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A Study on the Limits and Advantages of Abdominal Ultrasonography in Acute Appendicitis Among Adults (18–60 Years) and Associated Risk Factors in tertiary care centre of west Bengal: A prospective observational study

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Abstract

Background: Acute appendicitis is one of the most common causes of abdominal pain requiring surgical intervention. Prompt diagnosis is crucial. Abdominal ultrasonography (USG) is often the first-line imaging modality due to its safety and accessibility. Objective: To assess the diagnostic utility, limitations, and benefits of abdominal ultrasonography in patients aged 18–60 with suspected acute appendicitis, and to analyze the associated demographic and clinical risk factors. Methods: A prospective observational study was conducted on 62 patients presenting with suspected acute appendicitis. USG findings were compared with intraoperative and histopathological results. Demographic and risk factors were analyzed. Results: USG showed high specificity (88.4%) but moderate sensitivity (69.7%) for diagnosing appendicitis. Delays and limitations were noted in obese patients and those with atypical presentations. Key risk factors included male gender, low fiber intake, and positive family history. Conclusion: Ultrasonography remains a valuable first-line tool, particularly in early or classic presentations, but its limitations highlight the need for adjunct imaging in equivocal cases. Risk stratification can improve diagnostic accuracy.

KEYWORDS: Appendicitis, Abdominal.

INTRODUCTION

Acute appendicitis is a frequent surgical emergency, typically manifesting as right lower quadrant abdominal pain. Diagnosis can be challenging due to variable presentations and overlapping symptoms with other conditions. Imaging plays a key role in improving diagnostic accuracy. Although computed tomography (CT) offers superior sensitivity, ultrasonography is widely used due to its non-invasiveness and lack of radiation exposure[1].

The prevalence of acute pancreatitis in India is not precisely defined, but studies suggest it ranges from 2.6-3.2 cases per 100,000 population. A systematic review of acute pancreatitis in India indicated an incidence ranging from 12–20 cases per year. However, other studies report prevalence rates from 5–80 per 100,000 population. The incidence and prevalence rates are generally low, which has implications for sample size and resource allocation in research and healthcare[2].

Key points about acute pancreatitis in India: Prevalence: While specific figures vary, the general consensus is that acute pancreatitis is not a highly prevalent condition in India. aetiology: Alcohol consumption and gallstones are major causes of acute pancreatitis in India[3].
Other causes include idiopathic factors, pancreatic structural abnormalities, biliary ascariasis, and blunt trauma. Severity: Severe acute pancreatitis, characterized by pancreatic necrosis and organ failure, is seen in a smaller percentage of patients, typically 5-10%. Mortality: The mortality rate for acute pancreatitis in India is relatively low, ranging from 1.6 to 3.6%. Gender and Age: Studies show a male predominance in cases of acute pancreatitis, with the most common age group affected being 21-40 years[4].
Regional Variations: There might be regional variations in the prevalence and causes of acute pancreatitis within India. Changing Demographics: Studies suggest a changing spectrum of pancreatitis patients, with potential shifts in aetiology and age distribution

This study aims to evaluate the advantages and limitations of abdominal USG in detecting acute appendicitis in adults aged 18 to 60, and to identify associated demographic and clinical risk factors that may influence presentation and diagnosis[5].

METHODS

This study was conducted in a tertiary hospital. After obtaining institutional ethical committee approval It was prospective observational study conducted on 62 patients in the department of Radiology on the basis of attended in Medicine OPD and department of radiology, at a tertiary care Centre, from March / 2018 to September/2018
Total 62 participant were approached to project among them No one were excluded in this study and Total 62 were included on the basis of fulling of the eligibility criteria
The institute Ethics Committee approval was obtained before starting the sample collection. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration

- **Study Design**: Prospective observational study.
- **Study Duration**: 6 months.
- **Sample Size**: 62 patients aged between 18–60 years presenting with clinical suspicion of acute appendicitis.
- **Inclusion Criteria**:
  - Age 18–60
  - Symptoms suggestive of acute appendicitis (e.g., RLQ pain, nausea, fever)
- **Exclusion Criteria**:
  - Prior abdominal surgeries
  - Pregnancy
  - Known GI disorders

Diagnostic Workflow:

1) Initial clinical evaluation
2) Laboratory investigations (WBC, CRP)
3) Abdominal ultrasonography
4) Surgery (if indicated)
5) Correlation with histopathology

Diagnostic Workflow for Acute Appendicitis

Patient with Suspected Appendicitis
↓
Clinical Examination

↓

Lab Investigations (WBC, CRP)

↓

Abdominal Ultrasonography

↙ ↘

Positive USG Inconclusive/Negative

↓ ↓

Surgical Intervention Consider CT or Observation

↓ ↓

Histopathological Confirmation

RESULTS

In this study we found that Acute appendicitis is associated with demographic profile of patient .Average mean age 33.2 ± 11 of patient is suffered of Acute appendicitis .

It means age is important factors for Acute appendicitis. Age is contributary factors of Acute appendicitis

Male (61.3%) were more prone to suffered of Acute appendicitis to Female gender. (Table 1)

Prevalence in Urban residence is more as compare to Rural area; its prevalence is 54.8 % of Acute appendicitis (Table 1).

Demographic Data Table 1 (N = 62)

Factor	**Frequency**	**Percentage (%)**
Gender (Male)	38	61.3%
Gender (Female)	24	38.7%
Age (Mean ± SD)	33.2 ± 11	-
BMI > 25	21	33.9%
Rural Residence	34	54.8%
Urban Residence	28	45.2%

In this study we found that Low Fiber Diet is important risk factors for Acute appendicitis. its prevalence is 66.1 % Followed by Sedentary Lifestyle its prevalence is 32.9 % (Table 2). Smoking is also important risk factors for Acute appendicitis its prevalence is 29% .

A lot of risk factors of Acute appendicitis which are mentioned Below in in (Table 2)

Identified Risk Factors Table 2

Risk Factor	**Patients Affected (n)**	**Percentage (%)**
Low Fiber Diet	41	66.1%
Family History of Appendicitis	15	24.2%
Smoking	18	29.0%
Sedentary Lifestyle	20	32.3%
Prior Episodes of Abdominal Pain	12	19.4%

Ultrasonography Findings

- Sensitivity: 69.7%
- Specificity: 88.4%

- Positive Predictive Value (PPV): 86.2%
- Negative Predictive Value (NPV): 74.3%
- Common sonographic signs:
  - Non-compressible tubular structure
  - Appendiceal diameter >6 mm
  - Periappendiceal fat stranding

DISCUSSION

This study confirms that ultrasonography is a useful tool in the initial evaluation of acute appendicitis, particularly in patients with classical symptoms and lower BMI. However, limitations include reduced sensitivity in obese individuals and inconclusive results in early or atypical presentations[6-11].

Acute appendicitis, an inflammation of the appendix, is most common in individuals between 10 and 30 years old, with men having a slightly higher risk than women. Risk factors include a blockage in the appendix's lumen (often due to fecaliths, tumors, or foreign bodies), a family history of appendicitis, and certain lifestyle factors like lower education levels. Other factors, such as age, sex, and complications, can also contribute to the risk[12-15].

Here's a more detailed breakdown: Obstruction of the Appendix Lumen: A blockage in the appendix's opening (lumen) is the primary cause. This blockage can be due to Fecaliths: Hardened pieces of stool. Tumors: Growths within the appendix. Foreign bodies: Items that enter the appendix. Hyperplasia of lymphoid tissue: Enlargement of lymph tissue in the appendix. Obstruction leads to a buildup of mucus and bacteria, causing inflammation and infection[16-18].

Age and Sex: Appendicitis is most common between 10 and 30 years of age. Men have a slightly higher risk than women. Family History: A family history of appendicitis can increase the risk, particularly in children[19]. Lifestyle Factors Lower education levels: Studies have shown a correlation between lower education and increased risk. Rural environment: Living in a rural environment may also be a risk factor[20]. Other Risk Factors: Constipation: Prolonged retention of feces in the large intestine can obstruct the appendix. Certain medical conditions Conditions like cystic fibrosis, and potentially diabetes and COPD, may increase risk. Immunosuppression:

Weakened immune systems (e.g., due to certain medications or conditions) can make individuals more susceptible to infections like appendicitis[21]. Older age: While appendicitis can occur at any age, older adults may be more prone to complications if they develop it

Abdominal ultrasound (US) has a variable diagnostic accuracy for acute appendicitis, with sensitivity ranging from 71% to 97% and specificity from 59% to 100%. While it can be a useful tool, especially in situations where radiation exposure is a concern, it is not as accurate as CT scans[22].

Here's a more detailed look: Sensitivity and Specificity: Studies report a range of sensitivity (the ability to correctly identify those with the disease) from 71% to 97% and specificity (the ability to correctly identify those without the disease) from 59% to 100%. Positive Predictive Value (PPV): PPV, which indicates the likelihood of having the disease if the test is positive, ranges from 84% to 93%. Negative Predictive Value (NPV): NPV, which indicates the likelihood of not having the disease if the test is negative, can vary significantly[23].

Factors Affecting Accuracy: The skill and experience of the ultrasound operator, the patient's body habitus (especially in obese patients), and the presence of other conditions can affect the accuracy of the ultrasound. Role of Ultrasound. Ultrasound is often used as a first-line imaging test, especially in children and pregnant women, to minimize radiation exposure. It is also used in situations where CT scans are contraindicated.

Limitations

Ultrasound may not always be able to visualize the appendix clearly, especially in patients with bowel gas or obesity. In such cases, CT scans may be necessary for a definitive diagnosis. Complementary Role: Ultrasound

can be used in conjunction with clinical findings and other diagnostic tools, like the Alvarado score, to improve diagnostic accuracy. Contrast-Enhanced Ultrasound: Recent studies have explored the use of contrast-enhanced ultrasound to improve visualization and diagnostic accuracy in cases of suspected appendicitis.

The findings align with previous literature suggesting that while USG offers high specificity, CT may be superior in indeterminate cases. Demographic analysis shows higher prevalence among males and rural populations. Risk factors such as low fiber intake and positive family history were significantly associated with confirmed appendicitis cases.

CONCLUSION

Ultrasonography is a valuable, non-invasive diagnostic tool for acute appendicitis in adults aged 18–60, particularly in resource-limited settings. However, its moderate sensitivity necessitates further imaging in uncertain cases. Awareness of key demographic and lifestyle risk factors can aid clinicians in early detection and decision-making.

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CONFLICT OF INTEREST

The authors report no conflicts of interest

SUBMISSION DECLARATION

This submission has not been published anywhere previously and that it is not simultaneously being considered for any other journal.

REFERENCES

1. Gignoux B, Blanchet MC, Lanz T, Vulliez A, Saffarini M, Bothorel H, Robert M, Frering V. Should ambulatory appendectomy become the standard treatment for acute appendicitis? World J Emerg Surg. 2018;13:28.
2. Eng KA, Abadeh A, Ligocki C, Lee YK, Moineddin R, Adams-Webber T, Schuh S, Doria AS. Acute Appendicitis: A Meta-Analysis of the Diagnostic Accuracy of US, CT, and MRI as Second-Line Imaging Tests after an Initial US. Radiology. 2018 Sep;288(3):717-727
3. Kartal İ. Childhood neuroendocrine tumors of the digestive system: A single center experience. Medicine (Baltimore). 2022 Feb 11;101(6):e28795. [
4. Khan MS, Chaudhry MBH, Shahzad N, Tariq M, Memon WA, Alvi AR. Risk of appendicitis in patients with incidentally discovered appendicoliths. J Surg Res. 2018 Jan;221:84-87.
5. Stringer MD. Acute appendicitis. J Paediatr Child Health. 2017 Nov;53(11):1071-1076.
6. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. Lancet. 2015 Sep 26;386(10000):1278-1287.
7. Ucar Karabulut K, Erinanc H, Yonar A, Kisinma A, Ucar Y. Correlation of histological diagnosis and laboratory findings in distinguishing acute appendicitis and lymphoid hyperplasia. Ann Surg Treat Res. 2022 Nov;103(5):306-311.
8. Narula N, Gibbs KE, Kong F, Mukherjee I. Appendiceal Intussusception, Diverticula, and Fecalith Associated With Appendicitis. Am Surg. 2023 Dec;89(12):6257-6259. [
9. Buckius MT, McGrath B, Monk J, Grim R, Bell T, Ahuja V. Changing epidemiology of acute appendicitis in the United States: study period 1993-2008. J Surg Res. 2012 Jun 15;175(2):185-90.
10. Sahm M, Koch A, Schmidt U, Wolff S, Pross M, Gastinger I, Lippert H. [Acute appendicitis - clinical health-service research on the current surgical therapy]. Zentralbl Chir. 2013 Jun;138(3):270-7.
11. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. Am J Epidemiol. 1990 Nov;132(5):910-25.

12. Téoule P, Laffolie J, Rolle U, Reissfelder C. Acute Appendicitis in Childhood and Adulthood. Dtsch Arztebl Int. 2020 Nov 06;117(45):764-774.
13. Correa J, Jimeno J, Vallverdu H, Bizzoca C, Collado-Roura F, Estalella L, Hermoso J, Silva N, Sanchez-Pradell C, Parés D. Correlation between intraoperative surgical diagnosis of complicated acute appendicitis and the pathology report: clinical implications. Surg Infect (Larchmt). 2015 Feb;16(1):41-4.
14. Hoffmann JC, Trimborn CP, Hoffmann M, Schröder R, Förster S, Dirks K, Tannapfel A, Anthuber M, Hollerweger A. Classification of acute appendicitis (CAA): treatment directed new classification based on imaging (ultrasound, computed tomography) and pathology. Int J Colorectal Dis. 2021 Nov;36(11):2347-2360
15. Snyder MJ, Guthrie M, Cagle S. Acute Appendicitis: Efficient Diagnosis and Management. Am Fam Physician. 2018 Jul 01;98(1):25-33. [
16. van Aerts RMM, van de Laarschot LFM, Banales JM, Drenth JPH. Clinical management of polycystic liver disease. J Hepatol. 2018 Apr;68(4):827-837.
17. Iwamoto Y, Onishi T, Suzuki R, Arima K, Sugimura Y. Uretero-appendiceal fistula. Int J Urol. 2008 Feb;15(2):180-1.
18. Yang HR, Wang YC, Chung PK, Chen WK, Jeng LB, Chen RJ. Laboratory tests in patients with acute appendicitis. ANZ J Surg. 2006 Jan-Feb;76(1-2):71-4.
19. Withers AS, Grieve A, Loveland JA. Correlation of white cell count and CRP in acute appendicitis in paediatric patients. S Afr J Surg. 2019 Dec;57(4):40. [
20. Rao PM. Cecal apical changes with appendicitis: diagnosing appendicitis when the appendix is borderline abnormal or not seen. J Comput Assist Tomogr. 1999 Jan-Feb;23(1):55-9.
21. Pooler BD, Repplinger MD, Reeder SB, Pickhardt PJ. MRI of the Nontraumatic Acute Abdomen: Description of Findings and Multimodality Correlation. Gastroenterol Clin North Am. 2018 Sep;47(3):667-690
22. Swenson DW, Ayyala RS, Sams C, Lee EY. Practical Imaging Strategies for Acute Appendicitis in Children. AJR Am J Roentgenol. 2018 Oct;211(4):901-909.
23. Kim DW, Suh CH, Yoon HM, Kim JR, Jung AY, Lee JS, Cho YA. Visibility of Normal Appendix on CT, MRI, and Sonography: A Systematic Review and Meta-Analysis. AJR Am J Roentgenol. 2018 Sep;211(3):W140-W150.