Evaluation of negative appendicectomy rate in cases of suspected acute appendicitis and to study the usefulness of ultrasonography in improving the diagnostic accuracy

Rajeev Sharma · Dev K. Kasliwal · Raj G. Sharma

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Abstract

Context Acute appendicitis poses a significant diagnostic challenge to the surgeon. Despite modern advances, the diagnosis of appendicitis remains essentially clinical. Ultrasonography is effective in supplementing the clinical diagnosis.

Aims This study aims to evaluate the negative appendicectomy rate in patients subjected to appendicectomy and to assess the usefulness of ultrasound in improving the diagnostic accuracy.

Settings and Design It is a retrospective review of prospectively collected data on 118 patients operated for suspected acute appendicitis in a single surgical unit between May 2001 and December 2002.

Methods and Material The detailed history, clinical examination and preoperative investigations according to protocol were recorded on a *proforma*. All patients underwent an

ultrasonography of whole abdomen including pelvis. Each patient with suspected acute appendicitis was subjected to surgery and appendix was submitted for histopathological examination. The negative rate of appendicectomy, sensitivity and specificity of ultrasonography and positive and negative predictive value of ultrasound were calculated.

Results The negative appendicectomy rate was 23.72%. In males it was 13.43% and in females 37.25%. Ultrasonography had a sensitivity of 63.33 % and a specificity of 82.14 %. The predictive value of a positive test was 91.93% and the predictive value of a negative test was 41.07%.

Conclusions The clinical diagnosis of acute appendicitis when supplemented with an ultrasonography, can achieve a reasonable degree of diagnostic accuracy with resultant low negative exploration rates thereby reducing the *financial burden* and morbidity by avoiding unnecessary appendicectomy and keeping the cost of treatment affordable.

Keywords Appendicectomy · Ultrasonography · Negative Rate

Key Messages

- Despite modern advances in imaging and technology, one can still reliably diagnose acute appendicitis clinically.
- It is important to have low negative appendicectomy rates in order to minimize the financial burden and the attendant increased morbidity and late complications like adhesive intestinal obstruction following unnecessary appendicectomy.

R. Sharma (✉) · D. K. Kasliwal · R. G. Sharma
Upgraded Department of General Surgery,
Sawai Man Singh Medical College,
Jaipur,
India.

4 BHA 5 (A), Bank Street,
Jawaharnagar,
Jaipur – 302 004.
Ph: +91 / 11 / 9811906572
E-mail: rajeevsharma28@yahoo.co.in

- Ultrasound can effectively supplement the clinical diagnosis and rule out alternative diagnoses. However its use as the sole diagnostic criterion to decide about appendicectomy should be discouraged.
- The use of computed tomography, though promising, is limited in the developing world due to its high cost.

Introduction

Acute appendicitis poses a significant diagnostic challenge in emergency care especially to the surgeon concerned. Delay in early diagnosis will lead to complications with their attendant increased morbidity, while overzealous diagnosis may lead to an increased negative appendicectomy rate.

Ultrasonography has traditionally been used for diagnosis of complications of this disease and for excluding alternative diagnoses. Although computerized tomography scan is reported to be more accurate than ultrasonography, it is significantly more expensive and has the added disadvantage of radiation exposure.

Despite advances in modern radiographic and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical knowledge.

The aim of our study is to assess the usefulness of ultrasound in the diagnosis of acute appendicitis and evaluation of the negative appendicectomy rate in these patients by correlating the clinical and radiological diagnosis with histopathological examination of the resected specimen and to reduce the financial burden and morbidity in patients by avoiding unnecessary appendicectomies.

Subjects and methods

The present study is a retrospective review of prospectively collected data on 118 patients operated for suspected acute appendicitis admitted in the various wards of a single surgical unit between May 2001 and December 2002. All the cases under study have been taken from a single surgical unit so as to maintain uniformity in the treatment and management of all patients.

The detailed history, clinical examination and preoperative investigations, according to our protocol, of each patient were recorded on a *proforma*. All patients underwent an ultrasonography of whole abdomen including pelvis with full bladder. We did not perform a computerized tomography scan of the abdomen in any patient mainly because of the prohibitive cost. Each patient with a clinical diagnosis of acute appendicitis, irrespective of radiological findings, was subjected to surgery and the resected specimen of appendix was submitted for histopathological examination.

The negative rate of appendicectomy was calculated. The sensitivity, specificity, positive and negative predictive value of ultrasonography was also calculated.

All patients with a normal appendix on histopathological examination were advised annual follow up with clinical examination and ultrasound of the abdomen to look for alternative pathology.

Observations

In our study we present 67 male and 51 female patients. The male: female ratio was 1.3:1. Most patients complained of right lower quadrant pain. The classic shift of pain from umbilical region to the right lower quadrant was observed only in 10 (8.4%) patients; nausea and vomiting in 84 (71.1%); anorexia in 72 (61.0%) and fever in 25 (21.10%)

Table 1 Table showing symptoms & signs

S. No.	Symptom / Sign	Number of patients (n =118)	Percentage
1.	Pain in RIF classic shift of pain from umbilical → RIF	118 10	100% 8.4%
2.	Nausea / vomiting	84	71.1%
3.	Anorexia	72	61.0%
4.	Fever	25	21.1%
5.	Urinary symptoms	0	0%
6.	Diarrhoea / constipation	2	1.6%
7.	Past h/o pain more than one attack Single attack	45 32 13	38.1% 27.1% 11.0%
8.	Tenderness in RIF	118	100%
9.	Guarding	39	33.0%
10.	Rebound Tenderness	19	16.1%

Table 2 Table showing the USG findings

S. No.	Findings	Number of patients
1.	Graded Tenderness	64
2.	Visualization	27
3.	Periappendicular Fluid	23
4.	Complex mass	10
5.	Local adynamic ileus	39
6.	Appendicolith	0
Total number of cases studied		118

patients. Urinary symptoms were not observed in any patient and diarrhoea/constipation was present in 2 (1.6%) patients. 45 (38.1%) patients gave a past history of similar pain; 32 (27.1%) experienced two or more such episodes of pain in the past and 13 (11.0%) experienced a single attack of such pain in the past.

The most consistently observed physical sign was right lower quadrant tenderness, which was present in all patients. Other signs like guarding and rebound tenderness were present in 39 (33.0%) and 19 (16.1%) patients respectively.

An ultrasound scan was considered positive if a non-compressible appendix 6 mm or greater in the AP direction was demonstrated. The presence of an appendicolith was also considered diagnostic. Periappendicular fluid, local adynamic ileus and complex mass constituted the indirect evidence of acute appendicitis. When the diagnosis of appendicitis was excluded by ultrasonography, a brief survey of the remainder of the abdominal cavity was performed to establish an alternative diagnosis.

In our study graded tenderness was observed in 64 patients. Direct visualization was possible in only 27 patients. Indirect evidence in the form of periappendicular fluid, complex mass and adynamic ileus was observed in 72 patients.

Among the 28 patients with a normal appendix found at histopathological examination, an alternative diagnosis was found in only five patients (ovarian cyst in four, and ascariasis in one). In the remaining 23 patients, the cause of pain right iliac fossa could not be defined.

Results

Ultrasonography had a sensitivity of 63.33% and a specificity of 82.14 %. The predictive value of a positive test was 91.93% and the predictive value of a negative test was 41.07 %.

In our study, the negative appendectomy rate was 23.72% (28 out of 118). In males it was 13.43% (9 out of 67) and in females, 37.25% (19 out of 51).

Table 3 Evaluation of USG results by correlating with Histopathological examination

Histopathological examination report	Ultrasonography (n = 118)	
	Acute Appendicitis	Normal
Inflammatory	57 (True Positive)	33 (False Negative)
Normal	5 (False Positive)	23 (True Negative)

Table 4 Overall results of USG (118 cases)

Sensitivity (%)	63.33
Specificity (%)	82.14
Positive predictive value (%)	91.93
Negative predictive value (%)	41.07

All patients with a normal appendix on histopathological examination (28 patients) were advised annual follow up with clinical examination and ultrasound of the abdomen to look for alternative pathology. However none of those patients turned up again since most were from a rural background living far away from medical care.

Discussion

Ultrasonographic appearances of acute appendicitis were initially described by Pearson [1] as that of a non-compressible, aperistaltic tubular structure with a central dilated lumen, surrounded by an inner echogenic mucosal layer and an outer, edematous wall that shows few echoes. The criteria of AP diameter and wall thickness were suggested by R. Brooke Jeffery Jr [2, 3] and his findings were confirmed by David H. Adams et al [4] and Ooms and Associates [5]. Wide variations in sensitivity, specificity and positive predictive value of ultrasonography have been reported [6, 7].

The low specificity and sensitivity value that we have obtained in our study with ultrasound clearly suggests that though ultrasound can be a good modality to *supplement* the clinical diagnosis, it cannot alone be relied upon to diagnose acute appendicitis.

In our study the negative appendectomy rate was 23.72% (28 out of 118). In males it was 13.43% (9 out of 67) and in females, 37.25% (19 out of 51).

Negative appendectomy rates of 10–20% have been accepted in order to minimize the incidence of perforated appendicitis with its increased morbidity. Wide variations in negative appendectomy rates have been reported with rates ranging from 9% to 85% [9, 10, 11].

A negative rate of 23.7% is certainly higher than the accepted standards. It therefore draws our attention to newer modalities with a better sensitivity and specificity like computed tomography [12]. Its widespread use in the de-

veloping world however, is not practical due to its high cost. Although at our centre we do not have any experience with computed tomography to diagnose acute appendicitis, yet the data from literature regarding its utility is promising.

Conclusion

We conclude that the diagnosis of acute appendicitis is still essentially clinical and undue reliance should not be placed on ultrasound of abdomen to diagnose and treat this condition. The idea of achieving a low negative appendicectomy rate is to avoid unnecessary appendicectomy thereby reducing the morbidity in patients and minimizing the financial burden on patients and society. Ultrasound of the abdomen, however, is recommended in all cases of suspected acute appendicitis, especially in women, to exclude alternative diagnoses. Further, Ultrasound facilities are readily available even in remote areas in our country making its utility realistic. Computed Tomography scan, *though promising*, cannot be recommended in every patient in a developing country like India due to its limited availability, prohibitive cost and the added risk of radiation exposure, especially in children.

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