Gastroenterology and Hepatology From Bed to Bench. ***2010;3(3):138-141***

ORIGINAL ARTICLE

Preoperative abdominal ultrasonography: validity and it's diagnostic errors in suspected appendicitis

Fereshteh Kamani, Vahid Amini

Department of surgery, Taleghani Hospital, Shahid Beheshti University, M.C., Tehran, Iran

ABSTRACT

Aim: The aim of this study is to evaluate the accuracy of preoperative abdominal ultrasonography in suspected appendicitis, and equivocal exam.

Background: Acute appendicitis is a common problem and occasional challenging diagnosis in emergency department of every general hospital.

Patients and methods: Within a period of one year from march 2007 through March 2008, all patient with suspected appendicitis and equivocal physical exam admitted in emergency department of Taleghani hospital undergone preoperative sonography and then results compared with intra operative finding and final pathologic report.

Results: Among totally 106 urgent appendectomies performed in this period of time, 65 (61.3%) of patients had highly suspicious physical finding and underwent appendectomy directly without delay. Of the remainder, 41 (38.7%) with equivocal exam, preoperative ultra sonography were performed and then underwent appendectomy and entered in this study. Of totally 41 patients, 25 (61%) were male and 16 (39%) were female. Preoperative ultra sonography were highly suggestive appendicitis in 15 (36.59%) of patients, that correlate with intra operative finding and final pathologic results of appendicitis in 14 (93.3%), eight (19.51%) patients with final operative finding of appendicitis had also preoperative sonography suggestive of appendicitis. Among 18 (43.9%) patients with preoperative ultra sonography of normal appendix or inability for visualization appendix, 14 (77.7%) had final pathologic diagnosis of appendicitis. Sensitivity, specificity, positive and negative predictive values of preoperative sonography were 73.3%, 75%, 95.6% and 27.3%, respectively.

Conclusion: Preoperative ultra sonography as a tool in evaluation of patients with equivocal physical findings, suspicious of appendicitis, has a moderate accuracy in this setting, considering ultra sonography as operator- dependent measure.

Keywords: *Acute appendicitis, Abdominal ultrasonography, Diagnostic accuracy.*

(Gastroenterology and Hepatology From Bed to Bench 2010;3(3):138-141).

INTRODUCTION

Acute appendicitis is a highly prevalent surgical issue facing general surgeons and occasional referral centers. Physical exam is yet the most reliable mean in frequent diagnosis of appendicitis. Sometimes it becomes a challenging conflicting problem (1-3), necessitates the application of additional tools for the definite preoperative diagnosis. Well-timed diagnosis followed by urgent appendectomy reduce devastating result of misdiagnosis with high morbidity rate and also the rate of negative appendectomy, specially for women of reproductive age. Despite the increased use of ultra sonography and CT in evaluating some selected patients with preoperative equivocal

Received: 29 March 2010 *Accepted*: 10 May 2010
Reprint or Correspondence: Vahid Amini, MD. Department of surgery, Taleghani Hospital, Shahid Beheshti University, M.C., Iran
E-mail: vahidamini53@gmail.com

exam, the rate of misdiagnosis followed by appendiceal rupture and peritonitis remained constant. This also include negative appendectomies encountered child- bearing age women with subsequent infertility.

This study aims to overview the accuracy of preoperative sonography in some selected patients with conflicting finding.

PATIENTS and METHODS

During a period of one year from March 2007 through 2008, 106 patients with suspected acute appendicitis underwent urgent appendectomy, in surgery department of Taleghani hospital. Sixty five patients with certain diagnosis based on history and physical finding and lab. Data underwent appendectomy without delay, and preoperative imaging wasn't performed in this group and therefore was excluded from this study.

Forty one patients with equivocal presentation who recently established Alvarado scale of 5-8 undergone preoperative abdominopelvic US and then followed by appendectomy with variable intervals. Mc' Burney incision was the selected procedure in thirty seven patients and four midline laparatomy based on subsequent physical findings. Intra operative findings and final histopathologic report were compared with preceding US finding.

Abdominopelvic graded compression sonographies were performed by usually residing in hospital junior radiology resident. Scan results are considered positive if a non compressible appendix $\geq$6mm in AP direction is demonstrated. The appendix was identified as a blind-ending, non peristaltic bowel loop originating from the cecum. Thickening of the appendiceal wall and the presence of periappendiceal fluid was also noted and indicated highly suggestive of appendicitis. Normal appendix is a compressible blind-ending tubular structure measuring $\leq$5 mm (4, 5). Finally inability of visualizing this structure was indicated as inconclusive results.

Pathologic results of specimens were classified in six categories and in order of progression include: premature appendicitis, acute appendicitis, appendicitis and peri appendicitis, acute supurative appendicitis, gangrenous appendicitis and at the most perforated appendicitis.

Sensitivity, specificity, positive and negative predictive values of pre-operative US were concluded after excluding inconclusive result.

RESULTS

Sixty five patients (61.3%) of totally 106 urgent appendectomy had absolutely diagnostic criteria for suggestive acute appendicitis and underwent appendectomy without necessity of preoperative imaging. Of forty one patients (38.7%) remained with equivocal presentation, 25 (61%) were male and 16 (39%) were female, with male to female ratio of 1.4:1 (table 1), Age ranged 11-86 years with a mean of 28.56±14.

Table 1. Final pathologic results and patients sex

Final Diagnosis	Female	Male	Total
Acute Appendicitis	13(31.7)*	23(56.1)	36(87.8)
Normal Appendix	3(7.3)	2(4.9)	12(12.2)
Total	16(39)	25(61)	41(100)

* Figures in parenthesis are in percent.

The chief complaint at presentation was abdominal pain in 40 (97.6%) patients and obstipation in one. Preoperative diagnosis impression was acute appendicitis in 38 (92.7%), acute abdomen without any definite diagnosis in 2 (4.9%) and intestinal obstruction based on physical finding and air-fluid level observed in plain abdominal X-ray in one (2.4%). Time interval of admission through operation ranged 1-24 hours, with a mean of 5.98±0.3 hours. The selected procedure of operation was Mc Burney incision in 37 (90.2%) and midline laparatomy in

Table 2: Evaluation of sonographic reports compared with final pathology

	Preoperative sonographic report				
Final diagnosis	Inconclusive	Normal Appendix	Positive Finding Suspected Appendicitis	Highly suggestive acute appendicitis	Total
Acute Appendicitis	6(24.6)*	8(19.5)	8(19.5)	14(34.2)	36(87.8)
Normal Appendix	1(2.4)	3(7.3)	0	1(2.4)	5(12.2)
Total	7(17.7)	11(26.8)	8(19.5)	15(36.6)	41(100)

* Figures in parenthesis are in percent.

4 (9.8%). Operative finding were compatible with acute appendicitis in 36 (87.7%) and normal appendix contributed to negative appendectomy in 5 (12.2%). Among negative appendectomies 3 (60%) were male and 2 (40%) female. No Significant correlation was obtained between sex and prevalence of negative appendectomies.

Based on final histopathologic results specimens were compatible with acute premature appendicitis in one, acute appendicitis in five, appendicitis and periappendicitis in 8, acute supurative appendicitis in 16, gangrenous appendicitis in 5, and at last perforated appendicitis in one.

Preoperative US findings were compatible with highly suggestive appendicitis in 15 patients, that pathologically correlate in 14 patients and ultimately opposed in one (Normal appendix). In 8 patients with positive US findings of appendicitis, report of pathology also confirmed this issue. Among 11 patients with confirmation of normal appendix by preoperative US, only 3 patients had pathologic compatibility. Finally in the remaining 7 patients with inconclusive sonogram, pathologic results were appendicitis in 6 patients (table 2). Based on the results of this study excluding in conclusive sonogram, sensitivity, specificity, positive and negative predictive values of preoperative sonography were respectively 73.3%, 75%, 95.6% and 27.3%.

US results were compatible according to final pathologic findings in 25 patients with resulting accuracy of 61%. Among 4 patients performing midline laparatomy, US results were false negative in two (2), true negative in one (1) and inconclusive in another one, indicating No significant difference in US accuracy and type of procedure, also there was no prominence in US accuracy and time the interval of initiation of symptoms and US performance (table 3)

At last 39 (95.5%) of patients were discharged on time, with well general condition. One complicated with wound infection and long hospitalization. Unfortunately one died, 86 years old woman presenting symptom of obstipation and definite diagnosis of suppurative peritonitis due to perforated appendicitis.

Table 3. Evaluation of sonographic adopted reports based on time interval of symptom initiating and sonographic performance

Sonographic report	Time interval		Total
	>24 h	<24 h	
Adoption to final diagnosis	8	17	25
No Adoption to final diagnosis	2	14	16
Total	10	31	41

DISCUSSION

Evaluating average results of US values in our study as a tool in assistance preoperative confidence of acute appendicitis in our selected patients based on equivocal presentation make clear several point found in previous study according to validity and accuracy of preoperative US in suspected acute appendicitis reveal significance higher values of sensitivity, specificity, positive and negative value (6-8). A study reported 92% accuracy, 83% sensitivity and 95% specificity in US diagnosis of acute appendicitis. And also, higher positive and negative predictive values of 86% and 94%, respectively, were reported (6). In other studies, a sensitivity of 69-75%, specificity of 86-100%, and

accuracy of 91-94% and 89-97% were reported (9, 10); there values were that significantly higher than our present resulted values, especially in specificity and negative predictive values, and also in overall resulting accuracy. Low specificity and negative predictive values in our study maybe attributed to poorly selected candidates performing preoperative US.

Recently published literature noted Alvarado scale of 5-6 as a well candidate for preoperative imaging study, and also mentioned that helical CT scan to be a choice (11, 12), although pregnant women is reasonable candidates for US evaluation (8, 13). Poor scaling and in continuation unfit candidates may also be due to in experience examiner in this regard and ultimately inexpert US operator and of course low ultrasonographyic system technology. In conclusion, all patients undergone abdominopelvic US in our study ultimately had appendectomy and this may be another causative low values in this situation. Seemingly a precise physical exam is yet a better indicator of operation than US, and US diagnostic criteria and indications necessitate additional studies.

REFERENCES

1. Paulson EK, Kalady MF, Pappas TN. Clinical practice, suspected appendicitis. N Engl J Med 2003; 348: 236-42.

2. Wilson EB, Cole JC, Nipper ML, Cooney DR, Smith RW. Computed tomography and ultrasonography in diagnosis of appendicitis: when are they indicated? Arch surg 2004; 136: 670-75.

3. Wise SW, Labuski Mr, Kasales CJ, Blebea JS, Meilstrup JW, Holley GP, et al. Comparative assessment of CT and sonographic techniques for appendiceal imaging. AJR Am J Roentgenol 2001; 176: 933-41.

4. Applegate KE, sivit CJ, salvator AE, Borisa VJ, Dudgeon DL, Stallion AE, et al. Effect of cross-sectional imaging on negative appendectomy and perforation rates. Radiology 2001; 220: 103-107.

5. Franke C, Bohner H, Yang Q, Ohmann C, Röher HD. Ultra sonography for diagnosis of acute appendicitis: Results of prospective multicenter trial. world J Surg 2001; 23: 141-46.

6. Jeffery RB, Jain KA, Nghiem HV. Sonographic diagnosis of acute appendicitis: interpretive pitfalls. AJR Am J Roentgenol 1998; 162: 55-59.

7. Flum DR, Koepsellt. The clinical and economic correlates of misdiagnosed appendicitis: Nationwide analysis. Arch surg 2002; 137: 799-804.

8. Hale DA, Molloy M, Pearl RH, Schutt DC, Jaques DP. Appendectomy: a contemporary appraisal. Ann Surg 2000; 225: 252-61.

9. Bailey LE, Finley RK Jr, Miller SF, Jones LM. Acute appendicitis during pregnancy. Am Surg 1986; 52: 218-21.

10. Bendeck SE, Nino-Murcia M, Berry GJ, Jeffrey RB Jr. Imaging for suspected appendicitis: Negative appendectomy and perforation rates. Radiology 2002; 225: 131-136.

11. Raptopoulos V, Katsov G, Rosen MP, Siewert B, Goldberg SN, Kruskal JB. Acute appendicitis effect of increased use of CT on selecting patients earlier. Radiology 2005; 226: 521-26.

12. Puylaert JB. Acute appendicitis: US evaluation using graded compression. Radiology 1990; 158: 355-60.

13. Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Pollock RE, Editors. Schwartz's principles of surgery. 8th ed. Maryland: McGraw-Hill Companies; 2005.