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Original Research Article

Comparison of performance statistics of CT scan and ultrasonography in complicated appendicitis: experience in a tertiary care centre

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ABSTRACT

Background: This study is conducted from November 2018 to November 2019 in this institute, where comparison of performance statistics is done between CT scan and Ultrasonography in patients with complicated appendicitis scheduled for conservative management, elective or emergency surgery. Aim of the study was to evaluate and compare the performance statistics of CT scan and Ultrasonography in complicated appendicitis.
Methods: The CT scan or USG findings of 87 patients were reviewed. The patients were divided into two groups i.e. CT scan group (group-1/18 patients), USG group (group-2/69 patients). Satistical analysis Student"s t-test, Fischer"s test, p-value, k-value.
Results: Clinical signs, CT findings, USG findings, complications at surgery and histological examinations were noted. 2, 3, 13, patients presenting with CT features and 5, 13, 51 patients presenting with USG features of appendicular perforation, peri-appendicular abscess, inflammatory appendicular mass respectively. No clinical signs showed a significant association with the presence of appendicular perforation, peri-appendicular abscess, inflammatory appendicular mass or the complication encountered at surgery.
Conclusions: In this study, by comparing CT scan group and USG group in complicated acute appendicitis, CT scan can change the plan of management in doubtful cases, decrease length of hospital stay and expenses, reduce the complication rate and negative laparotomy rate, and reduce the episodes of conversion to open surgery.

Keywords: Computerized tomography, Complicated appendicitis, Inflammatory appendicular mass, Performance statistics, Ultrasonography

INTRODUCTION

Acute appendicitis is having around 7% probability of occurrence over one's lifetime.[1] Acute appendicitis is a common gastro-intenstinal disease affecting 5.7-57 per 1 lakh individual each year with a highest incidence in children and adolescents. Acute appendicitis is the most common reason for emergency abdominal surgery and must be distinguished from other causes of abdominal pain. When the diagnosis is delayed, it may be complicated by perforation and inflammatory mass in 2-10% cases.[2] However overall diagnostic accuracy achieved by traditional history, physical examination and laboratory tests has been approximately 80%. The accuracy of diagnosis varies by the patient"s age, sex, and is more difficult in women of child bearing age, children, and elderly persons. Imaging studies in patients with a clinical suspicion of acute appendicitis can reduce the negative appendicectomy rate, reduce morbidity from perforation, and lower hospital expenses, which has been

reported to be as high as 15%. CT Scan and other imaging modalities have been used when diagnosis is unclear. i.e. in other words approximately 45% do not display classic signs of acute appendicitis, making imaging a potential useful tool i.e. approximately 1/3rd of patients have normal WBC counts and some are afebrile until perforation.[3] In such situation CT and other imaging modalities can aid the diagnosis. Ultrasonography is safe and readily available with the accuracy rate between 71-97%, although it is highly operator dependent and difficult in patient with a large body habitus. While there is controversy regarding the use of USG, CT Scan technique is best with accuracy rate between 93-98%. The disadvantages of CT Scanning include radiation exposure, cost and possible complications from contrast media. In past, three major approaches have been advocated (i) unenhanced CT of abdomen and pelvis (ii) addition of oral and/or IV contrast media, and (iii) focused appendiceal CT (imaging only the right lower quadrant) using rectally administered contrast media. Recent investigation indicates that abdomino-pelvic CT Scan is an appropriate initial approach to imaging patients for acute appendicitis.

The sensitivity and specificity of an abdomino-pelvic CT Scan are 94% and 95% respectively.[4] The accuracy of CT Scan relies in part on its ability to reveal a normal appendix better than ultrasonography. An inflamed appendix revealed on a CT Scan is larger than 6 mm in diameter, has appendiceal wall thickening and wall enhancement after contrast media infusion. CT Scan also reveals appendicolith, periappendiceal inflammatory changes which may include inflammatory fat stranding, phlegmon, free fluid, free air bubbles, abscess, and adenopathy. Contrast/air in lumen of appendix virtually excludes the diagnosis of appendicitis. The helical CT Scan also an excellent imaging tool for differentiating appendicitis from most acute gynecologic conditions, thus challenging the use of ultrasonography in women. The goal of this study is to analyse comparison of performance statistics of CT scan and ultrasonography in complicated appendicitis.

METHODS

Source of data- Patients admitted in department of General Surgery, Veer Surendra Sai Institute of Medical Science and Research (VIMSAR), Burla, Sambalpur, Odisha, India for suspected complicated appendicitis were reviewed during this study period. Period of study was November 2018 to November 2019. Calculated sample size (n) was 87.

Inclusion criteria

- Patients between 15 to 65 years of age irrespective of sex.
- Patients with RIF mass may consistent with appendicular mass.

Exclusion criteria

- Age below 15 years and more than 65 years.
- Symptoms less than 72 hours
- Immuno-compromised patients
- Patients with other diseases

Method of collection of data-Details of cases were recorded including history and clinical examination. Age, gender, and clinical characteristics (presence of abdominal pain, fever, guarding in right iliac fossa, elevation of C-reactive protein levels, leucocyte counts with all routine investigations) of patients were noted. Authors also recorded the type of surgery carried out (open appendectomy, laparoscopic surgery) and whether conversion to open surgery was needed.

Two groups of patients were made according to CT Scan and ultrasound features.

Group 1 - CT Scan group
Group 2 - Ultrasound group

Complications encountered at and after surgery were evaluated. Conversely, surgery was classified as non-complicated when the laparoscopic approach or open procedure was performed with no complication either intra-operatively or post-operatively.

Ethical approval

Department of Surgery, Veer Surendra Sai Institute of Medical Science and Research (VIMSAR) has been taken before starting the study

Statistical analysis

Two patients' groups were compared using Fischer exact test and student's t test. p- value of <0.05 indicated a statistically significant difference for all comparisons. CT diagnosis complicated appendicitis was assessed by using k statistics.

A k value of 0.0 indicates poor agreement, a value of 0.01-0.20 indicates slight agreement, a value of 0.21-0.40 indicates fair agreement, a value of 0.41-0.60 indicates moderate agreement, a value of 0.61-0.80 indicates good agreement and a value of 0.80-1.0 indicates excellent agreement.

RESULTS

The study was conducted on 87 patients, aged between 15 to 65 years, who underwent elective surgery, emergency surgery, conservative management in V.S.S Institute of Medical Science And Research (VIMSAR), Sambalpur, Odisha, india from November 2018 to November 2019. Out of 87 patients 53 patients were male (group 1-12, group 2-41) and 33 patients were female (group 1-6, group 2-28).

Table 1: Clinical findings.

Clinical findings and lab findings	Number	Percentage (%)
Fever	87	100
Guarding in RIF	75	86
Nausea and vomiting	37	43
Elevated CRP level	77	89

In this study, clinical features were abdominal pain and fever in 87 patients (100%), guarding in right iliac fossa in 75 patients (86%), nausea and vomiting in 37 Patients (43%). Elevation of CRP levels and leucocyte counts were present in 77 Patients (89%) (Table 1). None of these features had a statistically significant association with IAM and with other complications. On CT, average appendix diameter was 12mm and positions were retrocecal (46%), orthotopic (23%), pelvic (14%), mesoceliac (10%), sub-hepatic (7%).

Table 2: CT scan and USG findings.

	CT scan group (group 1)	USG group (group 2)
Appendicular perforation	2	5
Peri-appendicular abscess	3	13
IAM	13	51
Total	18	69

Out of 87 patients, 18 patients were subjected to CT Scan. From which 2, 3, and 13 patients were diagnosed as appendicular perforation (k=0.94), peri-appendicular abscess (k=0.82), and inflammatory appendiceal mass (IAM) (k=0.91) respectively. Out of 87 patients, 69 patients were subjected to ultrasonoghaphy. From which 5, 13, and 51 patients are diagnosed as appendicular perforation (k=0.58), peri-appendicular abscess (k=41), and inflammatory appendiceal mass (IAM) (k=0.52) respectively (Table 2).

Table 3: Pre-operative vs final diagnosis.

	Group 1 (CT group)		Group - 2(USG group)	
	CT scan finding	Final ourdiagnosis	USG finding	Final diagnosis
Perforation	2	2	5	6
Abscess	3	4	13	21
IAM	13	12	51	42

In CT Scan Group, 2 (against 2 patients on pre-operative diagnosis), 4 (against 3 patients on pre-operative diagnosis), and 12 (against 13 patients on pre-operative diagnosis) patients are diagnosed intra-operatively or on long follow up as appendicular perforation, appendiceal abscess, and IAM respectively. In USG Group, 6 (against 5 patients on pre-operative diagnosis), 21 (against 13 patients on pre-operative diagnosis), and 42 (against 51 patients on pre-operative diagnosis) patients are diagnosed intra-operatively or long follow up as appendicular perforation, appendiceal abscess, and IAM respectively. There is a lot of discrepancy between pre and intra-operative findings in USG group (Table 3).

Table 4: Management.

	Group - 1 (CT group)	Group - 2 (USG group)
Conservative management	10	37
Surgery	8 (out of which lap - 3, open - 5)	32 (out of which lap - 8, open - 24)

Patients of both groups were managed by either conservatively or by surgery. In Group - 1, 8 (out of which Lap- 3, Open - 5) and 10 patients were managed by surgery and conservatively respectively. In Group - 2, 32(out of Lap - 8, Open - 24) and 37 patients were managed by surgery and conservatively respectively (Table 4).

Table 5: Conversion to open and complications.

	Group - 1 (CT group)	Group - 2 (USG group)
Conversion to open in laparoscopic appendectomy	0 out of 3	3 out of 8 (37.5%)
Complications (intra and post-operative)	1 out of 8 (12.5%)	9 out of 32(28.1%)

In group 1, patients undergoing laparoscopic surgery, no surgery was converted to open, and in group 2- 3 (37.5%) patients were converted to open surgery. 1 (12.5%) out of 8 patients in group 1 encountered complications (p=0.005) and 9 (28.1%) out of 32 (p=0.038) patients in group 2 encountered complications (Table 5).

Table 6: Length of hospital stay and NAR (negative appendectomy rate).

	Group - 1 (CT group)	Group - 2 (USG group)
Average length of hospital stays	4 days	8 days
Negative appendectomy rate (nar)	0 (out of 8)	15.62% (5 out of 32)

Both average length of stay in hospital and negative laparotomy rate are less in Group - 1 (4 days, 0 out of 8 patients) in comparison to Group - 2 (8 days, 5 0ut of 32 patients) respectively (Table 6).

DISCUSSION

Clinical diagnosis of IAM is difficult due to symptoms may change and are quite non-specific.[5] As now a days

CT Scan is very useful for the diagnosis of acute abdominal diseases in adults, the diagnosis of acute appendicitis, types of it's complications present, and choosing of the best management strategy are often made by using CT Scan. IAM is a delayed complication of acute appendicitis, which represents 2-10% of all complications of acute appendicitis.[6]

In this study of 87 patients, 18 patients were subjected to CT scan with IV contrast. CT Scans were performed from the diaphragm to the pelvis with patients in the supine position. Contrast material was injected in all patients. Scanning began 90 seconds after the start of the injection of 90-ml contrast material delivered at the rate of 2-4 ml/s using a power injector. No oral contrast agent was given to patients.

Following CT Scan findings were evaluated i.e diameter of appendix, location of appendix (orthotopic, retrocecal, mesoceliac, pelvic), appendiceal wall enhancement, peri-appendiceal fat stranding, and presence of an appendicolith. A thickened and dilated appendix (diameter >6-mm) associated with appendiceal wall hyper-enhancement and peri-appendiceal fat stranding was considered diagnostic of acute appendicitis 7. Complicated acute appendicitis was diagnosed when isolated perforation, peri-appendiceal abscess, or Inflammatory Appendiceal Mass (IAM) was identified via CT.[8] Perforated acute appendicitis was defined when presence of extraluminal gas, extraluminal appendicolith, and focal defect of enhancement of the appendiceal wall were identified in radiological literature.[9] Peri-appendiceal abscess was identified by a well-delineaated collection with rim enhancement next to appendix.[10] Inflammatory Appendiceal Mass (IAM) diagnosed on CT Scan when walled-off perforation of appendix, peri-appendiceal phlegmon and the joining of adjacent bowel loops and at times other viscera were identified.[5] Rest 69 patients were subjected to USG and classified accordingly. USG finding of appendicular abscess is hypoechoic collection in the appendicular region, which is rounded and well circumscribed or ill-defined and irregular in appearance. Appendix may or may not be visualized within the mass. Appendicular perforation can be diagnosed by demonstration of right iliac fossa abscess or phlegmon in association with signs of appendiceal inflammation and appendicolith. After performance of either of the modality's patients were treated according to their pathologies. The radiological findings are compared with the post intervention final diagnosis. Out of 69 patients undergoing USG, 5, 13, and 51 patients were diagnosed as appendicular perforation (k=0.58), peri-appendicular abscess (k=41), and Inflammatory Appendiceal Mass (IAM) (k=0.52) respectively. Out of 18 patients subjected to CT Scan, 2, 3, and 13 patients were diagnosed as appendicular perforation (k=0.94), peri-appendicular abscess (k=0.82), and Inflammatory Appendiceal Mass (IAM) (k=0.91) respectively.

Today, the management of acute appendicitis without IAM is very clear and based on immediate surgery.[7] Surgical treatment of acute appendicitis can be performed either by the classical Mc Burney's procedure or laparoscopic procedure. These two approaches were used in this study. On the other hand management of IAM is very controversial i.e. though the gold standard treatment is Ochsner method (which is based on conservative management followed by interval appendicectomy 6-12 weeks later) 11, some authors insists for immediate surgery arguing on the basis of low morbidity rate, decreased duration of hospital stay, early diagnosis and treatment of unexpected pathologies.[12] On the contrary others defend for complete conservative approach.[10]

CONCLUSION

In this study, by comparing CT scan group and USG group in complicated acute appendicitis, CT scan can change the plan of management in doubtful cases, decrease length of hospital stay and expenses, reduce the complication rate and negative laparotomy rate, and reduce the episodes of conversion to open surgery. When the diagnosis is delayed, acute appendicitis may be complicated by perforation and IAM in 2-10% cases. In this study of 87 patients, by comparing CT group and USG group, CT Scan can change the plan of management in doubtful cases, decrease length of hospital stay and expenses, reduce the complication rate and negative laparotomy rate, reduce conversion to open surgery. Authors really think that CT Scan has larger role (in comparison to USG) in the diagnosis and management of acute appendicitis and its complications.

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Ethical approval: The study was approved by the Institutional Ethics Committee of VIMSAR, Burla, Sambalpur, Odisha

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