

# The Role of Ultrasound and CT Scan In Reducing Negative Appendectomy Rate

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## ABSTRACT

**Objective** To assess the utility of ultrasound and CT scan abdomen and in patients with clinical diagnosis of acute appendicitis so as to reduce the negative appendectomy rate.

**Study design** A retrospective observational study.

**Place & Duration of study** Department of General Surgery, Liaquat National Hospital Karachi, from January 2016 to December 2020.

**Methodology** We reviewed the records of 440 patients who had an appendectomy at our institute. Of this 101 patients with incomplete records were excluded from final analysis. The primary outcome measure was the negative appendectomy rate. Descriptive statistics were applied and logistic regression analysis done to find out the relationship. Odds ratio were also calculated for multiple variables.

**Results** The negative appendectomy rate when computed tomography was used to aid in diagnosis was 2.08% and for ultrasound scan 5.89%. Logistic regression analysis suggested the superiority of computed tomography over ultrasound in the diagnosis of acute appendicitis with odds of 3.895 times when compared to ultrasound with odds of 1.949 times only.

**Conclusion** Use of computed tomography preoperatively for diagnosis of acute appendicitis can help in reducing the negative appendectomy rate.

**Key words** Acute appendicitis, Ultrasonography, Computed tomography, Negative appendectomy rate.

## INTRODUCTION:

Globally, acute appendicitis is a common surgical emergency.<sup>1</sup> The condition is difficult to diagnose especially during the early stages when the classical signs and symptoms are usually subtle. The consequences of missing appendicitis may be grave.<sup>2,3</sup> Historically, negative appendectomy rates of 20%–25% and as high as 40% in women have been reported.<sup>4,5</sup> Many surgeons favored early

laparotomy even in the absence of a definitive diagnosis to reduce the risk of appendiceal perforation.<sup>6</sup> However, with recent advances in the field of radiology, the use of CT scan and ultrasound has considerably decreased the negative appendectomy rate. Internationally negative appendectomy rate of 15% was cited for the United States in 1997, however it has decreased to as low as 6-8%.<sup>7</sup> From Pakistan a negative appendectomy rate of 10 – 12.3% has been reported.<sup>8</sup>

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Diagnosis of appendicitis is usually clinical which is made more objective by using various scoring systems. Biochemistry and radiology also help in strengthening clinical diagnosis. The radiological evaluation mainly includes the use of ultrasound and computed tomography. Keeping in view the advantages of imaging in diagnosis of acute appendicitis the rational approach is warranted. Ultrasound has proven to be a reliable diagnostic

modality. However, it is operator-dependent and the frequency of genitourinary disorders in females can lead to diagnostic errors. In contrast, many studies have shown the increased diagnostic accuracy of CT scan over ultrasound.<sup>9</sup> Adopting standard practice for the diagnosis of acute appendicitis can help in reducing negative appendectomy rates. The aim of this study was to evaluate if diagnostic accuracy for acute appendicitis can be enhanced by rational use of radiological aid.

#### **METHODOLOGY:**

This was a retrospective observational study where electronic medical records ((surgery, radiology, and histopathology) of patients who underwent appendectomy for acute appendicitis from January 2016 to December 2020 at the Department of General Surgery, Liaquat National Hospital Karachi, were reviewed. The ethical approval was granted by an ethical review committee of the hospital.

All patients above 14-years of age with clinical impression of acute appendicitis were included. Data recorded on age, gender, comorbid condition, presenting symptoms, duration of symptoms, ultrasound and computed tomography findings and histopathological reports. All patients had baseline workup including complete blood count, renal function test, and urine DR.

The primary outcome measure of the study was the negative appendectomy rate. The negative appendectomy rate was finally documented by evaluating pathology reports of the specimen sent. All inflamed appendices were labelled as cases of acute appendicitis and all other findings were considered as negative appendectomy reports. Data were analyzed with Statistical Package for Social Sciences (SPSS) Version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics were applied and logistic regression analysis was done.

#### **RESULTS:**

The record of 440 patients were reviewed. Out of these 287 (65.2%) were males and 153 (34.8%) females with a mean age of  $28.43 \pm 5.6$  year. The data of 101 patients were found incomplete, thus excluded from further analysis. A total of 48 (11.3%) patients had co-morbid like diabetes mellitus, hypertension, ischemic heart disease, and peripheral vascular disease.

The most common symptoms were right iliac fossa pain in 233 (68.63%) patients, diffuse abdominal pain in 43 (12.95%), lower abdominal pain in 18 (5.45%), epigastric pain with or without radiation to

right iliac fossa 2% each, and para-umbilical pain with or without radiation to right iliac fossa <2% each. Other major presenting symptoms were fever, nausea, and vomiting. The mean duration of symptoms was  $2.27 \pm 0.35$  days and the mean hospital stay of  $1.98 \pm 0.25$  days.

A total of 339 patients had ultrasound scan done at our institution and 48 patients underwent computed tomography. All were reported as having findings suggestive of acute appendicitis. However, the histopathology reports showed that out of 339 patients who had ultrasound imaging done, acute appendicitis findings were noted in 319 (94.1%) subjects. Comparing it with the computed tomography group, only one (2.08%) patient did not have positive histopathology. Among those with negative appendectomy in the ultrasound group,<sup>14</sup> (70%) patients were females.

Logistic regression analysis showed that the odds of picking acute appendicitis with computed tomography were 3.895 times whereas those for ultrasound were 1.949 times. The odds for getting acute appendicitis were 0.410 times in females when compared to males. Similarly, the odds of being diagnosed with acute appendicitis with co-morbid conditions were 0.643 times compared to those with no co-morbid.

#### **DISCUSSION:**

Acute appendicitis presents with spectrum of symptoms. An early and prompt diagnosis is necessary to reduce the morbidity and mortality associated with it. In many developing countries the diagnosis of acute appendicitis still clinical with laboratory aids. The validity different scoring systems is still controversial. The most commonly used scoring system is ALVARADO which has sensitivity and specificity of 93.5% and 80.6% respectively.<sup>10</sup> Thus chances of negative appendectomy can still be expected. This study aimed at finding utility of two imaging modalities; ultrasound and CT scan, though former was used in majority of the patients as it was cost effective, readily available and without risk of radiation.

Ultrasound adds useful information in a patient clinically suspected of having acute appendicitis. Thus it is an important adjunct. In various studies a sensitivity of 71.2% and specificity of 83.3%, with an overall negative appendectomy rate of 7-11% has been reported.<sup>11,12</sup> This study also added similar evidence to the literature, however there were still number of patients where histopathology report did not find any features suggestive of acute appendicitis.

**Table I:**

Variables	Total Number (%)	Positive n (%)	Negative n (%)	Logistic Regression Statistics
Ultrasound scan	339 (100%)	319 (94.1%)	20 (5.89%)	1.949
CT scan	48 (14.15%)	47 (97.9%)	1 (2.1%)	3.895

Therefore a need of effective diagnostic aid is stressed.

The use of computed tomography for the diagnosis of acute appendicitis was suggested many decades back. The overall sensitivity and specificity of computed tomography for the diagnosis of acute appendicitis in a study is reported as 87.8% and 75.0% respectively.<sup>13</sup> Index study showed that by incorporating computed tomography in selected cases the diagnosis of acute appendicitis is enhanced thus reducing negative appendectomy rate. Ultrasound though cost effective and handy tool but still has 5.89% failure rate which is more in female patients as reported in other study.<sup>14</sup> The low negative appendectomy rate in the CT scan group highlights the fact it is the gold standard investigation for diagnosis of acute appendicitis, therefore it should be added into armamentarium for diagnosing patients of acute appendicitis.

This study has a few limitations including, being carried out retrospectively, data taken from a single institution, and a relatively small number of patients. However, it added useful evidence based report into the existing literature.

#### CONCLUSION:

The use of computed tomography preoperatively for diagnosis of acute appendicitis helps in reducing the negative appendectomy rate compared to ultrasound scan.

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