



## ROLE OF ULTRASOUND SCANNING IN THE EVALUATION OF CLINICAL SUSPECTED ACUTE APPENDICITIS

Ashok kumar Kattimani<sup>1</sup> and Nagraj Mitra<sup>2\*</sup>

<sup>1</sup>Assistant professor, Department of Radiodiagnosis, BRIMS Teaching Tertiary Care Hospital, Bidar, Karnataka, India.

<sup>2</sup>Assistant professor, Department of surgery, BRIMS Teaching Tertiary Care Hospital, Bidar, Karnataka, India.

### ABSTRACT

**Objectives:** To evaluate role of Ultrasonography in patients with clinically suspected acute appendicitis and its complications. **Materials and Methods:** One hundred twenty patients clinically suspected acute appendicitis underwent ultrasound examination using high-resolution transducers; linear array transducers of 7.5–10 MHz and curvilinear transducer of 3.5–5MHz. For the diagnosis of acute appendicitis, presence of signs like aperistaltic, noncompressible, blind-ended tubular structure with a diameter  $\geq 6$  mm in the right iliac fossa and in some other location and other sonographic findings such as the presence of appendicoliths, gas within the lumen of appendix and other indirect signs such as thickened echogenic mesentery, enlarged mesenteric lymphnode, loculated collections, and appendicular phlegmon in right lower abdomen were also considered. **Results:** Out of 120 clinically suspected acute appendicitis, 100 cases were acute appendicitis on ultrasound, rest 20 cases were right lower ureteric calculi (5 cases), right side hemorrhagic ovarian cyst (4 cases), right side ectopic pregnancy (2 cases), mesenteric lymphadenitis (5 cases) and colitis (4 cases). Among 100 patients diagnosed of acute appendicitis on ultrasound 64 cases were seen in male patients and 36 cases were seen in females. In our study the highest number of acute appendicitis cases were seen in the age group of 21–30 years (46 %). **Conclusion:** Grayscale US should be the first primary evaluation for patient suspicious of acute appendicitis, and color Doppler is an additional modality to increase sensitivity and more accuracy. However the accuracy of sonography is highly operator dependant. This study demonstrates the classic clinical presentation of appendicitis with incorporation of sonographic findings to support the diagnosis.

**Key words:-** Acute appendicitis, Color Doppler, Graded compression, McBurney's point, Ultrasonography.

Access this article online

Home page:

<http://www.mcmed.us/journal/ajomr>

DOI:

<http://dx.doi.org/10.21276/ajomr.2018.5.1.1>

Quick Response code



Received: 15.12.17

Revised: 31.12.17

Accepted: 04.01.18

### INTRODUCTION

Acute abdominal pain is a common complaint among emergency department patients. Acute appendicitis is the most common explanation for the so-called acute abdomen presentation to an emergency department, requiring rapid and accurate diagnosis to confirm or exclude perforation. Acute appendicitis is the

most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances. Diagnostics of acute appendicitis, has radically changed over the last decades [1].

The diagnosis of acute appendicitis is essentially clinical; however a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15–30 % cases. Patients typically have right lower quadrant pain, tenderness, and leukocytosis. Incorrectly diagnosing a patient with appendicitis although not

Corresponding Author

**Nagraj Mitra**

Email: - [nagaraj.mitra@gmail.com](mailto:nagaraj.mitra@gmail.com)

catastrophic often subjects the patient to an unnecessary operation [2].

A rapid and now widely used application of imaging methods in the diagnostic modality is compression ultrasound. Other modalities like Multi-detector computed tomography (MDCT) is considered the gold standard technique to evaluate patients with suspected Acute appendicitis, because of its high sensitivity and specificity. MRI has also shown high accuracy in the detection of Acute appendicitis, especially when radiation protection in children and in pregnant patients is of major importance [3].

On the other hand, research focusing on various aspects of US imaging in the diagnoses of Acute appendicitis has gained major importance over recent years as radiation protection, broad availability and cost-effectiveness became increasingly important aspects of modern imaging techniques in the diagnosis of Acute appendicitis.

Our study will focus primarily on the US imaging as the first-line imaging modality in patients with clinical suspicion of Acute appendicitis.

## **MATERIALS AND METHODS**

Prior to the study, ethical approval from the institutional ethical committee was taken. Informed consent was taken from all the patients willing to participate in the study and confidentiality was maintained

### **SOURCES OF DATA:**

All 120 patients admitted to the emergency department at BRIMS teaching hospital, Bidar, with signs and symptoms of appendicitis.

This is a time bound prospective study in which patients presenting with clinical suspicion of Acute appendicitis in BRIMS teaching tertiary care hospital, Bidar, were taken into study.

- The period of study was from December 2016 to September 2017.
- 120 clinically suspicious of acute appendicitis cases were taken up for study.

### **INCLUSION CRITERIA**

- 1) Patient with right acute lower abdomen clinical suspicious of acute appendicitis.
- 2) All patients of acute right lower abdomen irrespective of age and sex willing to participate in study.
- 3) Previously diagnosed acute appendicitis presenting with acute symptoms are included .

### **EXCLUSION CRITERIA**

- 1) All other cases of acute abdomen
- 2) Previously diagnosed acute appendicitis not presenting with acute symptoms.
- 3) Clinically diagnosed acute appendicitis cases but not ready to participate in study.

## **METHODS**

High frequency transducer was used, employing graded compression and Doppler technique. Ultrasound machine Siemens Acuson X 300 with linear probe of 7.5 to 10 MHz, with dosed compression. The dosed compression helps in expelling gas away from the bowel loops and decreases the distance among the transducer and the appendix helps in better visualization of the appendix. The careful exploration of the ileocecal region is performed, and also looked at umbilicus, inguinal ligament, ileopsoas muscle, cecum and the iliac artery and vein and subhepatic region.

## **RESULTS**

Of the one hundred twenty cases examined, the 100 cases were diagnosed acute appendicitis on ultrasound with use of color Doppler also, majority of were uncomplicated and some were complicated, uncomplicated appear typically inflamed, enlarged appendix and non-compressible was seen in all cases with external diameter ranges from 6.0 to 14.0mm, whereas in the complicated appendicitis in few patients the appendix was not seen, indirect signs like collection and inflammatory mass of mesentery and bowel loops noted in the right lower abdomen. Some complicated appendicitis cases where portion of appendix is barely visible with submucosal irregularity/breach in the wall of portion of appendix with collection surrounding to it with thickened inflamed echogenic surrounding mesentery with few enlarged mesenteric lymphnodes.

Of the 100 diagnosed acute appendicitis cases, 64 patients were male and 36 patients were female. 83 cases were seen in right iliac fossa, 15 cases were in right lumbar region and 2 cases were in right sub hepatic region. 15 cases were perforated, among which 5 patients were inflammatory mass formation of appendix. Appendicoliths were noted in the 5 patients of uncomplicated appendicitis. In Uncomplicated appendicitis, increased flow is noted on Doppler whereas in perforated appendix, decreased flow is noted.

.On performing ultrasound with linear probe, ultrasound findings are tubular hypoechoic fluid filled lumen with hyperechoic mucosa and submucosa with hypoechoic muscularis propria with surrounding inflamed echogenic mesentery in uncomplicated appendicitis. There is sumucosal irregularity with loss of echogenicity and mild amount of collection noted in periappendiceal region in complicated appendicitis suggestive perforation. Patients came to emergency room with acute right lower abdominal pain after clinically assessing the patient on Alvarado score sent to Ultrasound room. In 120 patients of study 80 cases have Alvarado score of more than 8/10, while 15 patients have alvarado score between 7 and 8 and 5 of patients have alvarado score between 5 and 6. Rest 20 patients score which were not diagnosed as acute appendicitis on Ultrasonography, the score was less than 5.

**Table 1. USG Findings: Real time US signs of acute appendicitis.**

| Direct signs   | Indirect signs  |
|--|---|
| Non-compressibility of the appendix Perforation: appendix might be compressible<br>Diameter of the appendix >6 mm.<br>Single wall thickness ≥3 mm.<br>Target signs:<br>Hypoechoic fluid-filled lumen.<br>Hyperechoic mucosa/submucosa.<br>Hypoechoic muscularis layer.<br>Appendicolith: hyperechoic with posterior shadowing.<br>Colour Doppler US:<br>Hypervascularity in early stages of Acute appendicitis.<br>Hypo- to avascularity in abscess and necrosis | Free fluid surrounding appendix.<br><br>Local abscess formation.<br>Increased echogenicity of local mesenteric fat.<br>Enlarged local mesenteric lymph nodes<br><br>Thickening of the peritoneum:<br>Signs of secondary small bowel obstruction |

**Table 2. Alvarado Score for Appendicitis Patients**

| Symptoms                                | Score |
|---|-------|
| Migratory right iliac fossa pain        | 1     |
| Nausea/Vomiting                         | 1     |
| Anorexia                                | 1     |
| Signs                                   |       |
| Tenderness in right iliac fossa         | 2     |
| Rebound tenderness in right iliac fossa | 1     |
| Elevated temperature                    | 1     |
| Laboratory findings                     |       |
| Leucocytosis                            | 2     |
| Shift to the left of neutrophils        | 1     |
| Total                                   | 10    |

**Table 3. USG Findings in Acute Appendicitis Patients**

| USG findings  | No of cases | Percentage |
|---|-------------|------------|
| Visualization of appendix                           | 97          | 97         |
| Target scan on transverse scan                      | 97          | 97         |
| Sonographic Mcburney's tenderness(Probe tenderness) | 83          | 83         |
| Appendicolith                                       | 5           | 5          |
| Free fluid in right iliac fossa                     | 15          | 15         |
| Echogenic surrounding Mesentery                     | 95          | 95         |
| Loss of Submucosal integrity                        | 15          | 15         |

**Table 4. Alvarado score for acute appendicitis patients**

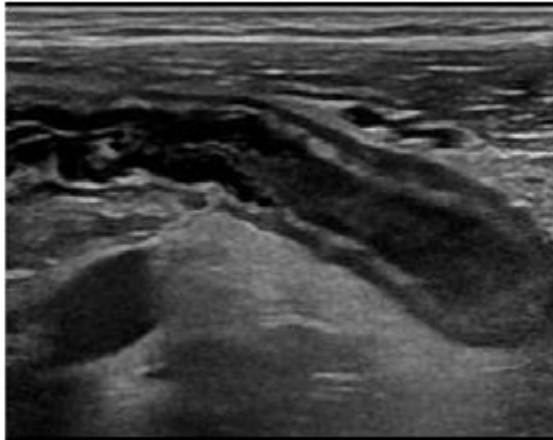
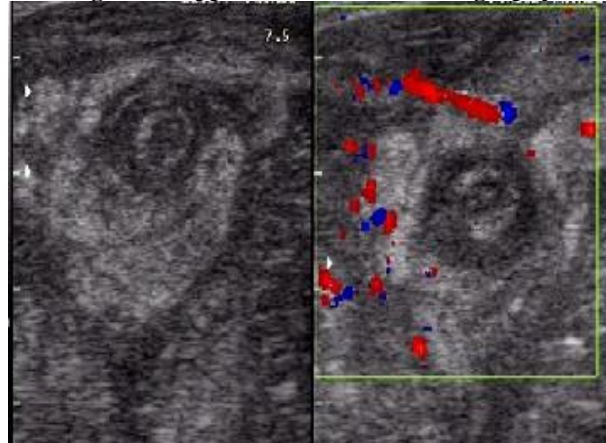
| Alvarado Score | No of cases | Percentage |
|----------------|-------------|------------|
| <5             | -           | -          |
| 5-6            | 5           | 5          |
| 7-8            | 15          | 15         |
| >8             | 80          | 80         |
| Total          | 100         | 100        |

**Table 5. Sex wise Distributions of Acute Appendicitis Patients**

| Sex    | No of cases | Percentage of patients |
|--------|-------------|------------------------|
| Male   | 64          | 64                     |
| Female | 36          | 36                     |
| Total  | 100         | 100                    |

**Table 6. Age wise Distributions of Acute Appendicitis Patients**

| Age        | Number of cases | Percentage |
|------------|-----------------|------------|
| 01-10years | 10              | 10%        |
| 11-20years | 26              | 26%        |
| 21-30years | 41              | 41%        |
| 31-49years | 17              | 17%        |
| >50years   | 6               | 6%         |

**Figure 1. Appendicitis on Ultrasonography****Figure 2. Appendicitis on Ultrasonography**

## DISCUSSION AND CONCLUSION

US has great diagnostic value in acute appendicitis. The advantage consists of: easy performance, noninvasive method, no radiation, short examination duration, the possibility for detection of other causes of distal abdominal pain, especially in pregnant women. The disadvantage is that the finding depends on the operator. The non-visualized appendix is interpreted as non-inflamed appendix, so it is from great importance the examination to be performed by experienced radiologist with attention and he would be able to accomplish maximal sensitivity [4,5].

If the examination with the dosed compression of the right lower quadrant is positive for the appendicitis, the surgery is recommended. If the finding is unremarkable, it is not enough to exclude appendicitis. In that case if the pain and the history are still present the follow up US is recommended for further observation by the abdominal surgeon.

With use of US and with use of exact established standards and criteria the timely and accurate diagnosis of acute appendicitis is allowed. It will reduce the number of the perforations and unnecessary surgery.

It has been demonstrated in a recent meta-analysis that an imaging protocol using US as a first-line imaging tool, followed by CT, offers significant cost savings over a CT-only protocol, and avoids radiation exposure. Imaging children with suspected AA was to start with US and follow each negative US examination with a CT examination [6].

Our study was a prospective study of 120 patients clinically suspected for acute appendicitis. After a detailed history and clinical examination, the patients were subjected to ultrasound examination of the right iliac fossa using graded compression technique using high resolution, high frequency probes (linear array 7.5-10MHz and curvilinear array 3.5-7.0MHz).

Age prevalence showed 10.0 % of patients in the age group of 1-10 years and 6.0 % of patients above the age group of 50 years were affected. 26 % patients were in the age group of 11-20yrs.41% patients were in the age group of 21-30years.17% patients were in the age group of 31-49years.Males were more commonly affected than females, with a male: female ratio of 1.78:1. These results were comparable to the study done by Lewis et al who observed that less than 10% of patients were affected in the age group of 1-10 years and less than 10% of patients were affected in the age group of 50 years and above with male: female ratio of 2:1[7]. Our study showed that highest number of acute appendicitis occurred in the age group of 21-30 years followed by age group of 11-20 years which is not consistent with the findings shown by Addis et al that it is most common in 10 to 19 year old age group, in our study that is second most common. Our findings of peak incidence of occurrence was consistent with Daga.s etal [8]

## ACKNOWLEDGEMENT

I acknowledge Director and Medical superintendent BRIMS teaching tertiary care hospital,

Bidar, Karnataka for their support and also patients for cooperation for conducting the study.

## REFERENCES

1. Gerhard Mostbeck E, Jane Adam, Michael Bachmann Nielsen. (1998).How to diagnose acute appendicitis: ultrasound first. *Ultrasound International*, 72, 148-52.
2. Sammalkorpi Henna. (1992).Diagnosis of acute appendicitis: Diagnostic scoring and significance of preoperative delay. *AJR Am J Roentgenol*, 141, 637-41.
3. Gligorievski, Skopje. (2010). *US diagnosis of acute appendicitis. Radiology*,167,27-29
4. Sudershan Kapoor, Punit Kumar, Ashish Kumar Sharma. (2011).Acute Appendicitis. *AJR Am J Roentgenol*, 137, 79-82.
5. Jeffery RB Jr, Laing FC, Townsend RR (1988). Acute appendicitis: sonographic criteria based on 250 patients. *Radiology*, 167,327-9.
6. Subash KC, Abhijit De, Mahesh Pathak, Brijesh Sathian. (2015). Diagnostic Role of Ultrasonography in Acute Appendicitis: A Study at a Tertiary Care Hospital. *American Journal of Public Health Research*, 3, 23-28
7. Lewis Fb, Holcroft JW, Boey J, Dumphy (1975). Critical review of diagnosis and treatment in 1000 cases. *Arch of Sur*, 110, 677-84.
8. Soniya Daga, Sushil Kachewar, Dilip L Lakhkar, Kalyani Jethlia, Abhijeet Itai. (2017). Sonographic evaluation of acute appendicitis and its complications. *West African Journal of Radiology*, 24, 152-156.

### Cite this article:

Ashokkumar Kattimani, Nagraj Mitra. Role of Ultrasound Scanning in the Evaluation of Clinical Suspected Acute Appendicitis. *American Journal of Oral Medicine and Radiology*, 5(1), 2018, 1-5.

DOI: <http://dx.doi.org/10.21276/ajomr.2018.5.1.1>



Attribution-NonCommercial-NoDerivatives 4.0 International