

Ultrasonography in Analyzing Appendicular Lesions based on Contents and Caliber

Deepak K. Rajput¹, Drusty K. Majmudar²

ABSTRACT

Introduction: Ultrasonography is equally sensitive and specific to computed tomography in diagnosing acute appendicitis with similar positive predictive value. Current study aimed to investigate the role of Ultrasonography as an initial diagnostic modality in suspected cases of acute appendicitis

Materials and Methods: A prospective study of 50 patients with right iliac fossa pain and / or nausea, vomiting were analyzed by GE Logiq P5 Ultrasonography machine during the period of June 2016 till February 2017. Graded compression technique by USG was used.

Results: Based on the contents and caliber of appendix, Ultrasonography was accurate to diagnose normal appendix in 22 patients and appendicular lesions in 28 patients.

Conclusion: High frequency ultrasound probe and Graded compression method has high diagnostic value for analyzing appendicular lesions.

Keywords: Right Illiac Fossa, Ultrasonography, Contents and Diameter of Appendix, Inflamed Appendix

INTRODUCTION

Ultrasonography is a unique mode of investigation as there is no radiation exposure, easily available, cost effective, multiplanar imaging capability when performed by skilled hand. Abdominal Ultrasonography is often the first morphologic study performed on patients with acute abdomen.¹⁻⁴

Its role in diagnosis of acute appendicitis has already been proven by many studies. In the early years of diagnostic ultrasonology the bowel was considered to be an obstacle to useful imaging mainly due to the artifacts produced by bowel gas. But recently, with the improved resolution of real time sonography. with graded compression sonography of right iliac fossa, appreciation of normal anatomy of the appendix, and hence pathological appearances has taken a good turn.⁴⁻⁷

Ultrasonography has been proven to have comparable sensitivity, specificity and positive predictive value as computed tomography in diagnosing acute appendicitis.^{8,9}

The detection of content of appendix in normal and inflamed appendix and analysis of content in normal and inflamed appendix is included in the present study, using Ultrasonography as the primary imaging modality.^{1,3,4,8}

To study the role of Ultrasonography as an initial diagnostic modality in suspected cases of acute appendicitis and patients presenting with symptoms in which acute appendicitis is included in differential diagnosis, to analyze contents of appendix in normal and inflamed appendix, to note any content has association with severity of inflammation and detection of various pathologies in right iliac fossa.

MATERIAL AND METHODS

A Prospective study of the role of Ultrasonography (logiq P5

ultrasonography machine) in detecting contents of appendix with wall thickness and caliber of appendix in normal and inflamed condition. Results were analyzed to associate any specific content with severity of inflamed appendix. This prospective study was conducted in AMC MET Medical college and LG hospital Ahmedabad Gujarat during the period of June 2016 to Feb 2017.

50 patients were selected for this study, who presented with clinical symptoms and signs pertaining to acute appendicitis. Permission of the ethical committee was obtained for performing this study.

Informed consent for performing graded compression technique of ultrasonography of right iliac fossa was taken from all the patients.

Scanning methods and transducers used

Initial scanning with GE Logiq P5 Ultrasonography machine with colour Doppler.

Scanning with graded compression technique.

USG of right lower quadrant for lymph nodes, free fluid, collection and inflamed mesentery.

Transducers used in the present study

Linear array, 6MHz to 11 MHz.

Curvilinear array, 3 to 6 MHz.

Tissue harmonic imaging

Inclusion criteria

Patients with clinically suspected appendicitis.

Exclusion criteria

Patients clinically suspected to have other pathologies like renal colic, ovarian torsion, ectopic pregnancy etc.

STATISTICAL ANALYSIS

Statistical analysis was done with the help of Microsoft office 2007.

RESULTS

In our study, 50 patients were selected for this study, who presented with clinical symptoms and signs pertaining to acute appendicitis, maximum number of patients were in the age group of 21-30 years. There were 14 patients in this age group

¹Associate Professor, ²Assistant Professor, Department of Radiology, AMC MET Medical College, L.G. Hospital Campus, Maninagar, Ahmedabad-380 008, Gujarat state, India

Corresponding author: Dr. (Major) Deepak K. Rajput, C/6, Satyamev Chavni V, Near Tapovan Circle, Sughad, Gandhinagar 382424, Gujarat State, India

How to cite this article: Deepak K. Rajput, Drusty K. Majmudar. Ultrasonography in analyzing appendicular lesions based on contents and caliber. International Journal of Contemporary Medical Research 2017;4(5):1089-1092.

out of which 9 were males and 5 were females. According to decreasing order of patients, other age group was 11-20 years 12 patients out of 8 female and 4 male, in age groups 31-40 years 9 patients out of 6 male and 3female, age group 0-10 years 4 patients and age group 51-60 years 3 patients respectively as shown in figure 1. Clinical diagnosis was accurate in all patients, faecal matter was the most common content in normal appendix. Fluid with internal echoes was the most common content in inflamed appendix.

Diameter of appendix was higher in normal appendix having faecal material. This may be due to inspissated faeces in normal appendix. Hence when diameter is intermediate around 6 mm more weightage can be given to consideration that appendix is normal when content is faecal material with other relevant clinical history and when wall thickness is less than 3. When fluid with internal echoes is present, it favours more towards acute appendicitis as diagnosis. The caliber of normal and inflamed appendix is shown in table 1.

Severity of inflammation was more when appendicolith, may be due to obstruction caused by lith. In case of perforated appendicitis diameter of appendix was less than 6 mm. In this case other supportive features like loculated pericecal fluid, phlegmon, abscess, prominent pericecal fat and circumferential loss of submucosal layer aided in diagnosing acute appendicitis. Free fluid in right iliac fossa and enlarged mesenteric lymph nodes were nonspecific findings in acute appendicitis since these are also present in many other conditions. Echogenic foci without posterior acoustic shadow (faecal matter) are more common content in normal appendix. Echogenic foci with posterior acoustic shadow (lith) are more common content in inflamed appendix. Echogenic foci with ring down artifact or indistinct posterior shadow (air) are more common content in normal appendix. Anechoic without internal echoes (fluid) is common in inflamed appendix and in mucocele. Anechoic with internal echoes (pus) is common in inflamed appendix.

DISCUSSION

Normal appendix can be visualized in great number of patients using modern high resolution sonography instrument and graded compression as compared to past instruments and old study like in RSNA volume 167 issues 2 studies of 250 patients of acute appendicitis in which 91 patients were sonographically positive on basis diameter of appendix. Other study in ultrasoundpaedia. In case of inflamed appendix it can be visualized almost in all cases except when prominent bowel gas obscures the field.^{1-7,9-15} Contents of normal appendix and abnormal appendix can be evaluated using USG first classifying either solid or fluid which can be done with sonography with great accuracy than computed tomography. Then solids are classified as faecal matter which does not show posterior acoustic shadow or fecolith which causes posterior acoustic shadow. Air has to be differentiated from fecolith by its indistinct posterior shadow and ring down artifacts caused by air though its echogenicity is like appendicolith.^{4,16} Fluids also are classified as one having internal echoes which may be pus, faeces mixed fluid, hemorrhagic fluid and combination of any of above mentioned contents. Fluid without internal echoes is commonly due to mucocele as shown in figure 3. Low level internal echoes also may be present in mucocele due its high protein content.^{3-7,15}

Ultrasonographic Classification of Contents of Appendix

- 1). Echogenic substance with posterior acoustic shadow. (Appendicolith)
- 2). Echogenic substance without posterior acoustic shadow. (Faecal Matter)
- 3). Echogenic substance with indistinct posterior acoustic shadow. (AIR)
- 4). Anechoic substance without internal echoes. (Clear Fluid like Mucus)

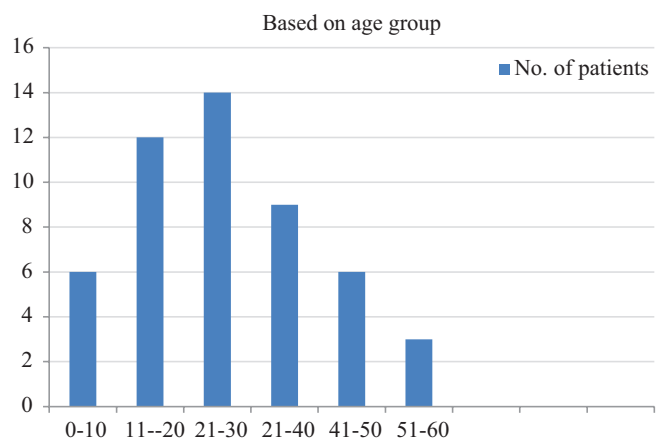


Figure-1: Number of patients and age group

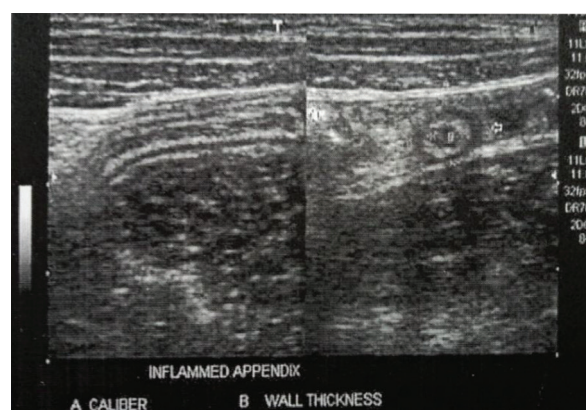


Figure-2: A inflamed appendix having echogenic foci without posterior acoustic shadow as content.

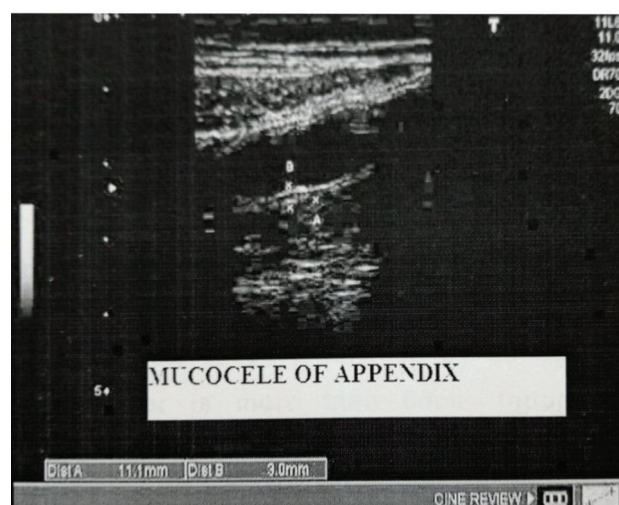


Figure-3: Mucous filled appendix showing indistinct posterior shadow and ring down artifact caused by echogenic air.

Caliber of appendix	Inflamed appendix	Normal appendix	Total
3.0 to 4 mm	0	4	4
4.1 to 5 mm	0	12	12
5.1 to 6 mm	2	6	8
6.1 to 7 mm	3	0	3
7.1 to 8 mm	5	0	5
8.1 to 9 mm	1	0	1
Above 9.1 mm	17	0	17

Table-1: Diameter of appendix in normal and inflamed appendix

- 5). Hypoechoic substance with internal echoes. (pus, mucus, and fecal mixed fluid)

Pathological Classification of Lesions of Appendix

- 1) Inflammatory conditions
 - Acute appendicitis.
 - Recurrent acute appendicitis.
 - complications of acute appendicitis.
 - Appendicular lump formation.
 - Appendicular abscess as a consequence of perforation of appendix.
 - Pelvic abscess a consequence of perforation of appendix.
- 2) Neoplastic
 - Carcinoid tumor.
 - Primary adenocarcinoma.
- 3) Other conditions
 - Mucocele of appendix.
 - Diverticula of appendix, true congenital diverticula. Involves all layers of appendix, acquired diverticula. Does not have muscular layer.
 - Intussusceptions of appendix.

Normal appendix has appearances similar to bowel loops having alternate hyperechoic and five layered structure. The upper limit of normal wall thickness is taken as 3mm and diameter is 6mm.¹⁻⁷ Appendix is said to be inflamed by sonography criteria when diameter is more than 6mm. In inflamed appendix, wall thickness is increased to more than 3mm, (figure 2) when the wall thickness is also added to the criteria sensitivity and specificity increases in diagnosis of appendix by sonography.³⁻⁶

Sonography diagnosis of acute appendicitis

Patient with right lower quadrant pain/elevated WBC count-Identify appendix which is seen as blind ending, aperistaltic tubular structure with gut signature arising from base of caecum with supportive features like inflamed pericaecal fat, pericecal collection and appendicolith.

Evaluation of complications of acute appendicitis

Perforation of Acute Appendicitis - By sonography perforated appendix is seen as having discontinuity in mucosa and as result there is collection or abscess formation surrounding the wall defect.¹⁻⁸ Usually the perforation is sealed of as there is guarding rigidity in right iliac fossa in acute appendicitis appendicolith is one factor associated with perforation which is usually present at base of appendix proposed mechanism for perforation with appendicolith at base is obstruction caused by appendicolith at base of appendix which hampers emptying the contents of appendix, this leads to increased pressure in appendix which compromises blood supply to appendix as consequence of

this ischemic changes develop in appendix which leads to perforation.^{3-5,14,15}

Once perforation occurs, leakage of contents to peritoneal cavity leads to shrinkage of appendix which may not be more than 6 mm, this may lead to diagnostic difficulty but other signs associated with perforation helps in diagnosis of perforated appendicitis. Signs associated with perforated appendicitis are loculated pericecal fluid, phlegmon, abscess, prominent pericecal fat and circumferential loss of submucosal layer.

Appendicular Abscess Formation - as a result of perforation contents of appendix leaks into peritoneal cavity which is sealed of by peritoneal inflammatory reaction as a protective mechanism suggestive of that it doesn't spread extensively into peritoneal cavity suggestive of free intra peritoneal gas is uncommon in perforated appendicitis.^{13,14,15}

Appendicular Lump Formation - in severely inflamed appendix, adjacent mesentery, mesoappendix and bowel loops also inflamed and adhere together with appendix or with each other forming lump in right iliac fossa. If there is perforation of lump with abscess formation also occurs.

CONCLUSION

A Prospective study of 50 patients was done, out of which there were 27 males and 23 females. Patients were followed up by repeated scans, pathological and per operative findings. Ultrasonography is an excellent mode of investigation to diagnose acute appendicitis. The usefulness of high frequency probe and graded compression method has high diagnostic value for acute appendicitis.

Graded compression sonography for appendiceal pathology has sensitivity and specificity of 96% and 93% respectively. In present study, all cases diagnosed with ultrasonography as inflamed appendix based on contents and caliber of appendix, had appendicitis per operation. Fecal matter was the most common content in normal appendix. Fluid with internal echoes was the most common content in inflamed appendix.

REFERENCES

1. Carol M. Rumack, stephanie R. Wilson J. William charboneau. Diagnostic Ultrasound 2ND edition, vol-1., Pg-303 to 306,316,1535
2. P.E.S. Palmer. Manual of Diagnostic Ultrasound, pg.137-150,
3. G S Rozycki. Surgeon-performed ultrasound: its use in clinical practice. Ann Surg. 1998; 228:16-28.
4. Kakarla Subarao, Samir Banerjee, Sudarshan K. Aggarwal. Diagnostic Radiology And Imaging, 1ST edition, vol-1,
5. Alexander R. Margulis, H. Joehim Burhenne, Alimentary Tract Radiology, 4TH edition, vol 1, Pg-229 to 302, 887,1212,1439,1648,1650.
6. Grainger and Allison. Diagnostic Radiology, 4TH edition, vol-2, Pg-994.995.1214,1215.
7. Kathryn A. Gill Abdominal Ultrasound: A Practitioner's Guide, Breast Sonography Review. Pg-263 to 265
8. J. George Teplick, Martin E. Haskin. Surgical Radiology, Volume 2, 1e (v. 2). Published by Saunders (1981)
9. Gray's Anatomy 5th edition; 514-515. Arcturus Publishing Ltd;
10. Snell.R.S; Clinical Anatomy for Medical Students. 4th Edition. Little Brown and Co; Boston,

11. Sadler, T W (Thomas W); Langman's medical embryology. 12th ed. / T.W. Sadler. Philadelphia: Wolters Kluwer Health/Lippincott Williams and Wilkins, c2012.
12. Anne M. R. Agur, Arthur F. Dalley. Grant's Atlas of Anatomy. 14th Edition. Publisher LWW
13. Robbins. Basic Principles Of Pathology 6th edition, 712-720.
14. Asai S et al. Sonographic evaluation of the treatment response in patients with immunoglobulin G4-related disease of the submandibular glands. J Ultrasound Med. 2015;34:783-8.
15. Kamisawa T, Okamoto A. Autoimmune pancreatitis: proposal of IgG4-related sclerosing disease. J Gastroenterol 2006;41:613–625.
16. Nordback I, Matikainen M. Secondary appendicitis--a sign of some other intra-abdominal inflammation. Ann Chir Gynaecol. 1985;74:134-6.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 17-04-2017; **Accepted:** 20-05-2017; **Published:** 03-06-2017