

## Original Article

# Role of abdominal sonography in the diagnosis of acute appendicitis

Khalid Saeed, Farzana Mehboob, Vaqar Azam

## ABSTRACT

### Objective

To evaluate the role of abdominal sonography in the diagnosis of acute appendicitis.

### Method

This was a descriptive study and was conducted in the Cantonment General Hospital Rawalpindi from May 2006 to December 2007. A total of 170 patients presenting with a clinical diagnosis of acute appendicitis, irrespective of age and gender, were included in the study. All had an ultrasonography by the graded compression technique. Histopathology was used to compare the clinical and sonographic judgment.

### Results

Out of 170 patients, 118 patients were histologically confirmed acute appendicitis. Ultrasonography suggested 100 out of 118 (85%) patients positive for acute appendicitis. It was normal in 46 out of 52 (88.4%) patients of negative appendicectomies. It gave a false negative result six cases. Sensitivity of sonography was 85% and specificity was 86%.

### Conclusions

The data supports a positive role for sonography in the diagnosis of acute appendicitis. Its role in male adults and children is encouraging, while in female adults ultrasonography has more false negative results. (Rawal Med J 2009;34: ).

### Keywords

Ultrasonography, appendicitis, negative appendicectomy.

## INTRODUCTION

Acute appendicitis is the most common cause of emergency abdominal surgery, which leads to hospitalization and surgery.<sup>1</sup> It is responsible for 10% cases of all the

general surgical emergencies.<sup>2</sup> The overall lifetime occurrence is approximately 12% in men and 25% in women.<sup>3</sup> The diagnosis is based on clinical manifestations<sup>4</sup> as a negative laparotomy for appendectomy is always justified by the probable grave complications if not operated. The diagnosis becomes difficult in extremes of ages or when patient is pregnant.<sup>5</sup>

Thus, it is recommended that other diagnostic tools like ultrasonography, CT scan, laparoscopy, c-reactive proteins and computer assisted data analysis may be used in doubtful cases of acute appendicitis and to reduce the negative appendectomy rate.<sup>6</sup> A number of radiological modalities may improve the diagnosis<sup>7</sup> but all have false positive and false negative results.<sup>8</sup> Ultrasonography remains the most simple, noninvasive, easily accessible and useful modality and has reduced the negative appendectomy rate to 8.9%, has sensitivity of 92%<sup>9</sup> and can significantly improve the diagnostic accuracy in patients with equivocal clinical features.<sup>10</sup> The aim of this study was to evaluate the role of abdominal sonography in the diagnosis of acute appendicitis.

## **PATIENTS AND METHODS**

This study was carried out in Cantonment General Hospital Rawapindi from May 2006 to December 2007 in the departments of Surgery, Radiology and Gynecology. Patient's selection was based on emergency admission to the surgical unit with probable diagnosis of acute appendicitis. Those who were not operated due to clinical judgment and treated conservatively were excluded from the study. The cut off age between adults and children was taken as twelve years.

A total of 170 patients were included. After thorough clinical examination and abdominal sonography was performed. Ultrasound was performed by the graded compression technique by a radiologist having more than 15 years of experience (Aloka SSD-1700 with a linear array high resolution transducer of 7.5 MHz). The sonographic diagnosis was based on presence of an enlarged non-compressible appendix, outer wall to wall diameter of more than 6mm, presence of a complex mass or presence of dilated bowel loops in the right iliac fossa and eliciting localized tenderness.<sup>9</sup>

All specimens were sent for histopathology.<sup>11</sup> Cases declared positive for appendicitis on histology were taken as true positive, and those declared positive for appendicitis on sonography but not confirmed on histology were taken as false positive. Similarly, cases declared normal on sonography and histology were taken as true negative, and those reported normal on sonography but proven otherwise on histology were taken as false negative. Data was analyzed using SPSS v 14.

## RESULTS

Out of 170 patients, 118(65.4%) cases were histologically confirmed for acute appendicitis, while 52 were normal (Table 1). Out of 118 patients, ultrasound suggested 100 positive cases and 18 were given normal reports which were declared as false negative reports in 18 cases.

**Table 1. Histological and sonographic diagnosis of appendicitis.**

	<b>Total no. of patients operated</b>	<b>Histological diagnosis for appendicitis</b>	<b>Sonographic diagnosis for appendicitis</b>
Patients	170	118	100 (85%)
Male adults	80	54	50 (92.5%)
Female adults	56	38	26 (68%)
Male children	25	19	17 (90%)
Female children	9	7	7 (100%)

Ultrasound had a normal report in 46 out of 52 negative appendicectomies, giving a false positive report in 6 cases. Total sensitivity of sonography was 85% and specificity of 86% (Table 2).

**Table 2. Analysis of Sonography in different groups.**

Patients	Total no of ultrasounds	Positive u/s for app	False negative on u/s	Normal u/s for negative app.	False positive on u/s	Sensitivity	Specificity
Male Adults	80	50/54	4	22/26	4	92.5%	85%
Female Adults	56	26/38	12	16/18	2	68%	75%
Male Children	25	17/19	2	6/6	0	90%	92%
Female Children	9	7/7	0	2/2	0	100%	100%
Total	170	100	18	46	6	85%	86%

In male adults, sonography showed a sensitivity of 92.5% and specificity of 85%. In female adults the results were more erratic giving the highest number of false negative results and a sensitivity of 68% and specificity of 75%. The children had a sensitivity and specificity of 90% and 92% in male children. Female children showed 100% sensitivity and specificity.

## **DISCUSSION**

Ultrasonography is very much operator dependent and needs a good knowledge of the anatomy and a refined skill. Graded compression ultrasonography is one of the new techniques that is reported to have improved the diagnostic accuracy and clinical outcome.<sup>12</sup> Our study was based on a study of Ramachandran and colleagues,<sup>9</sup> who used ultrasound as an adjunct in the diagnosis of acute appendicitis with graded compression technique and 5.0 MHz linear array transducer. His study on equivocal patients showed a sensitivity of 92% and specificity of 97%. In his study negative appendectomy rate was reduced to 8.9%. We found an overall sensitivity of 85% and specificity of 86%. The results were not as good as studied by Ramachandran but comparable to a study by Jehangir and colleagues who showed a sensitivity of 86.2% and specificity of 91.8%.<sup>13</sup>

Ahmad and colleagues in their study showed that ultrasound examination had a sensitivity of 71.8%, specificity of 62.5% and a positive predictive value of 88.4%

and a negative predictive value of 35.7%. They concluded that clinical evaluation is more sensitive than ultrasonography subject to the experience of the surgeon and expertise of the sonologist.<sup>14</sup> Qureshi and colleagues concluded that the use of ultrasound helps to make prompt decisions in suspected cases of acute appendicitis.<sup>15</sup> Bhutta and colleagues also found a sensitivity of 86.6% and specificity of 100% and recommended that all patients with suspicion of appendicitis should routinely undergo abdominal ultrasonography performed by an experienced radiologist to confirm the diagnosis and to prevent negative appendicectomies.<sup>16</sup> We found a high predictive value for children and male patients and the results are comparable to a study by Hehn and colleagues who concluded that in children the sensitivity, specificity and accuracy was 90%, 91% and 96% respectively<sup>17</sup>. We also found poor results in females of reproductive age group.

## CONCLUSION

Our data supports a positive role for sonography in the diagnosis of acute appendicitis. Its role in male adults and children is encouraging, while in female adults ultrasonography has more false negative reports.

From Cantonment General Hospital, Rawalpindi, Pakistan  
Correspondence: Khalid Saeed, Associate Surgeon, Cantonment General Hospital Rawalpindi, Pakistan. Email: saeed8200@yahoo.com  
Received: 18 September 2008 Accepted: 30 June 2009

## REFERENCES

1. Soriede O. Appendicitis: a study of incidence of death rate and consumption of hospital sources. *Postgrad Med J* 1984;60:341-45.
2. Kumar V, Cortan RS, Robbins S L: Appendicitis, Robbins Basic Pathology, 5th Edn. 1992. P520.
3. Flum DR, Koepsell T. The clinical and economic correlates of misdiagnosed appendicitis. Nationwide analysis. *Arch Surg* 2002;137:799-804
4. Birbaun BA, Wilson SR. Appendicitis at the millennium. *Radiology* 2000; 215: 337-48.
5. Leung AK, Sigalet DL. Acute abdominal pain in children. *Am Fam Physicians*

- 2003;67:2321-6.
6. Ali N, Sadiq M, Bacha J, Hadi G. Correlation of clinical and histological diagnosis of appendicitis. *J Postgrad Med Inst* 2003;17:254-7.
  7. Tourel P, Kessler N, Blayac P, Lesnik A, Galix B, Bruel JM. Acute appendicitis, to image or not to image. *J Radiol* 2002;83(12pt 2):1952-60.
  8. Pearson RH. Ultrasonography for diagnosis of Appendicitis. *BMJ* 1988; 297:309-10.
  9. Ramachandran P, Suit CJ, Newman KD Schwarts MZ. Role of ultrasonography in diagnosis of acute appendicitis. *J Pediat Surge* 1996; 31:164-7.
  10. Afzal M, Ahmed MS, Javed M, Rafi M, Siddiqui MAJ. Role of ultrasonography in improving diagnostic accuracy. *Biomedica* 1997;13: 46-50.
  11. Iqbal M, Khan A. An audit of histopathological reports of cases of acute appendicitis. *J Surg Pak* 2004;9:22-3.
  12. Akbar M, Mardan A, Mufti TS, Khattak I, Chilkanda N, Monem A, et al. Role of ultrasound in acute appendicitis. *J Ayub Med Coll.* 2007;19:72-79.
  13. Jehangir SK, Hussain H, Khan ZA. Investigations for acute appendicitis, can we rely on them? *Pak J Surg* 2002;18:27-30.
  14. Ahmed AN, Fatima N, Hussain RA, Qadir SNR. Comparative evaluation of the role of sonography versus surgeon,s clinical impression in acute appendicitis. *Ann King Edward Med Coll* 2003;9:27-8
  15. Qureshi IA, Tarin BA, Shafiq M. Role of ultrasonography in clinically suspected case of acute appendicitis. *Pak Armed Forces Med J* 2001; 51:90-3.
  16. Bhutta IA, Nawaz F, Mustafa J, Mudassar N. The role of high resolution sonography in diagnosis of acute appendicitis. *J Rawal Med Coll* 2004;8: 87-9.
  17. Hehn H, Hopner F, Von Kalle T. Role of ultrasonography in children in acute appendicitis. *Radiology* 1997;37:454-8.



