THE ASEAN JOURNAL OF RADIOLOGY 2010; 16(1): 30-34

Original Article

The Role of Ultrasonography in the Patients with Suspected Acute Appendicitis

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Abstract

Objective: To evaluate the usefulness of ultrasonography in the cases of suspected acute appendicitis.

Materials and Methods: Sixty-four patients with clinically suspected acute appendicitis in Makarak hospital, Karnchanaburi from June 2006 to July 2008 were retrospectively reviewed for ultrasonographic diagnosis. The sensitivity, specificity, PPV, NPV and accuracy were noted.

Results: Nine patients were diagnosed as acute appendicitis but 1 case was false positive. Fifty-five patients were assessed as non appendicitis group but 3 cases were false negative. The specificity and sensitivity were 98% and 73%. The PPV, NPV and accuracy rate were 89%, 95% and 94% respectively

Conclusions: Ultrasonography may help in the diagnosis of acute appendicitis and exclude other diseases and decrease unnecessary operation.

Introduction

Acute appendicitis is one of the most common acute surgical conditions of the abdomen. The diagnosis of appendicitis traditionally has been based on clinical features found primarily in the patient's history and physical examination.[1] However the clinical diagnosis in many patients are difficult to establish. A negative appendectomy rate is about 20-25%.[2,3] In patients with an equivocal diagnosis, imaging techniques such as ultrasonography or computed tomography have a role for improve diagnostic accuracy and patient outcomes.[3,4]

Ultrasonography is a noninvasive, inexpensive and widely available imaging for diagnosis the patients with suspected acute appendicitis. Diagnostic accuracy, reported to range from 71-97% is dependent on operator skill.[4]

The present study aims to evaluate the usefulness of ultrasonography in the cases of suspected appendicitis.

Materials and Methods

From June 2006 to July 2008, sixty-four consecutive patients with clinically suspected acute appendicitis were admitted to Makarak Hospital, Karnchanaburi and underwent ultrasonography.

The examination was performed by using an ALOKA 3500. A curvilinear 3.5 MHz transducer and high resolution 5-7.5 MHz linear array transducer were used. The scanning was done from right costal margin downwards to right iliac area to demonstrate ascending colon and cecum. The tip of cecum and ileocecal region were concentrated to identify the appendix. The positive criteria for acute appendicitis were a blind-end aperistalsis, noncompressible tubular structure with a laminated wall that arase from the base of the cecum, having an outer appendicial diameter of 6 mm or greater on cross section.[1,5]

All of the patients were retrospectively reviewed the medical records and ultrasonographic reports. The patients with clinically suspected appendicial abscess or phlegmon were not included in this study.

Results

The retrospective review of 64 patients clinically suspected of acute appendicitis were underwent ultrasonography. There were 16 male (25%) and 48 female (75%) patients, with an age range of 4-88 years (mean, 29 years)

Nine patients were diagnosed by ultrasound to have acute appendicitis, while 55 patients were classified as non appendicial group based on ultrasound.

From table 1, the ultrasonographic finding of nine patients who were diagnosed of acute appendicitis have positive criterion for appendicitis with anteroposterior outer diameter ranged from 7-23 mm (mean, 14 mm). In fig. 1, 2 and 3 all of them were underwent appendectomy and confirmed with histological evaluation. Eight of nine patients were diagnosed of appendicitis (True positive) and 1 (11%) has pathological diagnosis of periappendicitis (False positive).

Table 1 Correlation between the ultrasonographic results and pathological diagnosis

	Pathology (+)	Pathology (-)
Ultrasound (+)	8	1
Ultrasound (-)	3	52

Specificity (52/53) x 100% = 98%
Sensitivity (8/11) x 100% = 73%
Accuracy (60/64) x 100% = 94%
Positive predictive value (8/9) x 100% = 89%
Negative predictive value (52/55) x 100% = 95%

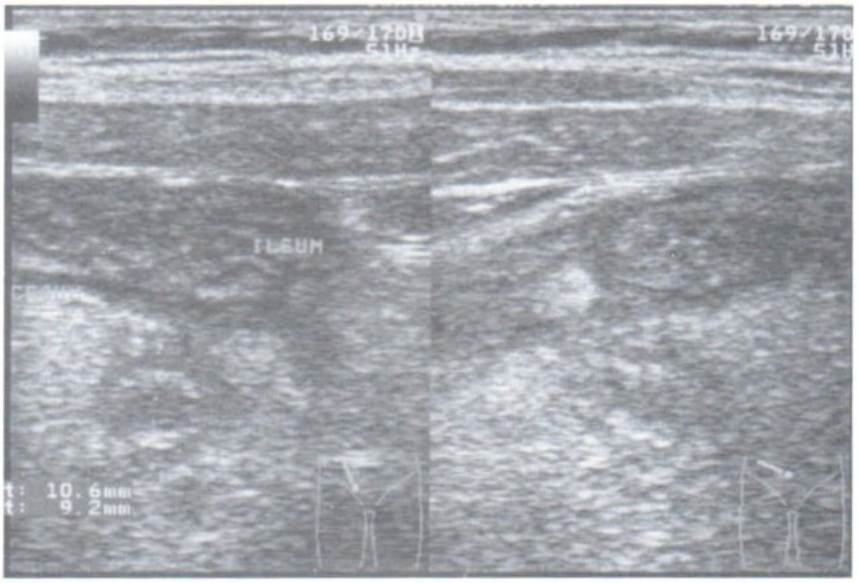

Fig.1 Acute appendicitis : cross-sectional ultrasound images of RLQ obtained with a linear transducer show a 10.6 mm diameter, blind-ended, nonperistalsis tubular structure with a laminated wall.

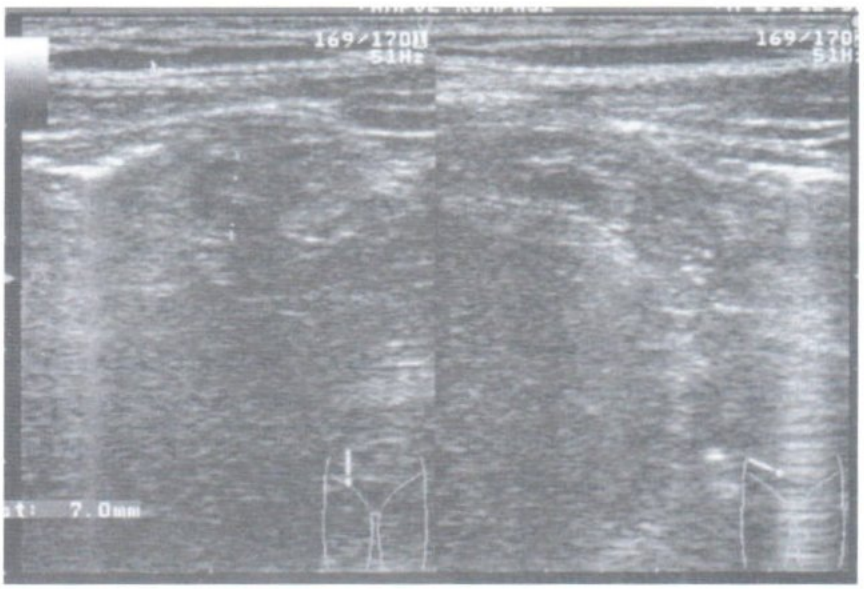

Fig.2 Transverse and longitudinal ultrasound images at RLQ abdomen show inflamed appendix as a 7.0 mm AP diameter, blind-ended, noncompressible tubular structure.

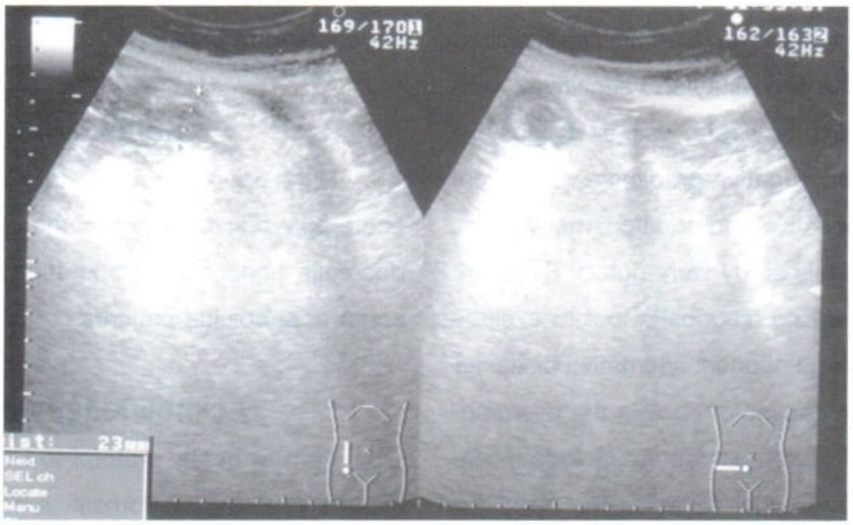

Fig.3 Ultrasound images in longitudinal and cross-sectional views obtained with a convex transducer of acute appendicitis reveal a 23 mm AP diameter of blind-end aperistalsis, noncompressible tubular structure at right lower quadrant of abdomen

In the 55 patients with negative ultrasonographic findings for appendicitis, three patients were clinically determined to have appendicitis and then underwent surgery with pathological confirmation (False negative). Fifty-two patients had no evidence of appendicitis sign (True negative). In these 52 patients, ultrasound provided alternative diagnosis in 18 patients (gynecological conditions 6 patients, urological diseases 7 patients and hepatobiliary diseases 5 cases). The other 34 patients were clinically diagnosed as having gastrointestinal diseases in 17 patients and nonspecific abdominal pain in 17 patients.

Discussion

Acute appendicitis is the most common acute surgical condition of the abdomen. The clinical diagnosis of acute appendicitis is based primarily on patient history and on physical examination. In classic presentation, a patient with appendicitis has a typical histological sequence of symptoms (poorly localized periumbilical pain followed by nausea and vomiting, with subsequent migration of pain to the RLQ) and physical findings that vary with time and with the location of the appendix.[6,7] The classic presentation occurs in only 50-60% of patients, and the diagnosis may be missed or delayed when atypical pattern of disease are encountered.[1] The overall diagnostic accuracy of acute appendicitis is about 80% in men and women with approximately 20% false negative appendectomy rate.[1]

In atypical case or equivocal clinical findings, ultrasonography and computed tomography are imaging tools that helps to improve diagnostic accuracy. Ultrasound is available, noninvasive method for diagnosis acute appendicitis. In experience hands, ultrasound has reported specificities of 86-100%, sensitivity of 75-90%, accuracies of 87-96%, positive

predictive values of 91-94% and negative predictive values of 89-97% for diagnosis of acute appendicitis.[1] In present study, the specificity and sensitivity were 98% and 73%, accuracy rate was 94%, positive predictive value and negative predictive value were 89% and 95% respectively. In addition, many cases of true negative in this study were noted. Therefore ultrasonography may be diagnostic tool to exclude acute appendicitis and suggest alternative diseases.

The common causes of error in the overdiagnosis of appendicitis with ultrasound include misinterpretation of the terminal ileum as the appendix and misinterpretation of a normal appendix as an inflamed appendix.[1] However in this study 1 case of false positive had clinical diagnosis of acute right pyelo-nephritis, severe form, with inflammation of paracolic region and periappendicitis. The underdiagnosis of appendicitis is much more difficult to address.[1] Many factors include ultrasonographic machine quality, technique of ultrasound, patient obesity and position of appendix (particularly true pelvic and retrocecal types of appendix). Furthermore, perforation of the appendix may lead to decompression of the appendicial lumen. Two of three cases with false negative in present study, 1 was retrocecal appendicitis and 1 had acute appendicitis with pelvic type.

This study had limitation on number of cases and was performed by one radiologist. However, good accuracy of present study had encountered. Accordingly, ultrasound imaging may help to diagnose acute appendicitis and decrease the negative appendectomy rate.

Conclusion

Ultrasonography may help in the diagnosis of acute appendicitis and exclude other diseases and decrease unnecessary operation in the suspected acute appendicitis patients.

Acknowledgements

I am sincerely grateful to Dr.Thanachet Kangsapattarakul and Dr.Pornsak Amornsri, department of surgery, Makarak hospital, for operative and pathological information.

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