Original Article

Diagnostic Value of Maximal – Outer – Diameter with High Frequency Probe Ultrasound by Graded Compression Technique in Acute Appendicitis

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Abstract

Acute appendicitis is a common problem in all age groups and clinical over diagnosis is very common. The aim of this study is to know the diagnostic value of maximal-outer-diameter (MOD) of the appendix. This was measured by high frequency ultrasound probe by graded compression technique in acute appendicitis. This study was conducted in the departments of Diagnostic Radiology at Combined Military Hospital and Bahawal Victoria Hospital, Bahawalpur from 1st January 2009 to 1st November 2010. Ninety one patients of 8 – 70 years old with a suspicion of acute appendicitis based on Alvarado score of more than 7 were included. The appendix was scanned using a high resolution transducer (9 – 11 MHz linear transducer) the maximum outer diameter (MOD) was measured. Sixty nine were proved as acute appendicitis by biopsy. The sensitivity and positive predictive value of MOD of 8 mm or more in the diagnosis of acute appendicitis is 98.5% and 100% respectively.

Key Words: Acute appendicitis; Graded compression; Sensitivity; Diagnosis.

Introduction

Acute appendicitis is a common problem in all age groups and clinical over diagnosis is very common. There a lot of methods for the diagnosis of acute appendicitis. These methods include clinical examination, clinical scoring like Alvarado,[1] blood complete examination, computerized tomography and ultrasound abdomen. The gold standard of diagnosis is biopsy which is a highly invasive procedure. The diagnostic yield of clinical examination, clinical scoring like Alvarado and blood complete examination is not very high. Computerized tomography is costly, not easily available and needs much expertise.[2] So the ultrasound seems a good option for the diagnosis of acute appendicitis. In 1970 ultrasonography become a popular diagnostic tool still its use for the diagnosis of acute appendicitis was started in 1980 and since then its accuracy, sensitivity and specificity is being evaluated by new people and good results are available encouraging the clinicians to rely upon it especially in doubtful

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cases.[3] Puyleart was the first in 1986 who used the graded compression technique and reported 89% sensitivity and 100% specificity in the diagnosis of acute appendicitis.[4] The ultrasound findings in acute appendicitis with graded compression technique can include blind ended non peristaltic, non compressible loop along with loculated free fluid, intraluminal fluid or appendicolith with increased diameter. The most reliable finding is increase in diameter.[5] The aim of this study is to know the diagnostic value of maximal – outer – diameter with high frequency probe ultrasound by graded compression technique in acute Appendicitis.

Materials and Methods

This prospective study was conducted in the department of Diagnostic Radiology at Combined Military Hospital and Bahawal Victoria Hospital, Bahawalpur from 1st January 2009 to 1st November 2010. Patients of 8 – 70 years old with a suspicion of acute appendicitis based on Alvarado score > 7 (1) and referred from various surgical units were selected for the study. After written consent all patients underwent ultrasonography of abdomen with ultrasound unit Pnemio 20 Toshiba Medical Systems by experienced radiologists. The appendix was scanned from the base to the tip under graded compression using a convex (3.5 – 6 MHZ) transducer and linear high resolution transducer (9 – 11 MHz) transducer and then the maximum outer diameter (MOD) was measured at the thickest point in the cross sectional image. The MOD was defined as the distance between the outer hyper echoic borders of the appendix. The patients who were obese (body mass index 30 or more), under 12 years of age, patients not given the consent or who left against medical advice were not included in the study.

All above patients with a suspicion of acute appendicitis based on Alvarado score > 7 under underwent surgery and the diagnosis of appendicitis was confirmed histopathologically.

Results

The diagnosis of sixty nine (75.8%) out of ninety one patients (n = 91) with a clinical suspicion of acute appendicitis were proved by biopsy. All of these confirmed cases of appendicitis were having MOD of 8 mm or more except in one case which was having 4.9 mm MOD in which the appendix was ruptured. None of the case in which the diagnosis of acute appendicitis was excluded on biopsy was having MOD of 8 mm or more. The sensitivity and positive predictive value of MOD of 8 mm or more in the diagnosis of acute appendicitis is 98.5% and 100% respectively. Rest of the twenty two clinically suspected cases of acute appendicitis were having MOD < 8 mm on graded compression ultrasonography were diagnosed as lymphoid hyperplasia and acute congestion on Biopsy.

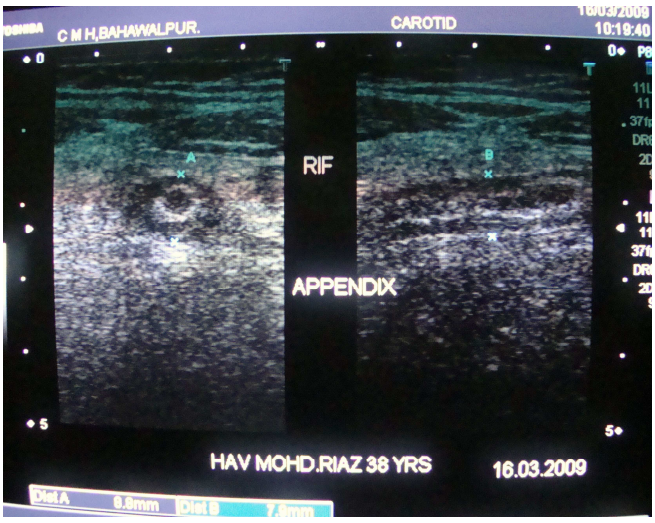

Fig. 1: USG scan showing inflamed appendix with maximum diameter of 8.5 mm.

Discussion

Acute appendicitis is of the most common surgical emergencies. The presentation is at times so atypical that even the most experienced hands may remove normal appendix or sit on the perforated appendix. Clinical decision to operate leads to removal of about 20% normal appendices to avoid the complications of missed or delayed diagnosis in equivocal cases.[6] This was said to be the optimum balance between negative appendicectomy and rate of perforation which were thought to be reciprocally related. This traditional concept is however being questioned recently. By incurporating new diagnostic modalities in clinical decision making, low negative appendicectomy rate can be achieved without increasing the rate of perforation. The most widely studied new diagnostic modalities are graded compression technique in ultrasonography, CT Scan and laparoscopy. The graded compression sonography of the right lower quadrant has gained increasing acknowledgement in establishing the diagnosis of acute appendicitis.

Sonography is relative inexpensive, widely available, rapid, noninvasive, requires no patient preparation or contrast material administration and most important that it poses no ionizing radiation risk to the patient. This latter advantage is significant when evaluating pregnant patients. In addition, radiation is an important concern in the pediatric and young adult patient, who is up to 10 times more sensitive to the effects of ionizing radiation than middle aged and elderly patients. Unfortunately the graded compression sonography is operator dependent and requires a high level of skill and expertise. Obese patients and patients with a retrocecal appendix or with severe abdominal pain and with large amount of bowel gas are difficult to examine using sonography.

A number of ultrasound techniques are there to detect acute appendicitis however the optimal technique for this is controversial. Decision to use the specific technique / protocol very much depends upon depends upon time availability, patient physique, patient cooperation, expertise of technical staff and polices of diagnostic center. In our center we examined the right lower quadrant of the patients with graded compression technique using low as well as high frequency transducers in the transverse, sagittal and oblique planes from tip of the liver to the pelvic brim. The MOD was defined as the distance between the outer hyper echoic borders of the appendix (Fig. 1). We found that the sensitivity and positive predictive value of maximum outer diameter 8 mm or more in the diagnosis of acute appendicitis was 98.5% and 100% respectively. Rettenbacher TA et al 2001[7] showed that diameter of 6 mm or more confirmed acute appendicitis with a sensitivity of 100% and positive predictive values of 63%.

None of child without acute appendicitis was having diameter 8 mm or more in our study. Rettenbacher TA et al 2001[7] showed that symptomatic patients without appendicitis were in the range of 2 – 11 mm.

Cross – sectional imaging studies revealed that outer diameters of acutely inflamed appendices are not less than 6 mm,[8-14] 7 mm,[15-18] or 8 mm,[19] while other investigators reported diameters of 5 mm,[20] 4 mm,[21,22] or even 3 mm.[23] The reason why acutely inflamed appendices with diameters of less than 8 mm are mentioned in some reports could be the inclusion of cases with mild or questionable appendicitis into the group of acute appendicitis. Another explanation for the mention of diameters less than 8 mm in reports of cross – sectional imaging studies could be that the diameter was obtained in the proximal normal portion in cases of distal appendicitis. Another explanation may be population variation. Further studies are needed to know the importance of this MOD cut off point (8 mm or more) as well as to know its specificity and Negative predictive values.

Conclusion

The diagnostic ultrasound is more accessible, less expansive and accurate radiological investigation in the diagnosis of acute appendicitis. The maximum outer diameter (MOD) of appendix ≥ 8mm is highly sensitive for the diagnosis of acute appendicitis. Further studies need to be done on this topic to confirm the importance of this MOD cut off points (8 mm or more) as well as to know its specificity and negative predictive values.

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