Role of Graded Compression Ultrasonography in Evaluation of Acute Appendicitis.

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ABSTRACT

Introduction: Acute appendicitis is a common surgical emergency which can lead to high morbidity and mortality in the absence of timely treatment. Ultrasonography (USG) is commonly used to diagnose appendicitis and exclude other intraabdominal pathology leading to right iliac fossa pain in an emergency setting. We aimed to find out the diagnostic value of graded compression USG in suspected appendicitis cases.

Methods: Altogether 107 patients with clinical impression of acute appendicitis were followed. Four cases were excluded because of other diagnosis established in USG. Appendicitis was diagnosed by standard criteria of inflamed appendix by graded compression technique. Information of 103 cases were recorded in proforma which was later entered in SPSS and statistical calculations done.

Results: Out of 103 cases followed, 93 had appendicitis. Of those, 46 cases only showed inflamed and distended appendix, others showed ancillary features only. Males were more affected (61 patients (65.6%) than females. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasound in detecting appendicitis were 98.9%, 90%, 98.9%, 90% and 97.1% respectively.

Conclusions: Graded compression ultrasonography is a good investigation modality in assessment of suspected acute appendicitis.

Keywords: appendicitis; graded compression ultrasonography; laparotomy.

INTRODUCTION

Acute appendicitis is one of the commonest surgical emergencies presenting clinically with right lower quadrant abdominal pain, nausea and fever. Making the decision for a surgical operation based only on the patient’s signs and symptoms results in removing normal appendixes (negative appendectomy) in 15% to 30% of cases1,2, and delay in diagnosis due to clinical dilemma and extensive investigations can lead to perforation and peritonitis, which leads to high mortality and morbidity3.

Computerised tomography (CT) scanning has become the standard modality in the diagnosis of appendicitis in both children and adults but its liberal use has come under fire recently because of the risk of malignancy due to its ionizing radiation4, also the high cost of investigation and nonavailability in most emergency set up makes CT as no replacement for ultrasonography. Other methods like barium enema has less diagnostic accuracy5.

Graded compression ultrasonography (USG) is an inexpensive, fast and noninvasive method with an accuracy rate of 71%-90% for the diagnosis of acute appendicitis6. Still few cases are missed due to various reasons like obesity, severe guarding and excessive bowel gases7. Moreover, lack of proper infrastructure (poor quality ultrasound machine) and sufficient time to patient care can lead to less detection of appendicitis by ultrasound.

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Our study aims to find out diagnostic yield of graded compression USG in identifying appendicitis correctly and to find out the cause for negative ultrasound in imaging.

METHODS
Retrospective hospital based study was conducted at Shree Birendra Hospital. Altogether, 107 patients with clinical impression of acute appendicitis with detailed medical records were followed from April 2012 to March 2013. Patients with peritoneal abscess, abdominal tuberculosis, GI malignancy were excluded. Clinical assessment was done by experienced surgeon. Patient presenting with right lower quadrant pain, nausea/vomiting, decreased appetite, guarding and tenderness of right iliac fossa were clinically suspected as acute appendicitis. Ultrasound was carried out in Medison aqua 300 machine by experienced radiologists. Linear transducer with frequency of 7.5-10 Mhz was used and graded compression was used while looking for appendix. B mode and color doppler were also used.

Using ultrasound, patients were classified in 3 groups: definite appendicitis, suggestive of appendicitis and negative appendicitis. Ultrasound diagnosis of appendicitis was done by blind ending non compressible tube originating from base of cecum with diameter 6mm or more with bowel (target) sign (figure 1). Appendicolith was also taken as surest sign of appendicitis. Likely appendicitis was defined for cases whose appendix was not visualised but if there are features of mesenteric inflammation like increased pericecal mesenteric vascularity, minimal interbowel fluid collection and rebound tenderness seen in right iliac fossa region. At least three of those features had to be present to call it as likely acute appendicitis. Negative appendicitis was defined by cases where appendix was seen but not inflammed (compressible and smaller than 5mm in diameter) or appendix not seen and no features of periappendiceal inflammation noted in both B mode and color doppler study. Perforated appendix was defined by swollen/inflammed appendix with free fluid collection in RIF or when direct wall defect was noted or when appendicolith was noted in peritoneal cavity. Subacute bowel obstruction was defined by dilated bowel loops in setting of vomiting in those patients. In those cases, where laparotomy was not done after negative ultrasound scan, were followed by medical records for 3 months, and where no medical record was present, patient were followed up by phone calls directly to look for features of appendicitis/treatment elsewhere. Histopathological confirmation was followed in most cases.

Data was entered in preformed proforma which was later entered in statistical programme for social science (SPSS) version 16 and analysed. Sensitivity, Specificity, Positive predictive value (PPV), Negative predictive value (NPP) and accuracy of sonographic evaluation was calculated from standard formula. Numerically significant variables were subjected for chi square tests and correlation analysis, and statistically significant were defined by p value less than 0.05.

RESULTS
Of 107 cases undergoing ultrasonography for suspected appendicitis, three cases were found to have ovarian cyst and one case was found to have hydronephrosis with renal calculi, remaining 103 cases were enrolled in our study. Among these 103 cases, 93 showed appendicitis; 61 (65.6%) males and 32 (33.4%) females (figure 2). Mean age of presentation was 28.87± 12.18year. Most of the patient (75%) visited hospital within 2 days, 37% within first day itself (table 1). Definite inflammed appendix was seen in 46 cases
Fourty eight (46.6%) cases showed features of inflammation of appendix but appendix was not visible, which were categorised as likely appendicitis cases. Negative appendicitis was diagnosed in 10 cases in ultrasound. In follow up of these patients, one developed features like appendicitis requiring laparotomy.

Mean diameter of appendix was 8.8± 2.2 mm, with mean thickness of wall 3.2 mm (ranging from 2-4mm). Appendicolith was noted in 7 cases (6.8%) only. Complication overall in USG was noted in 6 cases, of those 4 had perforation and 4 had sub acute Intestinal obstruction; two patient with perforation also had sub acute Intestinal obstruction.

Of total 103 cases, 93 underwent laparotomy. Out of these, 92 cases showed features of appendicitis and 1 showed normal appendix. These all were ultrasound positive cases. Perforation as complication were mentioned in 4 cases who had documentation in USG also. Sensitivity, specificity, PPV, NPV and accuracy of ultrasound in detecting appendicitis was 98.9%, 90%, 98.9%, 90% and 97.1% respectively (table 2).

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<tr>
<th>Parameters</th>
<th>Value in percentage</th>
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<tbody>
<tr>
<td>Sensitivity</td>
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<tr>
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<td>90%</td>
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<td>Negative predictive value</td>
<td>90%</td>
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<td>Accuracy</td>
<td>97.1%</td>
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**DISCUSSION**

Acute appendicitis is the most common abdominal surgical emergency with lots of difficulty in diagnosis. There is great variation in performance in diagnosing appendicitis by ultrasound. Mean age of presentation was 28.87 year and is comparable to Khanal Br et al findings. In USA, male have higher incidence of appendicitis. Our study also showed more males suffer from appendicitis compared to females, agreeing previous findings of study conducted in Nepal by Khanal BR et al. Mean time of presentation to hospital was early, 75% presented within first 2 days of pain, this explains less complication rate like perforation in our study in contrary to higher complication rate in some studies. Perforation is found to be higher in males than in females (actually, all were male) which is supporting earlier findings. Perforation is found to be high in young children, toddler, extremes of age and delayed presentation. Young children cannot communicate well and they have less protective omental fat, which leads to more perforation. Females overall had other intraabdominal pathologies erroneously suspected as acute appendicitis which is common due to multiple gynaecological problem mimicking acute appendicitis. Overall complication detection rate in USG was very good.

Ultrasonographic diagnosis of appendicitis has high sensitivity, specificity and accuracy. It was comparable to previous many literatures including previous study from Nepal. Negative predictive value of 90% in our study is much higher than reported in some literatures, but is parallel to that of other
Sonography may miss perforated, retrocecal appendix and appendix in elderly. Missing direct visualisation of many of the appendix in our study may be because of lack of direct compression of back of lumbar region by hand and not seeing patient in left lateral position. Appendix of children are easily visible due to less fat in abdominal musculature, most of our cases were not children, that may have led to decreased direct visualisation of appendix. But overall reporting of appendix cases as ultrasonologically appendicitis was good. This signifies correlation with clinical and laboratory findings of those cases are very important, as mesenteric inflammation in right iliac fossa may occur due to variety of causes. Sensitivity of CT is better than ultrasound because of multiple reasons like fat in omentum and is not operator dependant but specificity parallels. But again, CT is not cost effective, easily accessible and has high radiation. CT can be used in doubtful cases after USG screening. MRI has role in diagnosis of suspected appendicitis in pregnant as USG detection is low and there is radiation risk with CT scan.

Main limitation of our study was a retrospective methodology and diagnostic value of clinical impression could not be evaluated as all cases with right iliac fossa pain didn’t undergo appendicitis but only those suspected by surgeons were sent for USG.

CONCLUSION
Graded compression ultrasonography is 97.1% accurate in diagnosing acute appendicitis with 98.8% sensitivity and 90% specificity.

REFERENCES
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