT scan are also grouped into two. The first group which had the inflamed appendix is marked as positive (+).The other group contains both the patients where the normal appendix is visualized, marked as negative (-)N and where the appendix not visualized, marked as inconclusive (IC).

RESULTS

Statistics

STATISTICS	USG	CT	USG + CT
SENSITIVITY	63%	91%	97%
SPECIFICITY	75%	92%	69%
+ PREDICTIVE VALUE	90%	95%	92%
- PREDICTIVE VALUE	36%	85%	85%
ACCURACY	66%	91%	91%

Socio-demographic Details

	NUMBER	MALE	FEMALE
USG	149	85	64
CT	67	41	26

USG Findings

POSITIVE	NEGATIVE + ALTERNATE DIAGNOSIS
82	67

CT Findings

POSITIVE	NEGATIVE + ALTERNATE DIAGNOSIS
41	26

HPE Examinations

NUMBER OF SURGERIES	134
HPE POSITIVE	117

We had 469 patients with c/o pain in the right lower abdomen. We clinically assessed everyone using ALVARADO SCORING SYSTEM. We selected patients who scored 7 and above. There were 177 patients scoring 7 and above. In the other group containing 292 patients, in whom 10 patients developed acute appendicitis of score 7 and above.

So totally 177+10 = 187 patients were Alvarado score 7 and above. They were explained about their disease and treatment methods. And they were explained about the study and they were allowed to choose. Totally 149 patients gave consent for our study.

All 149 patients was examined with USG. 82 patients had positive USG. 67 had inconclusive results (IC). 82 UG Positive cases were taken up for surgery. All 82 patients underwent surgery. In 74 patients HPE came as positive and in 8 patients HPE was negative (N). Out of the 74 patients who underwent surgery, 2 were gangrene, 7 with perforation, in 10 cases Faecolith, The gangrene and perforation cases had faecolith's. In this group post operative complication was LRI which was adequately treated. The total hospital stay in complicated cases was 10 days. For the uncomplicated cases it was only 3 days.

In the remaining 67 patients, 15 had alternate diagnosis. The USG inconclusive cases were subjected to CT scan. Out of 52, 41 were CT positive, 11 CI inconclusive, 15 had alternate diagnosis.

The patient who had alternate diagnosis treated accordingly with specialists concerned and they had regular follow up.

Since the clinical suspicion was high the CT positive and the CT inconclusive cases were both taken up for the surgery. 39 out of 41 were HPE positive. 4 out of 11 CT inconclusive were HPE positive.

In this group we had 2 mass formation cases both ended up with right hemicolectomy. Out of which one had fecal fistula.

The sensitivity and specificity of USG in diagnosis of acute appendicitis are 63% and 75% respectively.

The sensitivity and specificity of CT in diagnosis of acute appendicitis are 91% and 92% respectively.

The sensitivity and specificity of Combined use of USG and CT only in USG inconclusive cases in diagnosing acute appendicitis are 97% and 69% respectively.

Out of 67 cases containing USG negative and inconclusive groups, 41 cases are positive for CT, 11 Cases of negative and inconclusive patients. And 15 cases had alternate diagnosis.

The positive cases in USG, CT groups and the clinically suspected cases of acute appendicitis in CT inconclusive were taken up for the surgery. So totally 82 (USG +) + 41 (CT +) + 11 (CT inconclusive but clinically acute appendicitis), 134 cases were taken up for the surgery.

At surgery macroscopic findings were noted. And the inflamed appendix is marked as positive (+), the normal looking appendix were marked as negative (-).

At surgery out of 134 cases, 124 cases were positive/+/P. Two had gangreneous appendicitis, Seven had perforation, ten cases had faecolith (2 gangrene + 7 perforation + 1 inflammed appendix), Two cases had mass formation and Ten cases were looking normal. Out of 134 cases, 132 underwent appendicectomy, 2 underwent right hemicolectomy (One case with mass and another who had faecal fistula). The post operative complications were surgical site infection (1 case), lower respiratory infection (3 cases), Faecal Fistula (1 case). The surgical site infection was treated by letting out the pus, pus C/S and with suitable antibiotics. The respiratory infection was treated with respiratory toileting, sputum C/S and with suitable antibiotics. The Feacal Fistula case ended up with right hemicolectomy (mass).

The average stay in the hospital was three days. The surgical site infection and respiratory cases had a average stay of Ten days. The Faecal Fistula had a stay of Three weeks. Histological diagnosis of appendicitis was based on infiltration of the muscularispropria by neutrophil granulocytes. The inflamed appendix is marked as positive (+), the normal appendix is marked as negative (-). In the Ultra sound positive patients (82) who underwent appendicectomy 74 cases came as HPE positive. Out of the CT positive cases (41) who underwent appendicectomy 39 were HPE Positive. In the CT inconclusive cases (11), who underwent surgery 4 were HPE Positive.

All the patients were followed up for 6 weeks.

DISCUSSION

The most common ruptured appendix, the number one surgical crisis in the abdomen across the world, can lead to significant complications such as ileus, peritonitis, abscess and even death as well as substantial costs for healthcare system [1,2]. The incidence of ruptured appendicitis is about 233 cases per 100000 population per year with a lifetime prevalence risk ranging from 6.7% to 8.6% [3, 4]. While developed nations have recorded a decline in its incidence by mid-twentieth century; newly industrialized countries have shown an increasing trend in the twenty-first century [4–6]. As a result, ultrasound and computed tomography (CT) has become very popular modalities used to confirm acute appendicitis and also led to increase in antibiotic use. For those patients without high-risk CT findings; starting antibiotics first is recommended while surgery will be advised if antibiotics fail [7]. The use of clinical decision rules combined with ultrasonography reduces the use of CT in the evaluation of suspected appendicitis. A prospective cohort study of 840 children with clinically suspected appendicitis (267 of whom ultimately had a confirmed diagnosis) evaluated an algorithm using the Pediatric Appendicitis Score and ultrasonography [8]. This approach resulted in a significant reduction in CT use (75.4% to 24.2%) and reduction in the duration of emergency department stay (6.2 to 5.8 hours). With the slightly lesser sensitivity of ultrasonography to identify acute appendicitis, there is the possibility for increased rates of complications or missed diagnoses. However, a prospective observational study of 150 children (50 of whom were diagnosed with acute appendicitis via point-of-care ultrasonography) resulted in no missed diagnoses during the three-week follow-up period in the 100 children who did not undergo surgery [9]. According to a meta-analysis, US alone has a sensitivity and specificity for severe a perforated appendix of 69% and 81%, respectively. Meta-analyses show that CT and MRI are better at identifying severe a perforated appendix than US with a contour sensitivity and specificity for severe a perforated appendix of 91% and 90% for CT, and 97% and 96% for MRI [10,11]. The mean prevalence of US, CT, and MRI, as described in the reviews, is 76%, 50%, and 58%, respectively. Because a pre-selection presumably resulted in higher prevalence of severe a perforated appendix, results of these imaging studies can not directly be compared to those of the clinical diagnostic scores. For practical test statistics like PPV and NPV, this prevalence is essential. For example, hypothetically, when a very specific test is used in an unselected population with low prevalence of appendicitis. This results in low PPV, but high NPV. Conversely, in a selected high-risk group of patients, a low NPV and a high PPV may be established. When the described prevalences are combined in the calculations, PPV and NPV

for US were 92% and 45%, respectively, for CT 90% and 91%, and for MRI 97% and 96%. If the above mentioned clinical scores would be applied to a group of patients suspected for a perforated appendix with an appendicitis prevalence of 50%, relative to the prevalence in the CT study population, this would lead to a PPV and NPV of 89% and 56% for the Alvarado score, 88% and 55% for the Pretence, and 88% and 66% for the AAS. The diagnostic characteristics of CT and MRI are thus much better than attained by the three clinical diagnostic scores.

CONCLUSION

In our study the Sensitivity, the Specificity, of USG and CT in clinically suspected Acute Appendicitis as a Diagnostic tool was studied and further correlated with the HPE. For Ultra Sound the results are the Sensitivity is 63% and the Specificity is 75%. For CT the Sensitivity is 91% and the Specificity is 92%. For USG added with CT (when USG was inconclusive) the Sensitivity is 97% and the Specificity is 69%.

1. CT is better than USG.
2. Acute appendicitis is more of a clinical diagnosis.
3. When findings are equivocal resort to USG.
4. When USG does not help and if we are still in favour of acute appendicitis, CT is a better option.

REFERENCES

1. D'Souza N, Nugent K. Appendicitis. Am Fam Physician. 2016;93(2):142–143.
2. Hardin DM. Acute appendicitis: review and update. Am Fam Physician. 1999;60(7):2027–2034.
3. Jones MW, Lopez RA, Deppen JG. Appendicitis. StatPearls. ed. Treasure Island: StatPearls Publishing; 2020.
4. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. Am J Epidemiol. 1990;132(5):910–925. doi: 10.1093/oxfordjournals.aje.a115734.
5. Lee JH, Park YS, Choi JS. The epidemiology of appendicitis and appendectomy in South Korea: national registry data. J Epidemiol. 2010;20(2):97–105. doi: 10.2188/jea.JE20090011.
6. Sulu B, Günerhan Y, Palanci Y, Işler B, Cağlayan K. Epidemiological and demographic features of appendicitis and influences of several environmental factors. Turk J Trauma Emerg Surg: TJTES. 2010;16(1):38-42.
7. Talan DA, Salminen PJ. Management of acute uncomplicated appendicitis. JAMA Surg. 2022;6541.
8. Shah SR, Sinclair KA, Theut SB, Johnson KM, Holcomb GW III, St Peter SD. Computed tomography utilization for the diagnosis of acute appendicitis in children decreases with a diagnostic algorithm. Ann Surg. 2016;264(3):474-481.
9. Elikashvili I, Tay ET, Tsung JW. The effect of point-of-care ultrasonography on emergency department length of stay and computed tomography utilization in children with suspected appendicitis. Acad Emerg Med. 2014;21(2):163-170.
10. Van Randen A, Bipat S, Zwinderman AH. et al.: Acute appendicitis: Meta-analysis of diagnostic performance of CT and graded compression US related to prevalence of disease. Radiology 2008;249(1):97–106
11. Duke E, Kalb B, Arif-Tiwari H. et al.: A systematic review and meta-analysis of diagnostic performance of MRI for evaluation of acute appendicitis. AJR Am J Roentgenol 2016;206(3):508–51