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Original Research Paper

Graded Compression Ultrasonography. Is it Useful in Acute Appendicitis?

Medical Science

KEYWORDS :

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ABSTRACT

Graded compression ultrasonography is one of the new diagnostic techniques that are reported to have improved the diagnostic accuracy and clinical outcome. Our aim was to assess the role of graded compression ultrasonography in the management of acute appendicitis. All the 50 patients presented to emergency department, with clinical suspicion of acute appendicitis were underwent ultrasonography and routine investigation followed by appendicectomy. Ultrasonography has high positive predictive value but low negative predictive value. So it can more likely diagnose acute appendicitis than subacute appendicitis.

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies which require prompt diagnosis. Appendicitis is a disease of the young, with 40% of cases occurring in patients between the ages of 10 and 29 years[1]. Its diagnosis is usually made depending on presenting history, surgeon's clinical evaluation, with the aid of laboratory tests and imaging modalities. A decision to operate based on subjective clinical suspicion alone can lead to removal of a normal appendix in 15-30% cases[2]. Negative appendicectomies are one of the burdens facing not only the general surgeon but also the patient himself and the society as a whole. In case of acute appendicitis, definitive diagnosis, by gold standard test (histopathology) before surgery, is not possible. The integration of clinical scores into the diagnostic process in acute appendicitis has had the purposes of improving decision making and reducing the negative appendicectomy rates in this common condition[4]. Since 1986, when Alvarado published his paper, several diagnostic scoring systems have been devised as an aid to the early diagnosis of acute appendicitis and to reduce the incidence of negative appendicectomy.[5] However, differences in sensitivities and specificities were observed if the scores were applied to various populations and clinical settings. For example, the percentage of misdiagnosed cases of appendicitis is significantly higher among women than among men[4,6]. Even with Alvarado and Modified Alvarado score, which have high false positive rate in women[7,8,9,10,11]. Studies and systematic reviews have shown that no single score may be used alone to dictate or decline surgery. Different cut-off points may also be considered for different subpopulations[12].

Aim of our study is to find out the efficiency of Ultrasonography in pre-operative diagnosis of acute appendicitis in a tertiary health care centre, to correlate these radiological findings with histo-pathological diagnosis and to compare these radiological findings in terms of measurable outcomes such as sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy and negative appendectomy rate.

MATERIALS AND MEHTODS

Sample size: From the patients admitted to emergency ward between September 2013 to October 2015 at our institute, 50 random patients were selected & included in the study.

Inclusion criteria:

Patients with provisional diagnosis of acute appendicitis, undergoing emergency surgical management,
Patients presented to emergency department,
Patient >12 years of age,
Patients with abdominal pain of <15 days.

Patients with conservative management, patients <12years of age, patients with abdominal pain of > 15 days, patients previously operated for other pathology were excluded.

Based on detailed history and thorough clinical examination, clinical diagnosis of acute appendicitis was made. These patients were subjected to the required preoperative investigations (including total count), ultrasonography and were taken for emergency surgical management. Graded compression ultrasonography is one of the two imaging modalities commonly used in the assessment of clinically suspected appendicitis. A linear array transducer, usually 5 or 7 Mhz, is typically employed. The patient was initially examined in the supine position. **Scanning** was **initiated** in the **region of maximal pain indicated by the patient** to expedite the sonographic evaluation. If no abnormality is found, then transverse and longitudinal images are obtained of the abdomen, including the right lower quadrant and the right lateral abdomen extending from the subhepatic location to the right pelvis. In all areas examined, the **anterior abdominal wall is compressed slowly but firmly** with the ultrasound transducer to displace normal bowel loops in an effort to locate an inflamed appendix. If an apparently normal appendix was identified, a careful survey of the entire length of the appendix was performed to avoid a false negative examination when inflammation is confined to the tip of the appendix. Decision for surgical management was taken by senior surgeon on duty & based on clinical examination and investigation.

OBSERVATIONS

Histopathological and clinical co-relation

Histology of specimen	No of patients (n = 50)	% of true clinical diagnosis
Acute appendicitis	40	80
Chronic appendicitis	10	20

Histopathologic examination of the resected specimen disclosed chronic appendicitis in 10 patients who underwent surgery with clinical diagnosis of acute appendicitis. Thus, negative appendicectomy rate for acute appendicitis was 20%. Final diagnosis of acute appendicitis was made in 40 patients. We therefore conclude that surgeon's clinical impression is true in 80% patients and false in 20% patients.

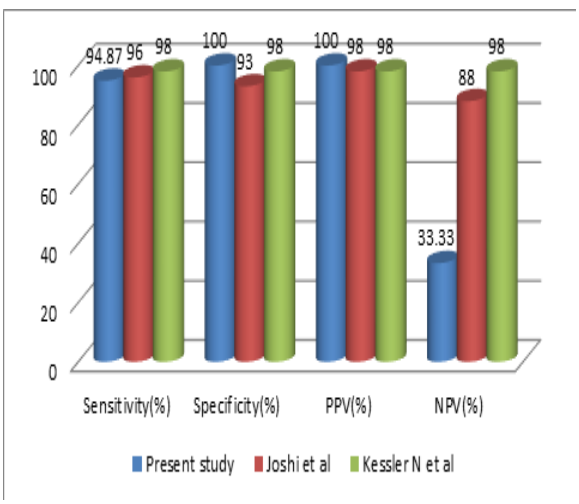
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Ultrasonography & intra-op Co-relation for acute appendicitis

Appendicitis on ultrasonography (n=40)	Intra-op appendicitis	Intra-op normal appendicitis	Total
Yes	37	0	37
No	2	1	3
	39	1	40

Sensitivity, Specificity, PPV and NPV of USG in pre-op evaluation of acute appendicitis is 94.87%[(37/39)*100], 100%[(1/1)*100], 100%[(37/37)*100] and 33.33%[(1/3)*100] respectively.

Comparison with other study[13,14].



Thus our study result almost matches with both of this study except for NPV. However this may be due to smaller sample size in our study.

Co-relation between different positions of appendix for intra-op appendicitis & USG finding.

In Retrocecal positive in 14 out of 16 with sensitivity of 87.5%, in pelvic positive in 3 out of 3 with sensitivity of 100%, in preileal positive in 12 out of 12 with sensitivity of 100%, in postileal positive in 14 out of 14 with sensitivity of 100% and in subhepatic positive in 0 out of 1 with sensitivity of 0%. Thus USG can detect appendicitis with more sensitivity in pelvic, preilial & postileal position as compered to that in retrocecal & subhepatic position of appendix. However larger sample size requires to conclude this.

Co-relation with diameter of appendix on USG with intra-op appendicitis

Intra op appendicitis(n=50)	Diameter on USG		Total
	<= 8mm	> 8mm	
Yes	32	14	46
No	4	0	4
Total	36	14	50

Sensitivity of USG for diameter less than or equal to 8mm is 88.89% [(32/36)*100] and for diameter more than 8mm is 100 %[(14/14)*100]. This study suggest that as the diameter of appendix increase, there are more chances of detecting appendicitis on USG.

DISCUSSION

GRADED COMPRESSION ULTRASONOGRAPHY

In 1986, Puylaert described the value of **graded compression sonography** in the evaluation of 60 consecutive patients suspected of having acute appendicitis.

Since then, other investigators have improved the sonographic criteria for diagnosis, firmly establishing the value of sonography in assessing patients with equivocal evidence of appendicitis. Puylaert's initial reports of success in diagnosing acute appendicitis with compression sonography depended solely on visualization of the abnormal appendix, a blind-ended, noncompressible, aperistaltic tube arising from the tip of the cecum with a gut signature. However, other investigators reported seeing normal appendices on a sonogram. The normal appendix is compressible, with a wall thickness of 3 mm or less.

Jeffrey etal. concluded that size can differentiate the normal from the acutely inflamed appendix. Threshold levels for the diameter of the appendix, above which acute appendicitis is highly likely, have been set at either 6 mm or 7 mm, with a resultant change in sensitivity and specificity. Sonographic visualization of an appendix with an appendicolith, regardless of appendiceal diameter, should also be regarded as a positive test.

Rettenbacher et al.added assessment of appendiceal morphology in confirming suspicion of appendicitis. A round or partly round appendix had a high correlation with acute appendicitis, whereas an ovoid appendix did not. Color Doppler is also contributory, showing hyperemia in the appendiceal wall in the acutely inflamed appendix.

Lee et al. described graded compression sonography with adjuvant use of a **posterior manual compression technique** for diagnosis of acute appendicitis. Using graded compression sonography alone, the authors achieved visualization of the vermiform appendix in 485 of 570 patients (85%). Use of a posterior manual compression technique identified the vermiform appendix in an additional 57 of the remaining 85 patients, increasing the number of identified vermiform appendices to 542 (95%).

Clinical misdiagnosis of appendicitis occurs most frequently in young women with gynaecologic conditions, especially acute PID, rupture or torsion of ovarian cysts, and postpartum ovarian vein thrombosis. As noted, Bendeck et al. confirmed that women with suspected appendicitis benefit most from preoperative CT or ultrasound, with a statistically significant, lower negative appendectomy rate than women who undergo no preoperative imaging. They concluded that preoperative imaging should be part of the routine evaluation of women with suspected acute appendicitis. Diseases other than those of gynaecologic origin may also be misdiagnosed as acute appendicitis. Gastrointestinal illnesses include acute terminal ileitis with mesenteric adenitis, acute typhlitis, acute diverticulitis (especially of cecal tip diverticulum), and Crohn's diseasein the ileocecal area or involving the appendix itself.

Urologic disease, especially stone-related and right-sided segmental omental infarction, may also mimic acute appendicitis. Addressing the value of sonography in establishing an alternative diagnosis in patients with suspected acute appendicitis. Gaensler et al.found that 70% of patients with another diagnosis had abnormalities visualized on the sonogram.

Conclusion

Ultrasonography has high positive predictive value but low negative predictive value. Sensitivity and specificity has variable results. Ultrasonography is more likely to diagnose acute appendicitis than subacute appendicitis. In retrocecal & subhepatic position of appendix USG is less sensitive as compared to other position. Sensitivity of USG increases as

the diameter of appendix increases and when patient presents early within 3 days of starting abdominal pain. Larger database and longer duration study is required to come to final conclusion. Co-ordination of history taking, physical examination, and radiological co-relation definitely help for diagnostic accuracy.

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