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Original Research Article

A clinico pathological study of acute appendicitis with special reference to ultrasonography

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ABSTRACT

Background: Acute appendicitis is one of the commonest conditions treated at emergency, despite of advances in diagnostic medicine and therapeutics, the diagnosis of appendicitis remains essentially clinical, requiring clinical acumen and surgical knowledge. Maximum incidence noted in second and third decade of life with male predominance. Ultrasonograpy is shown to be effective in the diagnosis of acute appendicitis with a sensitivity of 84 to 89% and specificity of 92 to 98%. Objectives of the study was to study the clinical features of acute appendicitis regarding Alvarado score. Role of USG and HPE Examination in supporting the clinical diagnosis of acute appendicitis and the morbidity, mortality of emergency appendicectomy.
Methods: 100 patients who were admitted to VIMS hospital, Bellary, from November 2004 to April 2006 with a clinical suspicion of acute appendicitis were included in the present study. Ultrasonography and Histopathological Examination was done in all cases and results were correlated with final analysis. Results were analyzed using 'Z' test, Chi-squire test, sensitivity and specificity.
Results: In present study of 100 cases 77 were males and 23 Females patient. Out of which 60 are in 15 to 30 years, 21 patients are 10 to 15 years followed by 13 in the age group of 30-40 years. All are undergone appendicectomy. 11 patents undergone Elective, and 89 emergency appendicectomy. Ultrasound was coming positive in 92 cases and negative in 8 cases. The sensitivity and specificity of 95.7% and 80% Respectively. HPE was done in all 100 cases 95 were positive 5 were negative with sensitivity of 96.8% and specificity of 80%.
Conclusions: Appendicitis is commonest in 2nd and 3rd decade followed by 4th decade with a male preponderance, Ultrasonography is useful in females to rule out any gynecological pathology. Patients who come early within 2 to 3 days of symptoms of acute appendicitis, emergency appendicectomy is the treatment of the choice and were will be less morbidity and mortality, post operatively.

Keywords: Appendicitis, Appendicectomy, HPE, USG

INTRODUCTION

The vermiform appendix described as "worm of the intestines", considered by most to be a vestigial organ can be a real nuisance at time, when it is the seat of infection. Its importance in surgery is mainly due to its propensity for inflammation. Acute appendicitis is the most common cause of "acute abdomen" in young adolescents and appendectomy is often the first major procedure performed by a surgeon in training. Sir heneageogilivie says, "Acute Appendicitis is one of the commonest conditions which the surgeon is called upon to treat as an emergency".[1] It requires utmost skill and care of the attending surgeon, besides good clinical judgment. Acute appendicitis is diagnosed mainly clinically. No single investigation has established its superiority over the simple, unbiased and repeated clinical examination by an expert in the surgical field.[2] Despite our tremendous

progress in modern technology, nobody, by no means, could predict which appendix goes for appendicitis at which time and later its attendant lethal complications.[3] Here we are presenting a study about efficacy of ultrasound in diagnosis of acute appendicitis and its comparison with biopsy.

Aims and objectives of the study

- To study the clinical features of Acute Appendicitis with reference to Alvarado score.
- To study the role of Ultrasonography in supporting clinical diagnosis of Acute Appendicitis.
- To study the morbidity and outcome of emergency Appendicectomies.
- Histopathological examination of specimen of Appendix.

METHODS

It was a prospective study. Material for this study was obtained from the patients admitted in the Department of General Surgery, in present Hospital, who were suspected of having Appendicitis. The study was conducted for a period of one year, from January 2004 to January 2006. A total of 100 cases were taken for detailed study.

Inclusion criteria

- Patients admitted with acute abdomen with clinical diagnosis was acute appendicitis irrespective of age and sex.
- Patients who underwent surgery were only taken for the study.

Exclusion criteria

- Patients admitted with hollow viscus perforation with peritonitis.
- Patients proved to have other causes of pain in right iliac fossa like renal colic, PID, ovarian cyst, appendicular abscess and appendicular mass.
- Patients not willing for admission or surgery.

A detailed history was taken from all patients regarding presenting complaints, their duration, severity, sequence of onset of symptoms, mode of onset, progression, change in pattern at the time of presentation, etc. Each patient was examined regarding built, nourishment, hydration, general appearance and presence of any systemic illness. Vital signs were recorded in each case. CVS and RS were examined as routine special attention was paid to abdominal examination and per rectal examination. In this study, the diagnosis of appendicitis was mainly clinical depending on history and physical examination. All patients underwent ultrasound examination of abdomen. Relevant investigations which were done in this study included blood–Hemoglobin percentage, total count, differential count, RBS, urea, S. Creatinine, grouping and Rh Typing, urine examination and gynecological opinion in some female patients was obtained. Routine investigations were performed to know the fitness for anesthesia in elective cases.

The ultrasonographic examination was performed, initially with a hand held 3.5 MHZ sector probe, in which the entire abdomen was scanned to exclude possible differential diagnosis of acute appendicitis. A 5 MHZ sector probe scan of the RLQ using graded compression technique described by Puylaert was followed.[4]

The patient was asked to identify the site of maximum tenderness (self- localization) and graded compression was used to displace the bowel loops in that area. The presence of a tubular, non-comprisable aperistaltic, blind ending structure in RIF, with a diameter of more than 6mm was taken as significant. Other signs were recorded with special reference to peri–appendiceal collection and appendicolits. Treatment was planned to depend upon type of appendicitis and presence or absence of complications.

Operative treatment

Most of the cases of acute appendicitis were treated with:

- Emergency appendicectomy.
- Laparoscopic appendicectomy.
- Conservative management followed by interval appendicectomy – either Laparoscopic or open.

Anesthesia was either G.A/S.A/E.A.

Abdomen was opened by either McBurney's / Lanz or lower right paramedian incision. The most commonly used incision was McBurney's incision. In a few cases, incision was extended upwards and laterally. Few laproscopic surgeries were converted to open appendicectomy. Majority of the cases of acute appendicitis in our study were treated by emergency open appendicectomy and in few cases, that came for interval appendicectomy, Open or Laparoscopic methods were applied.

RESULTS

The analysis of the 100 cases of acute appendicitis who underwent surgery were studied, clinical diagnosis was correlated with USG abdomen and histopathology between Jan 2010 to Jan 2011 is presented here.

USG Abdomen

Ultrasonography of abdomen was done in all the 100 patients, in 8 patients appendix was not visualized but probe tenderness, minimal free fluid in RIF was present, in 93 patients appendix was visualized, a peristaltic, non-compressible with the transverse diameter measuring

more than 6 mm in size with probe tenderness. So it signifies >95% sensitivity.

Table 1: Prevalence of acute appendicitis and its 95% confidence interval among the total abdominal surgery.

Prevalence	
Prevalence of acute appendicitis among the total abdominal surgery.	0.332
Standard error of the proportion	0.014
95% confidence interval for the proportion	0.305 to 0.360

The prevalence of acute appendicitis among the total abdominal surgery is 33.25% with standard error of 0.014%.

Table 2: Prevalence of acute appendicitis and its 95% confidence interval among the emergency abdominal surgery.

Prevalence	
Prevalence of acute appendicitis Among the total abdominal surgery.	0.525
Standard error of the proportion	0.019
95% confidence interval for the proportion	0.488 to 0.561

The prevalence of acute appendicitis among the total abdominal surgery is 0.525% with standard error of 0.019.

Table 3: Age and sex distribution of the patients in the study.

Age group (years)	Males	Females	Total
01-10	05	01	06
11-20	34	09	43
21-30	28	07	35
31-40	07	06	13
41-50	02	-	02
51-60	01	-	01
Total	77	23	100

The total number of male in the study group is 77 and female is 23. The male to female ratio is 3.34:1. Mean age and 95% confidence interval for the mean.

Table 4: Association of acute appendicitis with dietary habit.

Diet	Percentage among the acute appendicitis cases	Statistical significance
Vegetarian	13.68	Highly significant Z=9.87, P<0.001
Mixed diet	86.32	

Comparison of diet among the acute appendicitis cases shows 13.68% are vegetarian and 86.32 of them are mixed diet. It shows higher cases among the mixed diet group than the vegetarian group. This difference is statistically significant.

Table 5: Cases analysis of the present study.

Total no. of cases taken for the study	100
USG done	100
USG positive	92
USG negative	08
HPE done	100
HPE positive	95
HPE negative	05
Appendicectomies done	100
Emergency open	88
Emergency lap	01
Elective open	06
Elective lap	05

USG was done for all 100 cases and the data analysis is sufficient for clinical correlations and was present in all cases. Among 100 cases we studied, all were taken up for surgery of which 89 patients underwent emergency appendicectomy and 11 cases underwent elective appendicectomy.

Table 6: Types of acute appendicitis.

Types of acute appendicitis	
Acute appendicitis simple	70%
Acute appendicitis perforated	7%
Acute appendicitis gangrenous	7%
Recurrent appendicitis	11%
Sub-acute / normal	5%
Total	100%

Table 7: Comparison of clinical diagnosis and biopsy result of acute appendicitis.

Clinical diagnosis	Biopsy result		
	Positive	**Negative**	**Total**
Positive	92	01	93
Negative	03	04	07
Total	95	05	100

Table 8: Accuracy, sensitivity and specificity.

Accuracy, sensitivity and specificity of clinical diagnosis	Results
Accuracy	96%
Sensitivity	96.8%
Specificity	80%
Positive predictive value	98.9%
Negative predictive value	57%

The overall accuracy of clinical features in diagnosing acute appendicitis was 96%. The overall sensitivity was

96.8% and specificity was 80%. An overall positive predictive value was 98.9% and Negative predictive value was 57%.

Table 9: Clinical analysis by biopsy report.

Clinical analysis	
Clinically positive	92
Biopsy positive	07
Biopsy negative	01

Analysis of false negative cases by clinical assessment revealed seven out of ninety-two cases amounting to a diagnostic error of 7.6%.

Table 10: Comparison of USG result and biopsy result of acute appendicitis.

USG result	Biopsy result		
	Positive	**Negative**	**Total**
Positive	91	01	92
Negative	04	04	08
Total	95	05	100

Table 11: Accuracy, sensitivity and specificity.

Accuracy, sensitivity and specificity of USG	Results
Accuracy	95%
Sensitivity	95.7%
Specificity	80%
Positive predictive value	98.9%
Negative predictive value	50%

Analysis of 100 cases in present study ninety-two were USG Positive and eight cases were USG negative. The target lesion was the most common finding in acute appendicitis on ultrasound, being found in 91 cases with an accuracy of 95% minimal free fluid in twenty-two cases and faecolith in two cases. The overall accuracy of USG was 95% with a sensitivity of 95.7% and specificity of 80% Positive predictive value of 98.9% and negative predictive value of 50%. Analysis of false Negative reports by Ultra Sound revealed that four out of eight cases of USG Positive were operated and had retrocaecal appendix and they were not picked up by USG. The diagnostic error was 4.5%. The error in USG is may be due to the position of the appendix, obese patient, Un-cooperative patients, and the frequency of the USG used (3 MHz).

Table 12: Accuracy of clinical diagnosis.

Accuracy of clinical diagnosis in acute appendicitis	Results
Total No. of appendicectomies done	100
Total No. of biopsy positive	95
Total No. of biopsy negative	05
Negative appendicectomy rate	5.2%

In present Hospital study we were using 3 MHz and 5 MHz frequency USG array transducers and it may also little contributory to the negative reports in cases of acute appendicitis.

The five cases where negative appendicectomy was done amounts to negative appendicectomy rate of 5.2%. USG has given the correct diagnosis in two out of five cases which are ruled out on HPE, it may be performed by an experienced sinologist.

Table 13: Microscopy (HPE).

Types of acute appendicitis	Results
Acute appendicitis simple	70%
Recurrent appendicitis	11%
Acute appendicitis gangrenous	7%
Acute appendicitis perforated	7%
Normal appendix/ sub acute appendicitis	5%

Table 14: Pathological examinations.

Pathological examinations	
Inflamed oedematous appendix	83
Perforation of appendix (7)	
Sealed	0
Tip	2
Middle	1
Base	4
Gangrenous appendix (5)	
Distal 1/2	3
Proximal + Distal	2
Caecal base	
Fibrosed	Nil
Normal	3

Macroscopy: All the appendix were varying about 4-15cms.

Figure 15: Microscopy.

Types of acute appendicitis	Results
Acute appendicitis (AAS)	71
Recurrent appendicitis (AAR)	14
Subacute appendicitis	1
Acute appendicitis gangrenous (AAG)	5
Acute appendicitis perforated (AAP)	7
Normal appendix	2

The last group can be explained by: *A normal appendix can have appendiceal pain due to release of neurohormones and neuropathies from the muscular wall of the appendix.

DISCUSSION

The incidence of acute appendicitis is reducing in the western countries. In India the incidence is lower when compared to western countries. But still it is the third commonest operation in males and second commonest in females. The reason for this fall in incidence is probably due to the change in dietary habits. But no such drop in incidence has been noticed in India so far. The incidence

of acute appendicitis is still lower in South India when compared to North India. S.K. Sen has reported that appendicectomy constituted 41% of total operations in his hospital.

In a study conducted by Teubner A et al appendicectomy accounted for 26% of total abdominal operations.[12] In the present study, the appendicectomy is constituted about 22% of elective surgeries and 34.6% of emergency surgeries. However there are reports that incidence of acute appendicitis is decreasing in the western world but there are no such reports from India so far.

Ultrasonography

For ultrasound examination, graded compression, as described by Puylaert et al was used in present study to displace bowel loops from the right iliac fossa, the aim being to oppose the external abdominal musculature with the psoas muscle.[4] The Caecum and the External iliac vessels were found to be useful anatomic landmarks. Graded compression was, surprisingly, well tolerated by patients, in contrast to the extreme pain of sudden compression.

Table 16: Comparison of usg results of different series.

Ultrasound	Puylaert et al[4]	Jeffery et al[5]	Idachan & Bickvel[6]	Jonh Et al[7]	Seung Hum yu Korean Journal[8]	Adams et al[9]	Shinji Himeno Tokai[10]	Obermaier et al[11]	Present Study
Accuracy	89%	93.9%	92%	76%	88.2%	87%	91.5%	83.5%	95%
Sensitivity	--	89.9%	83%	78%	86.7%	89%	97.6%	83.1%	95.8%
Specificity	--	96.2%	95%	73%	90%	86%	82%	88.1%	75%

Comparison of usg results of different series

Jeffery et al could a successful ultrasound examination on 95% of their patients.[6] Sonographicself localization of the exact site of pain has been reported by Chesbrough et al as a valuable adjunct to diagnosis.[5] They found self-localization to be possible in 85% of patients with acute appendicitis in contrast to 15% of the patients with some other intra-abdominal pathology. Self-localization and elicitation of a 'Sonographic Mc. Burney's sign reduces' the time of examination and is lost in perforation of the appendix.

Although self-localization was not independently studied, it was found to be useful in diagnosis by ultrasound in our study. 96.5% (92 cases) showed U/S finding suggestive of acute appendicitis. In our study, a target lesion in the RIF was found to be the reliable feature of acute appendicitis, being present in 95% of patients. Non-compressibility had an accuracy of 96% Fakhry et al had described a target lesion to be characteristic of lesions of the bowel and the stomach.[13] Puylaertetal had found a non-compressible target lesion, which could be elongated to a blind end to be specific for appendicitis.[4]

An anteroposterior appendicular diameter of more than 6mm was significant and accuracy was 88% of the 92 cases reported to have a diameter of >6mm on ultrasound was positive on histopathology. Jeffery et al had studied 250 cases of suspected appendicitis and suggested that a maximum diameter of ≥7mm indicated a diagnosis of acute appendicitis.[6] In their study, 84 patients were found to have an appendix of diameter >7mm and 78 were proven to have acute appendicitis. Puylaert et al found a diameter of more than 6mm on ultrasound to be suggestive of inflammation.[4] John et al took a diameter of >12mm as significant and reported a thinning of the wall in cases where the lumen was distended with pus. In our study 66 patients were presented with minimal free fluid in RIF. Kang et al had found 100% specificity for periappendiceal collection while Puylaert et al reported a diagnostic accuracy of 89% for appendicular abscess.[4] Jhon et al found ultrasound to be particularly useful in detecting peri-appendiceal collection, with all 4 cases in their series being diagnosed by ultrasound.[7] Faecolith was found in 5 cases in present study. Jeffery et al had suggested that, with positive clinical findings, a faecolith should be taken to indicate acute appendicitis, irrespective of the diameter of the appendix.[4]

USG done in all hundred cases. In eight patient's appendixes was not visualized but probe tenderness in RIF with minimal free fluid was noted. In ninety-two patient's appendix visualized and out of ninety, majority of them had more than 6mms of transverse diameter, a peristaltic and non-compressible with probe tenderness present. It was most useful when the Alvarado scoring was less than six and in female patients to exclude any pelvic pathology and also in children less than twelve years. To get the accurate diagnosis it is most useful, reliable, non-invasive and less expensive; proving its sensitivity to about 92% in the diagnosis of acute appendicitis.

CONCLUSION

Still clinical diagnosis is accurate in most case of acute appendicitis. Ultrasonography has a definite role in acute

appendicitis. It is more useful in female patients whenever there is associated pelvic pathology and in children and also in obese patients where acute appendicitis is in dilemma.

Pain in Right iliac fossa, nausea, vomiting and fever are the cardinal symptoms of acute appendicitis. Tenderness in right iliac fossa, Rebound tenderness were the commonest signs with an accuracy of 90% and 92% respectively. Sensitivity and specificity of the clinical diagnosis were 96.8% and 80% respectively.

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