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Original Research Article

EVALUATING CLINICAL ALVARADO SCORING SYSTEM AND CT CRITERIA IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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Abstract: *The retrospective study was conducted in Combined Military Hospital from January 2021- January 2022 to assess the diagnostic value of CT and the clinical Alvarado scoring system for patients with acute appendicitis. A total of 200 participants were included in the study. Patient details were recorded, including demographic data, radiological findings, Alvarado clinical assessment scoring, and pathological findings. CT evaluation was based on the diameter of the Appendix, presence or absence of appendicolith, peri appendiceal inflammation, and free fluid. Results showed that there was a significant association between CT criteria (free fluid, peri appendiceal inflammation, and appendicolith) and the presence of appendicitis (P=.01). There also was a significant association between Alvarado score and appendicle diameter (P=.01), and also between WBC and appendicle diameter (P=.01). The cut-off value obtained for appendicle diameter was 6.4 mm. Computed tomography is an accurate modality for diagnosing acute appendicitis. CT and Alvarado score systems provide helpful insight for diagnostic workup of suspected cases of acute appendicitis.*

Keywords: Acute Appendicitis, Clinical Alvarado Scoring System, CT scan

Introduction

Acute appendicitis is the leading cause of acute abdominal surgeries and has an estimated risk of 6.8% in females and 8.7% in males (Bastiaenen et al., 2020). It is common in young individuals with peak risk during 2nd and 3rd decades of life (Iabichino et al., 2022). The treatment of choice for simple acute appendicitis is Appendectomy. According to reports, preoperative radiographic examination helps to bring the negative appendectomy rate to 6% from as high as 20%(Bom et al., 2021a). Computed tomography (CT) is a frequently used imaging modality for evaluating acute appendicitis. It has significant diagnostic value due to reduced negative appendectomies rate (Kang et al., 2019). CT has sensitivity and specificity of 97% and 98%, respectively, due to which it has an important role in the treatment planning of patients with acute appendicitis and a preferred imaging modality for diagnosis of suspected appendicitis (Di Buono et al., 2020; Kadi et al., 2022).

Alvarado's clinical scoring system is based on predictive clinical parameters to improve clinical assessment and accuracy in diagnosing acute appendicitis. This system includes clinical signs (shifting pain, fever, rebound tenderness, and right lower quadrant pain), symptoms (anorexia and nausea), and laboratory parameters (neutrophilia and leukocytosis). It has a maximum score of 10; leukocytosis and right lower quadrant pain score 2 each, while all other clinical parameters score 1 (Gonullu et al., 2022).

A Study on the diagnosis and management of acute appendicitis reported that CT scan and Alvarado scoring system could provide valuable insight for accurate assessment of acute appendicitis(El Hattabi et al., 2022). This study is conducted on the local population to assess the diagnostic value of CT and the clinical Alvarado scoring system for patients with acute appendicitis.

Methodology

The retrospective study was conducted in Combined Military Hospital from January 2021- January 2022. The study included male and female patients with acute abdominal pain who underwent abdominal CT within 24 to 48 hours. A total of 200 participants were included in the study. Informed consent of the participants was taken. The ethical board of the hospital approved the study.

Patient details were recorded, including demographic data, radiological findings, Alvarado clinical assessment scoring, and pathological findings. Patients were supine for abdominal C T. Iodinated contrast medium (100 to 120 mL) was injected through the antecubital vein. There was a 1-minute

gap between administration of the contrast medium and data recording.

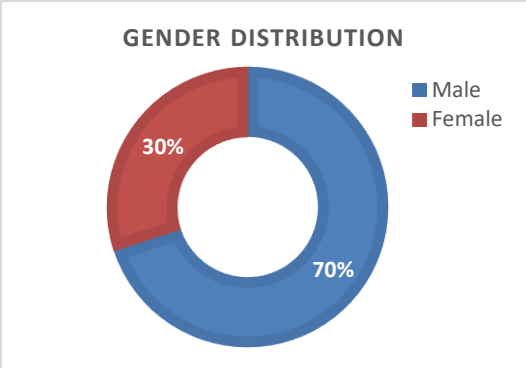
All images, except equivocal cases, were interpreted by a single experienced radiologist. For equivocal cases, the decision of two experienced radiologists was considered valid. Both of them were unaware of pathology results and post-operative notes. On CT images, appendicle diameter was measured, and the presence or absence of free fluid, inflammation, and appendicolith was analyzed against a reference (pathological diagnosis).

CT evaluation was based on IV criteria: I) Diameter, measured at the largest visible portion of the Appendix on the scan; if it was invisible coronal reformat images were used. II) Appendicolith, which is a well-defined structure in the Appendix. Its presence or absence was recorded. III) Inflammation and peri appendiceal inflammation was evaluated. If present, it was categorized into mild, moderate, and severe. 1 cm of peri appendiceal fat stranding was considered mild to moderate, while > 1cm was considered severe inflammation. IV) free fluid, which indicated abscess formation and preformation. Its presence or absence was recorded.

SPSS version 23.0 was used for data analysis. Demographic and laboratory data, CT findings, and Alvarado scores of patients with acute appendices were compared with normal appendices using the Mann-Whitney test. The correlation between Appendix, appendicolith, free fluid, and peri appendiceal inflammation was evaluated using the chi-square test. The correlation between white blood cells (WBC) and appendicle diameter was assessed through Spearman's correlation coefficient. P value < 0.05 was considered statistically significant.

Results

The mean age of the participants was 43 years. There were 140 (70%) males and 60 (30%) females (figure 1).



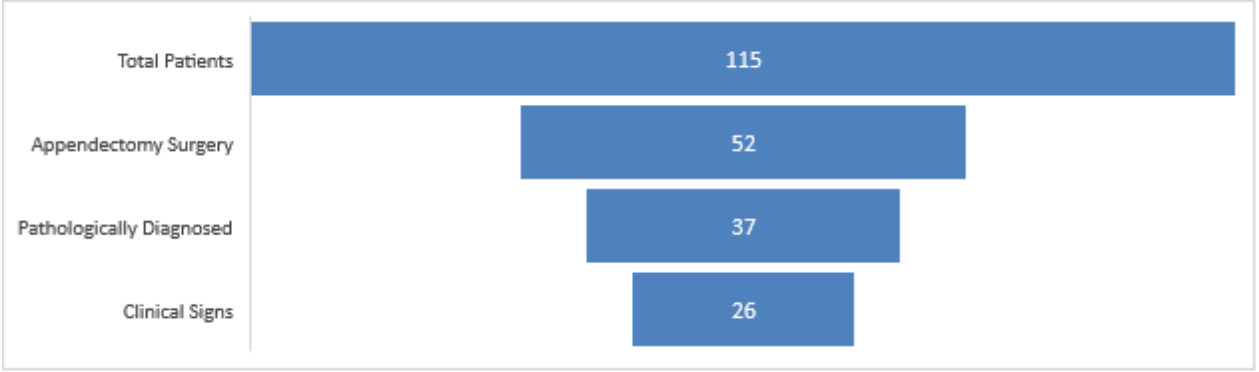
The table1 presents the distribution of participants based on their demographic characteristics.

In terms of gender, the study included 285 (40.77%) male participants and 414 (59.23%) female Of the 200 participants, 85 had normal appendices. Of 115 patients, 52 had appendectomy surgery, 37 had pathologically diagnosed with acute appendicitis, and 26 had clinical signs and were judged by a physician as acute appendicitis, though histopathology was normal (Figure 2).

Table I Evaluation of CT criteria in normal Appendix vs. acute appendicitis

CT sign	Normal Appendix n=85	Acute appendicitis n=115
Appendiceal diameter	3.2± 0.9 mm	8.6 ± 2.7 mm
Mild to moderate inflammation	11 (12.9%)	36 (31.3%)
Severe inflammation	4 (3.4%)	56 (48.6%)
Appendicolith	0	38 (33%)
Free fluid	8 (9.4%)	43 (37.3%)

Figure 2:



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According to histopathology, there were 4 (3.4%) false positive and 10 (8.6%) false negative CT interpretations.

There was no association between appendicitis and sex (P=0.887) and age (P=0.667) of the patient. On the other hand, appendicitis was significantly correlated with WBC and appendicle diameter (P=0.001). In patients with acute appendicitis mean WBC count was 14.5 × 10^9/L±4 and the mean appendicle diameter was 8.6 ± 2.7 mm, while in normal patients mean WBC count was 6.7 × 10^9/L±1.7 and the mean appendix diameter was 3.2± 0.9 mm. The Mean Alvarado score in acute appendicitis was 6.7±1.8. There was a significant association between Alvarado score and appendicle diameter (P=0.01) and WBC and appendicle diameter (P=0.01). The cut-off value obtained for appendicle diameter was 6.4 mm.

There was a significant association between CT criteria (free fluid, peri appendiceal inflammation, and appendicolith) and the presence of appendicitis (P=0.01). CT signs in acute appendices and normal Appendices are shown in Table I.

Discussion

In this study, we evaluated the diagnostic value of the Alvarado scoring system and CT for patients with acute appendicitis. In this study, we based CT evaluation on four criteria: peri appendiceal inflammation, free fluid, appendicle diameter, and appendicolith. For accurate diagnosis and ruling out other etiologies, it is important to determine the maximum appendicle diameter (Tatar et al.). In this study, the cut-off value for appendicle diameter was 6.4 mm, and Alvarado score and appendicle diameter were significantly correlated. The presence of appendicolith was indicative of severe appendicitis. A previous study reported that appendicoliths were associated with appendicle perforation and severe and recurrent appendicitis (Bom et al., 2021b), similar to the current study results. Appendicolith obstructs the root of the Appendix, as it has a narrow lumen and can cause severe disease. In the current study, CT evaluation showed that patients with acute appendicitis have peri-appendiceal inflammation. A previous study reported that peri appendiceal inflammation is most commonly found in retro colic space which is also accompanied by appendicle perforation (Castro et al., 2019).

The Alvarado scoring system is widely used in clinical practice. In the current study mean Alvarado score in acute appendicitis was 6.7±1.8, and there was a significant association between Alvarado score and appendicle diameter (P=.01). A study conducted on patients with pain in the lower right quadrant reported that Alvarado scoring helped establish the diagnosis, score 4 was significantly associated with absence and score 6 with the presence of appendicitis(Williams et al., 2023). Another study reported that an Alvarado score ≥ 7 suggests surgical treatment in patients with acute appendicitis(Kim et al., 2020). A study on the diagnostic accuracy of CT for acute appendicitis suggested that CT is valuable if the patient has leukocytosis and a low Alvarado score (Talabi et al., 2021).

It is important to accurately diagnose acute abdomen to distinguish appendicitis from other pathologies, which may mimic it on a CT scan. These include fibrofatty proliferation, local lymphadenopathy, ectopic pregnancy, endometriosis, mesenteric inflammation, Crohn's colitis, and cecal carcinoma(Bom et al., 2021b). A study showed that CT in routine diagnostic workups can prevent unnecessary surgical intervention(Lau et al., 2022). The surgeon's clinical judgment alone is reliable in cases where sufficient signs of acute appendicitis are present. However, in patients having few diagnostic signs, CT is necessary.

Conclusion

Computed tomography is an accurate modality for diagnosing acute appendicitis. CT and Alvarado score systems provide helpful insight for diagnostic workup of suspected cases of acute appendicitis.

Conflict of interest

The authors declared absence of conflict of interest.

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