



ANALYTICAL REVIEW OF THE ROLE OF ULTRASOUND IN ACUTE APPENDICITIS

Radio-Diagnosis

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ABSTRACT

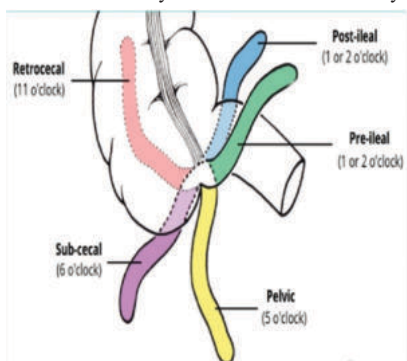
Introduction: Acute appendicitis (AA) is a common abdominal emergency with a lifetime prevalence of about 7%. As the clinical diagnosis of AA remains a challenge to emergency physicians and surgeons, imaging modalities have gained major importance in the diagnostic work-up of patients with suspected AA in order to keep both the negative appendectomy rate and the perforation rate low. In our opinion, US should be the first-line imaging modality, as graded-compression US has excellent specificity both in the paediatric and adult patient populations. **Methods:** In our opinion, US should be the first-line imaging modality, as graded-compression US has excellent specificity both in the paediatric and adult patient populations. Standard histopathological examination was conducted for all specimens. Sensitivity and specificity of abdominal ultrasonography was calculated by Statistics software. Ethical approval from institutional ethics committee was sought before starting the study. **Results:** Comparison of performance values shows that diagnostic sensitivity and specificity of USG in case of acute appendicitis patient presenting to emergency department. This means that very few cases of Acute Appendicitis will be missed. Negative appendectomy rate was also significantly lower. **Conclusion:** Ultrasound by graded compression technique is a useful adjunct to the clinical armamentarium of the present day surgeon. It can reduce the negative appendectomy rate without adversely affecting the perforation rate particularly in equivocal cases.

KEYWORDS

INTRODUCTION

A rapid and precise diagnosis is necessary to establish or rule out perforation in acute appendicitis (AA), a condition with a high prevalence. It has a lifelong prevalence of about 7% and is the most frequent abdominal emergency¹. The clinical diagnosis remains challenging, both in the pediatric and adult population, as the presentation is often atypical as appendix has various anatomical locations².

The symptoms frequently overlap with those of other illnesses and are non-specific³. The basic choice of whether to operate or not remains difficult despite all advancements in clinical and laboratory diagnosis and the publishing of various scoring systems to aid clinical decision-making. In a perfect medical universe, all patients with suspected AA would be properly diagnosed and treated without the need for unnecessary appendectomies. There is general consensus that high rates of negative appendectomies (around 15%) must be accepted in order to lower the rate of perforation because AA with perforation is linked to substantial morbidity and an increase in mortality³.



A variety of disorders can be investigated and diagnosed using ultrasonography. However, it is occasionally asserted that ultrasonography has greater sensitivity and specificity than what clinicians often see in their daily work. A blind ending, a peristaltic,

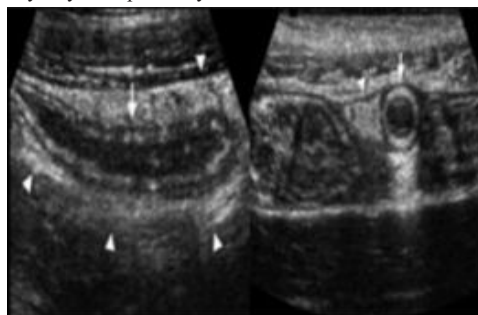
incompressible tubular formation in the right iliac fossa (RIF) with an enlarged diameter and thickened wall is typically a sign of appendicitis. However, it has been discovered that the number of scans stating "appendix not visualized" is increasing, demonstrating a discrepancy between published academic inferences and the actual diagnostic efficacy of ultrasonography in appendicitis.⁵ Therefore, the objective of this study is to critically analyze the literature on the sensitivity and precision of ultrasound in the diagnosis of acute appendicitis.

The typical imaging and diagnostic techniques for appendicitis combine invasive techniques like laparoscopy with non-invasive techniques like ultrasound, CT scan, and MRI. When asked about their preferred method of inquiry for evaluating a young patient presenting with acute right iliac fossa pain with normal blood tests and urinalysis, S.S. Jaunoo et al. conducted a poll on surgeons from the USA, Italy, and France in 2012. The findings revealed an odd disparity in opinion about the selection of the imaging modality, with American surgeons favoring CT and their European colleagues leaning toward laparoscopy, particularly for female patients. However, neither group considered using ultrasonography as a substitute for making a diagnosis, and MRI was not brought up as an imaging technique.⁶ Histopathology is the gold standard for the diagnosis of acute appendicitis.⁷

Even though acute appendicitis is a frequent condition, it is nevertheless challenging to identify in surgical practice. Only 70% of the time, clinical exams in these circumstances are accurate and may lead to high negative appendectomy rates (NAR), morbidity, and mortality. In terms of sonography, the diagnosis is deduced from the appendix's non-compressibility when its diameter is more than 6 millimeters. However, many authors believe that an appendix that USG does not see is typical.⁸ The variation in appendix sonographic visualisation rates suggests that this mode of examination may be extremely operator dependent. Hussain et al. advocated multiple clinical examinations to facilitate correct diagnosis in their study from 2009 because if the findings are unclear, the decision to operate may be impacted by the operator's hesitation to describe an appendix as normal

or inflamed on ultrasonography.⁹

The Hawthorne Effect, in which the researcher conducting a prospective study looks for the anomaly until it is found, may be responsible for the high sensitivity of ultrasound scans in published studies. On busy scanning lists, however, patients suspected of having acute appendicitis are frequently accommodated at the last minute in real-life situations. The operator's ability to perform and report scans accurately may be impacted by time constraints.



USG showing non-compressible tubular blind ending structure diameter >6 mm

METHODS

This prospective study was carried out in the department of surgery, in collaboration with the department of radiodiagnosis at SGT medical college and hospital. The study included 50 consecutive patients (32 males and 18 females) in the age group of 20-40 years who were referred from the OPD and casualty department between March 2021 and March 2022.

Inclusion criteria:

1. Patients with complaint of pain localised in right lower quadrant.
2. Other additional complains like history of migration of pain, vomiting and fever regardless of age and gender.
3. Raised WBC count with Right Iliac Fossa Tenderness
4. Abdominal and pelvic ultrasonography showing acute appendicitis

Exclusion criteria:

1. Patients with Appendicular mass.
2. Patient with chronic infectious disease like ileo-cecal tuberculosis.
3. Patients with carcinoid tumors and other neoplastic lesions of appendix.

Graded compression ultrasonography was done using high resolution linear array transducer according to the situation. Standard histopathological examination was conducted for all specimens after surgery.

Sensitivity and specificity of abdominal ultrasonography was calculated by Statistics software. Ethical approval from institutional ethics committee was sought before starting the study.

RESULTS

There were 50 patients in our study fulfilling the inclusion criteria undergoing USG for diagnosis of acute appendicitis. Figure - 1 shows the overall profile of patients operated to non-operated. It shows that 46 (92%) out of 50 patients had undergone emergency appendectomy and 4(8%) of the patients denied to undergo emergency appendectomy due to financial and poor compliance.

Table 1: Compares the total number of operated and non-operated patients.

	Frequency	Percentage
Non operated patients	4	8
Operated patients	46	92

Table - 2 gives us the knowledge about normal and inflamed appendix after operating 46 patients out of 46 patients having undergone emergency appendectomy, 45 patients had inflamed appendix while only 1 patient had normal appendix. The above data shows the accuracy of USG in diagnosing acute appendicitis and makes USG the first line of investigation to diagnose acute appendicitis.

Comparison between operated and non operated patients

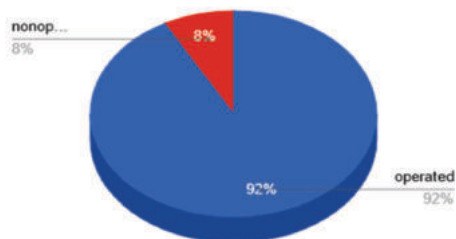


Table 2: Compares the findings of operated cases whether having normal or inflamed appendix.

	Frequency	Percentage
Operated normal appendix	1	2.2
Operated inflamed appendix	45	97.8

Comparison between operated inflamed and normal appendix

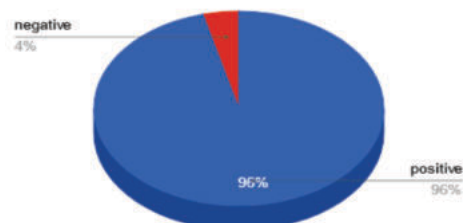


Table – 3 gives us the profile of USG finding showing negative and positive results. Out of 50 patient only 2 patient had negative findings while other 48 had positive findings on USG.

Table 3: Compares the efficacy of USG findings.

	Frequency	Percentage
USG negative for appendicitis	2	4
USG positive for appendicitis	48	96

Correlation between USG findings



Comparison of performance values of the above protocols show that diagnostic sensitivity and specificity of USG in case of acute appendicitis patient presenting to emergency department. This means that very few cases of Acute Appendicitis will be missed. Negative appendectomy rate was also significantly lower.

DISCUSSION

Diagnosis of Acute Appendicitis is not usually plain forward. Even the most skilled surgeon may occasionally remove the normal appendix or sit on the perforated one when the presentation is so unusual¹⁰. To prevent the difficulties of a missed or delayed diagnosis in cases when the diagnosis is ambiguous, the clinical choice to operate results in the removal of 20% of normal appendices.¹¹ It was claimed that this struck the ideal equilibrium between the two variables, negative appendectomy and perforation rate, which were assumed to be inversely connected. However, this age-old idea is now being challenged.⁸ Low negative appendectomy rates may be attained by incorporating novel diagnostic modalities into clinical decision-making without raising perforation rates.¹² The CT scan, ultrasonography, and laparoscopy are the new diagnostic modalities that have received the most research.^{13,14,15} Due to its widespread availability, simplicity, low cost, and lack of intrusiveness, we chose the ultrasound. It is now known that ultrasound can be helpful in the diagnosis of acute appendicitis. According to a research by Wilson J. et al., ultrasonography did not help reduce NAR, especially in women,

and instead caused a considerable delay in operation. Despite being subjected to greater pre-operative USG, females were found to have a higher rate of negative appendicectomy (40.4%) than adult males (16.7%) or toddlers (27.6%).¹⁶

T Terasawa et al.¹⁷ proposed a CT scan as the superior imaging modality in a comprehensive evaluation of 12 trials where ultrasonography had failed to detect any further pathology or see the appendix. The sensitivity and specificity of CT for appendicitis were assessed at 94% and 95%, respectively. S. Krajewski et al in 2011 went a step beyond with a meta-analysis of 28 studies to reveal that the NAR dropped from 16.7% to 8.7% following CT scanning as versus utilizing clinical evaluation alone.¹⁸

CONCLUSION

In conclusion ultrasound by graded compression technique is a useful adjunct to the clinical armamentarium of the present day surgeon. It can reduce the negative appendicectomy rate without adversely affecting the perforation rate particularly in equivocal cases. However, USG findings should be correlated carefully with clinical findings.

REFERENCES

- Gwynn LK. The diagnosis of acute appendicitis: clinical assessment versus computed tomography evaluation. *J Emerg Med.* 2001;21:119–123. doi: 10.1016/S0736-4679(01)00353-5. [PubMed] [CrossRef] [Google Scholar]
- Humes DJ, Simpson J. Acute appendicitis. *BMJ.* 2006;333:530–534. doi: 10.1136/bmj.38940.664363.AE. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- Shogilev DJ, Duus N, Odom SR, Shapiro NI. Diagnosing appendicitis: evidence-based review of the diagnostic approach in 2014. *West J Emerg Med.* 2014;15:859–871. doi: 10.5811/westjem.2014.9.21568. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- Janszky I, Mukamal KJ, Dalman C, Hammar N, Ahnve S. Childhood appendectomy, tonsillectomy, and risk for premature acute myocardial infarction – a nationwide population-based cohort study. *Eur Heart J.* 2011;32:2290–2296. doi: 10.1093/eurheartj/ehr137. [PubMed] [CrossRef] [Google Scholar]
- N D'Souza, C D'Souza, D Grant, E Royston, M Farouk, The value of ultrasonography in the diagnosis of appendicitis, *International Journal of Surgery*, Volume 13, 2015, Pages 165–169, ISSN 1743-9191.
- Berry J Jr, Malt RA. Appendicitis near its centenary. *Ann Surg* 1984; 200(5):567-75
- Silberman VA. Appendectomy in a large metropolitan hospital: Retrospective analysis of 1,013 cases. *Am J Surg* 1981; 142(5):615-18
- Hale DA, Molloy M, Pearl RH, Schutt DC, Jaques DP. Appendectomy: a contemporary appraisal. *Ann Surg* 1997; 225(3):252-61
- Zielke A, Hasse C, Sitter H, Rothmund M. Influence of ultrasound on clinical decision making in acute appendicitis: a prospective study. *Eur J Surg* 1998; 164(3):201-9.
- Schuler JG, Shortsleeve MJ, Goldenson RS, Perez-Rossello JM, Perlmutter RA, Thorsen A. Is there a role for abdominal computed tomographic scans in appendicitis? *Arch Surg* 1998; 133(4):373-6.
- Borgstein PJ, Gordijn RV, Eijssbouts QA, Cuesta MA. Acute appendicitis—a clear-cut case in men, a guessing game in young women. A prospective study on the role of laparoscopy. *Surg Endosc.* 1997;11(9):923-7.
- S.S. Jaunoo, *et al.*, An international survey of opinion regarding investigation of possible appendicitis and laparoscopic management of a macroscopically normal appendix, *Ann. R. Coll. Surg. Engl.*, 94 (7) (2012), pp. 476-480
- Marudanayagam R, Williams GT, Rees BI. Review of the pathological results of 2660 appendicectomy specimens. *J Gastroenterol.* 2006; 41:745-9.
- Lamture YR, Gajbhiye VP, Shahapurkar VV. The role of ultrasonography in acute appendicitis. *Int Surg J* 2017;4:1769-72.
- Hussain A, Mahmood H, Singhal T, Balakrishnan S, El-Hasani S. What is positive appendicitis? A new answer to an old question. Clinical, macroscopical and microscopical findings in 200 consecutive appendectomies. *Singapore Med J* 2009;50(12):1145.
- Wilson J, Skourat R, Lai LM, Babu E, Kelley C. Delay to surgery in acute appendicitis: contributing factors and associated morbidity. *Internet J Surg.* 2007;13(1):1-7.
- T. Terasawa, et al., Systematic review: computed tomography and ultrasonography to detect acute appendicitis in adults and adolescents, *Ann. Intern. Med.* 141 (7) (2004) 537e546.
- S. Krajewski, et al., Impact of computed tomography of the abdomen on clinical outcomes in patients with acute right lower quadrant pain: a meta-analysis, *Can. J. Surg.* 54 (1) (2011) 43e53.