

# Comparison of Radiologic Diagnosis with the surgical findings in 900 patients of acute appendicitis at Allama Iqbal Memorial Teaching Hospital, Sialkot

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## ABSTRACT

**Aim:** To compare the radiological diagnosis with surgical findings of acute appendicitis

**Methods:** This study included patients presenting with the complaint of pain in the right iliac fossa suggestive of acute appendicitis. The criteria for inclusion; twelve to sixty-five years of age, the existence of pain in the abdomen especially right iliac fossa or lower quadrant. Patients who presented with shock were excluded. Subjects suspected of acute appendicitis were referred for ultrasonography, which was carried out by a senior radiologist. A linear and convex probe was used for ultrasonography. Patients with insignificant findings on ultrasonography were evaluated for pain in the lower right quadrant. Those with ultra-sonographic findings strongly suggestive of acute appendicitis underwent a further evaluation to rule out complications.

**Results:** Our study is based on 900 patients who fulfilled criteria of inclusion, age ranged from 6-55 years (mean 35±6.9 years) male to female ratio (2.22:1), 1036 ultrasonographic scans were done in these patients, 964 urine routine examination. The radiological confirmation of acute appendicitis 723, while clinical diagnosis of 900 patients leading to operative intervention. Laparoscopic appendectomy was done in 288 patients while open surgery in 612 patients. Histopathology of specimen of all the patients were obtained. In sonographic findings, appendix was visualized in 723 (80.33%) patients, uncompressible tubular structure in 723(80.33%), fluid in right iliac region 118(13.11%), mesenteric node enlargement in 103(11.44%), high up subhepatic appendix in 23(2.55%), and mass formation in 24(2.66%) patients. The surgical operative findings in the patients are as: hyperemic swollen appendix 648(72%), Blackened/ gangrenous appendix 84(9.33%), Appendix with pus in surrounding area 57(6.33%), appendix swollen with enlarged mesenteric lymph nodes 210(23.33%), Perforated appendix 58(6.44%), Early mass formation 35(3.88%) and Subhepatic appendix 23(2.55%).

**Conclusion:** Ultrasonography being non invasive investigation is advised to diagnosis appendicitis. It has optimal sensitivity and for its diagnosis and suitable diagnostic method for assessing complications of appendicitis. The false negative diagnosis at ultrasonography for acute appendicitis is quantified as 14.44% with accuracy or sensitivity of 85.46%.

**Keywords:** Appendicitis, incompressible, tubular structure, clinical diagnosis.

## INTRODUCTION

The appendix is a vestigial organ in the human body. It is a tubular projection of the cecum with an approximate length of 7-11 cm. The inflamed appendix gives rise to acute appendicitis, which requires prompt treatment. It is the most common surgical emergency related to abdomen. Due to variable position of tip of the appendix, clinical presentations may differ; Retrocaecal/retrocolic (75%): Patient presents with pain in right loin along with tenderness on palpation. Signs and symptoms can be atypical<sup>1,2</sup>. Overlapping the cecum hinders tenderness on deep palpation and muscle rigidity. The patient keeps

his/her hip flexed to prevent the psoas muscle from being irritated. This is the reason for the exacerbation of pain in these patients during the extension of the hip. Subcaecal and pelvic (20%): Patient presents with pain in suprapubic region and diarrhea due to rectal irritation. There may be an increase in urinary frequency. Rectal or vaginal tenderness is usually present. Abdominal tenderness may be absent. On urine analysis, leukocytes and microscopic hematuria are observed. Pre-ileal and post-ileal (5%): There are no specific signs and symptoms with prominent vomiting. Ileal irritation may cause diarrhea. The patient usually presents with facial flushing and dry tongue associated with poor oral hygiene. Tachycardia along with high-grade fever is also common. The patient localizes the pain with his/her finger, usually pointing at the right iliac fossa<sup>3,4</sup>. On examination of the abdomen, the site localized

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is tender on palpation with muscle rigidity and rebound tenderness. On coughing, the pain is localized at the right iliac fossa. Any kind of movement exacerbates the pain of the patient. Usually, McBurney's point, which is two-third of the imaginary plane drawn between the anterior superior iliac spine and umbilicus, is maximally tender. Rectal and vaginal examination is usually insignificant but tenderness may be present in the case of the pelvic appendix. The most reliable signs of acute appendicitis include tenderness on percussion, muscle guarding and rebound tenderness. Rovsing, psoas and obturator signs may aid in the diagnosis<sup>5,6</sup>. Simple appendicitis: The appendix is inflamed but there is no abscess, gangrene or perforation. Complicated appendicitis: the appendix may be gangrenous, perforated or there may be a periappendicular abscess. Negative appendectomy: Appendix is found normal on biopsy when operated for acute appendicitis<sup>7,8</sup>.

Usually, there are two common incisions, which are made for open appendectomy. One of them is known as gridiron incision, which is given over McBurney's point. The other one is Lanz incision, which is made transversely along with McBurney's point and is acceptable cosmetically. An increase in laparoscopic procedures has reduced the rate of open appendectomy. Moreover, complications such as wound infection and post-operative pain are significantly decreased. Duration of stay at hospital and time taken to return to normal routine is also reduced. But the incidence of intra-abdominal abscesses was raised after laparoscopic surgery. However, a recent study has nullified the differences between the two techniques except for the improved quality of life after the laparoscopic technique. The laparoscopic technique requires special expertise and facilities. This technique can also be used for differentiating pathology from clinical diagnosis. Like Modified Elvorado scoring as : Migration of abdominal pain to the RLQ(1), Anorexia (or acetone in the urine)(1), Nausea/vomiting(1), Tenderness in the RLQ(2), Rebound pain(1), Increase of temperature ( $\geq 37.3$  °C) (1), Leukocytosis ( $>10,000$ ) (2), Shift to the left (in a differentiated WBC count) (eg, neutrophilia  $>75\%$ ) (1) . Cumulative scores : 5–6 compatible with acute appendicitis, 7–8 probable for acute appendicitis and 9–10 very probable for acute appendicitis. A score of 5 or 6 may be observed. A score of 7 or higher should proceed to appendectomy<sup>9,10</sup>.

The diagnosis is usually made on history given by the patient and clinical evaluation. The cause is multifactorial. Dietary and luminal factors may have significance. The most favorable treatment is laparoscopic appendectomy. Incidence of acute appendicitis is between ages of ten and twenty years, with male mostly affected. The most primary complaint with which the patient presents is abdominal pain, which is often followed by vomiting. The pain increases in intensity with the passage of time, therefore becoming constant and migrating to the right iliac fossa from the periumbilical region. Nausea, constipation and loss of appetite are often present. Profuse vomiting in such cases is indicative of peritonitis due to perforation. No symptom has found to be diagnostic of acute appendicitis except migratory pain. There is an increased risk of

mortality in elder patients with acute appendicitis; therefore, prompt intervention should be done<sup>11,12</sup>.

Imaging methods such as computed tomography and ultrasonography are used to confirm and correlate signs of acute appendicitis. Being a cheap method, ultrasonography is widely used in clinical setups though it has less sensitivity and specificity. Furthermore, it has not reduced the incidence of negative appendectomy. Surgeons are advised not to make clinical decisions based on ultrasonography. However, it is still reliable in thin and lean patients. The sensitivity of sonography has been under discussion and no formal data collection at our center was done previously so we wanted to record data and correlate it with operative findings.

## PATIENTS AND METHODS

This study included patients presenting with the complaint of pain in the right iliac fossa suggestive of acute appendicitis. The criteria for inclusion; twelve to sixty-five years of age, the existence of pain in the abdomen especially right iliac fossa or lower quadrant. Patients who presented with shock were excluded. The surgeon, having clinical experience of more than 10 years, evaluated the patients. Subjects suspected of acute appendicitis were referred for ultrasonography, which was carried out by a senior radiologist having at least 10 years of clinical experience. A linear and convex probe was used for ultrasonography. Patients with insignificant findings on ultrasonography were evaluated for pain in the lower right quadrant. Those with ultrasonographic findings strongly suggestive of acute appendicitis underwent a further evaluation to rule out complications. The appendix was not visualized on ultrasonography in a few patients. Appendectomy was performed on patients under the most recent guidelines. In some patients, rate negative laparotomy was performed in which a non-flamed appendix was removed though findings suggested acute appendicitis. Simple appendicitis: The appendix is inflamed but there is no abscess, gangrene or perforation. Complicated appendicitis : The appendix may be gangrenous, perforated or there may be a periappendicular abscess. Negative appendectomy: Appendix is found normal on biopsy when operated for acute appendicitis. Analysis was done by SPSS v 23. Chi-squared test was used for qualitative variables and independent *t* test was used for quantitative variables. Correlation between variables was assessed by Spearman test. *p* less than 0.05 was considered significant.

## RESULTS

Table I shows general statistics of the study. Table II shows the frequencies of sonographic findings. Table III presents operative findings. Table IV gives conclusion of the findings comparative analysis. Sonographic findings were suggestive of acute appendicitis in 777(86.33%) patients out of 900 (100%) surgeries while there were about 54(6.00%) normal appendices. So accuracy of 723 out of 846 i.e. 85.46% confirmed appendices; while clinical diagnosis lead to 900 appendicectomies and out of which

846(94.00%) were confirmed inflamed appendices while 54 (6%) cases were negative.

Table 1: General statistics

Total patients underwent sonography with pain in right iliac region	1628
Total patients operated in 3 years	1125
Patients fulfilling criteria of preop sonography and underwent surgery	900
Age	6-55 years (mean 35±6.9 years)
M:F	207: 93(2.22: 1 )
Ultrasonography reports	1036
TLC reports	1125
Urine R/E reports	964
Radiological diagnosis of Acute Appendicitis	723
Clinical diagnosis of Surgeon	900
Open surgery	612
Laparoscopic appendectomy	288
Follow up period	3 months
Duration of hospitalization	2±1 days
Histopathology reports	900

Table II: Radiologic/Sonographic findings (n=900)

Appendix visualized	723(80.33%)
Uncompressible tubular structure	723(80.33%)
Fluid in right iliac region	118(13.11%)
Mesenteric nodes enlargement	103(11.44%)
High up appendix (subhepatic appendix)	23(2.55%)
Mass formation	24(2.66%)

Table III – Operative findings (n=900)

Red / hyperemic/swollen appendix	648(72%)
Blackened/ gangrenous appendix	84(9.33%)
Appendix with pus in surrounding area	57(6.33%)
Appendix swollen with enlarged mesenteric lymph nodes	210(23.33%)
Perforated appendix	58(6.44%)
Early mass formation	35(3.88%)
Subhepatic appendix	23(2.55%)

Table IV -Analysis of Sonographic diagnosis (n=900)

Preoperative Diagnosis	777(86.33%)
Operative Diagnosis	846(94.00%)
Sonographic diagnosis in confirmed operative appendices	723 out of 846=(85.46%)
False negative Sonographic Diagnosis	123(13.66%)
False negative Operative Diagnosis	54(6.00%)

## DISCUSSION

Although appendicitis is common at all ages, Various factors such as age, sex, race, geographical location, diet, and appendix position can affect appendicitis-related mortality. The most important symptoms of appendicitis are abdominal pain, nausea, vomiting, and fever. Pain is the most common symptom and occurs in 50 to 100% of cases. Nausea and vomiting are usually followed by pain.

The pain is usually somatic and is felt around the umbilical region. In abdominal examination, in addition to tenderness and guarding, rebound tenderness is of great importance in diagnosis. In our study; the surgical operative findings in the patients are as: hyperemic swollen appendix

648(72.00%), Blackened/ gangrenous appendix 84(9.33%), Appendix with pus in surrounding area 57(6.33%), Appendix swollen with enlarged mesenteric lymph nodes 210(23.33%), Perforated appendix 58(6.44%), Early mass formation 35(3.88%) and Subhepatic appendix 23(2.55%). These symptomatology and operative findings are very much comparable with the study by Irish et al<sup>13</sup>.

Our study shows; Sonographic findings as suggestive of acute appendicitis in 777(86.33%) patients out of 900 (100%) surgeries while there were about 54(6.00%) normal appendices. So accuracy of 723 out of 846 i.e. 85.46% confirmed appendices; while clinical diagnosis lead to 900 appendicectomies and out of which 846(94.00%) were confirmed inflamed appendices while 54 (6.00%) cases were negative. These results are comparable to international studies as it is shown in the study by, Wagner et al<sup>14</sup>, Denjalic et al<sup>15</sup>, Rosengren et al<sup>16</sup>, Mohammadi et al<sup>17</sup>, Quigley et al<sup>18</sup>, Wiersma et al<sup>19</sup>, Ross et al<sup>20</sup> Reddan et al<sup>21</sup>, Quillin et al<sup>15</sup>. and Parsijani et al<sup>23</sup>

Proper and early diagnosis of appendicitis is important to reduce the complications of perforation. However, negative appendectomy often results in surgical and anesthetic complications such as positive appendectomy. Therefore, many methods have been suggested to improve diagnostic accuracy in suspicious cases, such as laboratory tests, ultrasound, CT, and laparoscopy. Among imaging modalities, ultrasound is a non-invasive, safe, inexpensive, and affordable method, more so, theoretically, Ultrasound has a higher diagnostic value, especially in children, because of their lower body thickness and less fat than adults. In this regard, the use of ultrasound with a specially designed protocol for the diagnosis of acute and complicated appendicitis in children is necessary to increase the diagnostic accuracy. Ultrasound as a diagnostic modality in acute appendicitis depends on the operator and protocol, and because of this, it is necessary to determine sensitivity and specificity in each center.

## CONCLUSION

Ultrasonography being non invasive investigation is advised to diagnosis appendicitis. It has optimal sensitivity and for its diagnosis and suitable diagnostic method for assessing complications of appendicitis. The false negative diagnosis at ultrasonography for acute appendicitis is quantified as 14.44% with accuracy or sensitivity of 85.46%. As compared to clinical accuracy of 94% and 6% of negative appendix removed surgically.

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