"ASSESSMENT OF COMBINED EFFICACY OF MODIFIED ALVARADO SCORE AND ABDOMINAL ULTRASOUND IN CASES OF SUSPECTED ACUTE APPENDICITIS"

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IN

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Under the Guidance of

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LIST OF ABBREVIATIONS

MAS: Modified Alvarado score

MASS: Modified Alvarado Scoring System

USG: Ultrasonography

CT: Computerized Tomography

CECT: Contrast Enhanced Computerized Tomography

NAR: Negative Appendectomy Rate

RIF: Right Iliac Fossa

RLQ: Right Lower quadrant

TLC: Total Leukocyte Count

CRP: C - reactive protein

MDCT: Multi Detector CT

PPV: Positive Predictive Value

NPV: Negative Predictive Value

Yrs: Years

+ve: positive

-ve: negative

HPE: Histo-Pathological Examination

M: Male

F: Female

WBC: White Blood Cells

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INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies with lifetime prevalence of approximately 1 in 7 and despite advances in diagnosis and treatment; it is still associated with significant morbidity (10%) and mortality (1–5 %) [1].

Presentations of acute appendicitis can mimic variety of acute medical and surgical conditions and the diagnosis is predominantly a clinical one.[2,3] The clinical history and physical examination represent the most important tools for early diagnosis of the disease. Delay in diagnosis definitely increases the morbidity, mortality and cost of treatment and incorrect diagnosis often subject the patient to unnecessary operation[4]. The goal of surgical treatment is removal of an inflamed appendix after early diagnosis prior to perforation with a minimal number of negative appendectomies.

Based on unaided clinical diagnosis, the negative appendectomy rate (NAR) is about 15-30% and reaches even higher (up to 45%) in women of a childbearing age because of the prevalence of gynecological diseases[5].It has been claimed that diagnostic aids can dramatically reduce the number of appendectomies in patients without appendicitis. Nowadays commonly used diagnostic aids for appendicitis are diagnostic scores, USG, CECT abdomen, laparoscopy. Despite the refined investigations there is no solution for the diagnostic dilemma of acute

appendicitis: no particular test can reduce the rate of negative appendectomy to zero, hence combination of diagnostic aids may increase the accuracy even more.

Alvarado score and its modification- Modified Alvarado score is one such widely accepted scoring system. The Modified Alvarado score is a 9 point scoring system for the diagnosis of appendicitis based on clinical signs and symptoms and a leucocytes count. Score of 7 or more were recommended for surgery.[19, 26]

USG is easily available, cost effective and radiation free. Graded compression ultrasonography has greatly improved the ability to diagnose acute appendicitis with ultrasound.[55]

This study is designed to assess the accuracy of using combination of modified Alvarado scoring and ultrasonography in acute appendicitis to help in surgical decision making.

OBJECTIVES OF THE STUDY

- To test the combined efficacy of Modified Alvarado score and USG in diagnosing acute appendicitis.
- To compare the Intra-operative findings and histo-pathological reports with the modified Alvarado score and abdominal USG findings and assessing the results.

REVIEW OF LITERATURE

The vermiform appendix is considered by most to be a vestigial organ; its importance in surgery results only from its propensity for inflammation, which results in the clinical syndrome known as 'acute appendicitis'. Acute appendicitis is the most common cause of an 'acute abdomen' in young adults[6].

In 1886, Reginald Fitz correctly identified the appendix as the primary cause of right lower quadrant inflammation. He coined the term appendicitis and recommended early surgical treatment of the disease.

ANATOMY[7]:

Appendix is derived from the midgut. The appendix appears at the eighth week of gestation as an outpouching of the cecum. As gestation progresses, the appendix becomes more elongated and tubular as the cecum rotates medially and becomes fixed in the right lower quadrant of the abdomen.

The appendix is of variable size (5 to 35 cm in length) but averages 9 cm in length in adults. Its base can be reliably identified by defining the area of convergence of the taeniae at the tip of the cecum and then elevating the appendiceal base to define the course and position of the tip of the appendix, which is variable in location.

The appendiceal tip may be found in a variety of locations, with the most common being retrocecal (but intraperitoneal) in approximately 60% of

individuals, pelvic in 30%, and retroperitoneal in 7% to 10%. Agenesis of the appendix has been reported, as has duplication and even triplication[9]. Knowledge of these anatomic variations is important to the surgeon because the variable position of the appendiceal tip may account for differences in clinical presentation and in the location of the associated abdominal discomfort.

The appendix possesses a complete peritoneal covering and has its own mesoappendix, which is attached to the mesentery of the distal ileum. Contained within the mesoappendix is the appendicular artery, which is a branch of the posterior cecal artery. Sometimes an Artery of sheshachalam is an accessory artery of appendix, runs through mesoappendix. A branch of posterior iliac artery which is a branch of ileocolic artery also supplies the appendix. Venous drainage of the appendix is via the appendicular vein, which drains into the posterior cecal vein.

The nerve supply of the appendix is derived from both sympathetic and vagal fibers. Visceral pain from the appendix is conducted by the afferent sympathetic fibers that enter at the T10 spinal level

8-15 lymphatic vessels ascend in the mesoappendix from the body and apex and are occasionally interrupted by 2 or 3 lymph nodes. They unite to form 3-4 larger lymph vessels and drain in to the lymphatic draining the ascending colon and end in the inferior and superior nodes of ileocolic chains.

Histological examination of the appendix indicates that goblet cells, which produce mucus, are scattered throughout the mucosa. The submucosa contains lymphoid follicles, leading to speculation that the appendix might have an important, as yet undefined immune function early in the development. In adults, the appendix has no known function.

PATHOPHYSIOLOGY:

Obstruction of the lumen is believed to be the major cause of acute appendicitis. The appendix is vulnerable to this phenomenon because of its small luminal diameter in relation to its length. Obstruction of the proximal lumen of the appendix leads to elevated pressure in the distal portion because of ongoing mucus secretion and production of gas by bacteria within the lumen. With progressive distention of the appendix, the venous drainage becomes impaired, resulting in mucosal ischemia. With continued obstruction, full-thickness ischemia ensues, which ultimately leads to perforation. Bacterial overgrowth within the appendix results from bacterial stasis distal to the obstruction. This is significant because this overgrowth results in the release of a larger bacterial inoculum in cases of perforated appendicitis.

The causes of the luminal obstruction are many and varied. These most commonly include fecal stasis and fecoliths but may also include lymphoid hyperplasia, neoplasms, fruit and vegetable material, ingested barium, and parasites such as Ascariasis. Pain of appendicitis has both visceral and somatic components.

Distention of the appendix is responsible for the initial vague abdominal pain (visceral) often experienced by the affected patient.

The time from onset of obstruction to perforation is variable and may range anywhere from a few hours to a few days. The presentation after perforation is also variable. The most common sequela is the formation of an abscess in the peri-appendiceal region or pelvis. On occasion, however, free perforation occurs that results in diffuse peritonitis.[7]

CLINICAL FEATURES:

Appendicitis needs to be considered in the differential diagnosis of almost every patient with acute abdominal pain[7]. It has been said that nothing can be so simple, nor yet as difficult as the diagnosis of acute appendicitis. Typically two clinical syndromes of acute appendicitis are described.[6]

Acute catarrhal (non-obstructive)

Acute obstructive appendicitis-dangerous type

SYMPTOMS:

Migratory abdominal pain:

Patients presenting with acute appendicitis typically complain of vague abdominal pain that is most commonly periumbilical in origin and reflects the stimulation of visceral afferent pathways through the progressive distention of the

appendix. As the condition progresses and the appendiceal tip becomes inflamed, resulting in peritoneal irritation, the pain localizes to its classic location in the right lower quadrant. This phenomenon remains a reliable symptom of appendicitis and should serve to further increase the clinician's index of suspicion for appendicitis.[11]

Anorexia:

Anorexia is a useful and constant clinical feature, particularly in children.[6]

Nausea and vomiting:

Vomiting generally occurs in the early stages of the attack, but usually a few hours after the initial pain due to protective pylorospasm. Many patients do not vomit, but instead have a sensation of vomiting. The degree of nausea and the frequency of vomiting in the early stages appear to depend on two factors – first, the amount of distension of the inflamed appendix, and secondly the reflux nervous susceptibility of the patient. It may be taken as an important general rule that the severity and frequency of the vomiting at the onset of an attack of appendicitis indicate the degree of distension of the appendix and consequently the immediate risk to the patient that perforation may occur[12].

Bowel disturbance:

Constipation is common. Diarrhea can occur in pre or post ileal positions of the appendix because of the irritation of the distal ileum. Pelvic abscess can irritate the distal gut leading to frequent evacuation or tenesmus.[12]

Urinary disturbance:

Irritation of the ureters by the retrocecal appendix may give rise to pain mimicking right ureteric colic. Increased frequency of micturition, hematuria, and dysuria can occur due to the irritation by the inflamed pelvic appendix.

PHYSICAL

SIGNS:

Temperature:

Fever is frequently present, ranging from low-grade temperature elevations (<38.5° C) to more impressive elevations of body temperature, depending on the status of the disease process and the severity of the patient's inflammatory response. Absence of fever does not exclude a diagnosis of appendicitis.[11, 12]

Pulse rate:

It is usually normal or slightly elevated. It increases in proportion with the temperature of the patient.

Tenderness:

As soon as the pain has shifted, there is localized tenderness either at Mc Burney's point or elsewhere, as determine by the site of the appendix. These determine the operative approach. Mc Burney (1889) stated that the seat of greatest pain determined by the pressure of one fingered examination, has been very exactly between an inch and a half to 2 inches from the anterior superior iliac spine in a straight line drawn from that process to umbilicus. Now it is generally accepted as a point of junction between lateral 1/3rd and medial 2/3rd of a line drawn from umbilicus to right anterior superior iliac spine. These points suppose to correspond to the base of the appendix. **Sir Cope**[11] remarks that tenderness over the Mc Burney's point is not always constant. The pain seems to be actually located in the appendix itself and therefore depends on the position of the appendix.

Guarding and Rigidity:

Guarding is an involuntary, protective process, preventing palpation. True guarding and voluntary false guarding should be differentiated. Guarding will usually be present over the right lower abdomen. Rigidity occurs when peritonitis sets in. Muscular rigidity occurs when the inflamed organ is in contact with the muscle.[6]

CLINICAL TESTS

Mc Burney's sign:

When appendix lies in the anterior position, the tenderness is often maximal over the McBurney's point, where the base of the appendix is situated.[13]

Rovsing's sign:

Rovsing's sign (Neils T.Rovsing, 1862–1927, Danish surgeon) is positive when pressure over the patient's left lower quadrant causes pain in the right lower quadrant. This sign is sometimes called indirect tenderness.[14].

Psoas sign:

Psoas sign or "Obraztsova's sign" is right lower-quadrant pain that is produced with the patient extending the hip due to inflammation of the peritoneum overlying the iliopsoas muscles and inflammation of the psoas muscles themselves. Straightening out the leg causes the pain because it stretches the muscles, and flexing the hip into the "fetal position" relieves the pain.[14]

Obturator sign:

If an inflamed appendix is in contact with the obturator internus, spasm of the muscle can be demonstrated by flexing and internal rotation of the hip. This maneuver will cause pain in the hypogastrium.[15]

Dunphy's sign:

Localized irritation and inflammation of the peritoneum results in pain with cough.[16]

Blumberg sign:

Also referred as rebound tenderness. Deep palpation of the viscera over the suspected inflamed appendix followed by sudden release of the pressure causes the severe pain on the site indicating positive Blumberg's sign and peritonitis.[17]

Hyperesthesia in Sherren's triangle:

Sherren's triangle is formed by imaginary lines joining the umbilicus, right anterior superior iliac spine and pubic symphysis. This is elicited by gently picking up a fold of skin and subcutaneous fat and drawing it away from the abdominal wall or by stroking the abdominal wall with a pin. Presence of hyperesthesia in Sherren's triangle is regarded by some clinicians as a good guide in the diagnosis of acute appendicitis before perforation. If in such a case, hyperesthesia disappears later on, it indicates the bursting of the gangrenous appendix.[18]

Pointing test:

The patient with acute appendicitis will point to the right lower abdomen on coughing pointing to the site of inflammation. This is due to the irritation of the parietal peritoneum by the inflamed organ.[6]

Rectal Tenderness:

In patients with appendicitis whose inflammation is confined to the pelvis, rectal examination may reveal tenderness, especially on the right side, and some patients with perforation may have a rectal mass (i.e., pelvic abscess).[6]

Conditions mimicking acute appendicitis:

The differential diagnosis of appendicitis can include almost all causes of abdominal pain.[11]

Table 1: Differential diagnosis of acute appendicitis[6]

Children	Adult	Adult female	Elderly
Gastroenteritis	Regional enteritis	Torsion/rupture of ovarian cyst	Diverticulitis
Mesenteric adenitis	Ureteric colic	Pelvic inflammatory disease	Intestinal obstructio
Meckel's diverticulitis	Perforated peptic Ulcer	Mittelschmerz	Colonic carcinoma

Intussusception	Torsion of testis	Pyelonephritis	Mesenteric infarction
Henoch-Scholein pupura	Pancreatitis	Ectopic pregnancy	Torsion appendix epiploicae

Diagnostic aids:

Acute appendicitis has customarily been a clinical diagnosis. Patients' history and physical examination is very important for proper diagnosis. It is possible to have an absolute diagnosis of appendicitis only after surgery and histopathological examination of specimen, thus it is impractical to have a definitive preoperative diagnosis. Decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% of cases and an associated morbidity of around 10%.

The clinical diagnosis of appendicitis is a subjective estimate of the probability of appendicitis based on multiple variables that individually are weak discriminators; however, used in conjunction, they possess a high predictive value. This process can be made more objective by the use of clinical scoring systems.[12]

Over the last two decades different protocols have been introduced and tested by different researchers which include **Alvarado A, Owen TD et al,**

Ohmann C et al, to make an early diagnosis of this sometimes very elusive disease.[19, 20, 21]

The Alvarado score was first described in 1988 by Alfredo Alvarado, it is diagnostic scoring system developed in an attempt to improve the diagnostic accuracy of acute appendicitis & to reduce the negative appendectomy

The high diagnostic value of this scoring system has been confirmed in a number of studies. The general consensus of researchers is that the Alvarado score is noninvasive, safe diagnostic method which is simple, reusable and repeatable and can aptly guide the clinician in establishing diagnosis and subsequent management. It carries high significance in the diagnosis of acute appendicitis.[22, 24]

Eight predictive factors were found to be useful in making the diagnosis of acute appendicitis. Their importance, according to their diagnostic weight, was determined as follows: localized tenderness in the right lower quadrant, leukocytosis, migration of pain, shift to the left, temperature elevation, nausea-vomiting, anorexia, and direct rebound pain. Based on these eight, Alvarado et al devised a practical diagnostic score that may help in interpreting the confusing picture of acute appendicitis.[19]

Table 2: Alvarado Score

Clinical feature		Score
Symptoms	Migratory RIF	1
	Anorexia	1
	Nausea/vomiting	1
Signs	Tender RIF	2
	Rebound tenderness	1
	Elevated temperature	1
Laboratory Findings	Leukocytosis	2
	Shift to Left of neutrophils	1
	Total	10

It is also known as the MANTRELS score, which tabulates migration of pain, anorexia, nausea and/or vomiting, tenderness in the RLQ, rebound tenderness, elevated temperature, leukocytosis, and shift to the left.

Kalan M et al omitted left shift of neutrophil maturation and produced a modified score of 9.[26]

Table 3: Modified Alvarado Score

Clinical feature		Score
Symptoms	Migratory RIF	1
	Anorexia	1
	Nausea/vomiting	1
Signs	Tender RIF	2
	Rebound tenderness	1
	Elevated temperature	1
Laboratory findings	Leukocytosis	2
	Total	9

Bhattacharjee PK et al[27]**, Abhinandan B et al (2016)**[28] in their study concluded that high score was found to be a dependable aid both in the pre- operative diagnosis of acute appendicitis and in the reduction of negative appendectomies in men and children but the same was not true for women who had a high false positive rate for acute appendicitis.

S Kanumba et al (2011)[29], in their study of 127 patient concluded the accuracy of MASS to be 92.9% and use of MASS in patients suspected to have acute appendicitis provides a high degree of diagnostic accuracy and subsequently reduces negative appendectomy and complication rates. However, additional investigations may be required to confirm the diagnosis in case of atypical presentation.

Talukder DB et al (2009)[30] in their study of 100 patients showed MASS had sensitivity of 93% in males, 84% in females with score >7 and total negative appendectomy rate of 12% in males and 21 % in females and concluded, Alvarado score is a fast, simple, reliable, noninvasive, repeatable and safe diagnostic modality without extra expense and complications.

AG Soomro et al (2008)[31], in their study of 227 patients, concluded that Alvarado scoring system can be used to diagnose acute appendicitis in the emergency department. It is easy and quick to apply. It also allows observation and re-observation regarding clinical behavior of patient, whether or not to intervene for surgery. Its application can avert negative appendectomy or else prevent from complications leading to gangrene, perforation, wound sepsis, and hence use of costly antibiotics and increased hospital stay.

Zahid Ali Memon et al (2013)[32], in their study of 110 patients concluded that

Positive and negative predictive values were 92.3% and 83.3%, respectively, and

accuracy was 89.8%. Alvarado score can be used effectively to reduce the incidence of negative appendectomies. However, its role in females was not satisfactory and needs to be supplemented by other means.

Lamparelli MJ et al, [33] **Shrivastava UK et al,** [34] has shown in their studies that sensitivity in the same score was more in male than female patients.

Lower values in female patients were due to presence of diseases in genital system i.e. ovaries, salphinges etc and suggested that in females additional investigations may be required to confirm the diagnosis.

Kohla SM et al (2015)[35]**,** in their study of 100 patients concluded that MASS at the cutoff value of (>/ 7) have a sensitivity of 93.3 % and accuracy of 84.42 % and strong indication for urgent surgery.

Kalan M et al[26] in their study showed 93%, 67% and 100% sensitivity in men, women and children respectively in cases with MAS (>/ 7).The negative appendectomy rate in women was 33%.

Owen TD et al, [20] in their study showed 94%, 78% and 88% sensitivity in men, women and children respectively in cases with Modified Alvarado Score > 7.

Goyal P et al(2014),[36] sensitivity of Modified Alvarado Score in male, female and children was 93.75%, 66.66% and 91.66% respectively in cases with MAS (>/ 7) with false positivity rate 5.25 %, 33.34%, 8.34% respectively and advised additional use of ultrasonography or diagnostic laparoscopy to minimize the unacceptably high false positive rate in women.

Andrew C. Meltzer et al (2013), [37] in their study of 261 patients concluded with a sensitivity of 72%, a low modified Alvarado score is less sensitive than clinical judgment in excluding acute appendicitis.

LABORATORY:

INVESTIGATIONS :

Total count – Leukocytosis:

Total count- leukocytosis ranging from 10,000 to 18,000/cu mm is usually present in uncomplicated appendicitis. In addition, an increase in the percentage of the neutrophils (the left shift) is seen. White blood cell counts above this level raise the possibility of a perforated appendix with or without an abscess. Of note is the observation of some that if TLC is repeated after a few hours, it tends to remain high in those with acute appendicitis but tends to fall in those without. Others have observed that TLC and neutrophil count are particularly sensitive in children. Thus although a raised WBC count is a highly sensitive test for acute appendicitis, it has low specificity and its value seems to be prompt in a patient with equivocal features of acute appendicitis.[38, 39]

C-reactive protein:

C-reactive protein (CRP) is an acute-phase reactant synthesized by the liver in response to infection or inflammation. A rapid assay is widely available. Several prospective studies (**Thimsen DA et al,**[40] **Albu E et al,**[41] **de Carvalho BR et al**[42]) have shown that, in adults who have had symptoms for longer than 24

hours, a normal CRP level has a negative predictive value of 97-100% for appendicitis.

Hyperbilirubinemia:

Hyperbilirubinemia is frequently associated with appendicitis. Elevated bilirubin levels have a predictive potential for the diagnosis of appendiceal perforation. The odds of appendiceal perforation are three times higher for patients with hyperbilirubinemia compared to those with normal bilirubin levels[43]

Chaudhary P et al (2013), [44] **Andrew Emmaneul et al (2011),** [45] **Estrada JJ et al (2007),** [46] in their studies concluded that bilirubin is a specific marker for acute appendicitis with a good positive predictive value, It is also a valuable indicator of patients more likely to have appendiceal perforation or gangrene and bilirubin should be used together with clinical examination and other laboratory investigations in the assessment of patients with suspected acute appendicitis.

Sand M et al (2009)[47] in their studies concluded that Patients with hyperbilirubinemia and clinical symptoms of appendicitis should be identified as having a higher probability of appendiceal perforation than those with normal bilirubin levels.

IMAGING:

X-ray:

Plain radiographs are frequently obtained in the emergency department setting for the evaluation of acute abdominal pain but lack both sensitivity and specificity for the diagnosis of appendicitis and are rarely helpful.[7]

Findings that may support the diagnosis include the presence of a calcified faecolith in the right lower quadrant, although this finding must be placed into the appropriate clinical context and is typically present in only 5% of cases.[48]

Pneumoperitoneum, if present, should alert the clinician to other causes of a perforated viscus (such as a perforated ulcer or diverticulitis), as this is not typically observed in cases of appendicitis, even with perforation.[7]

In a study by **Boleslawski E et al**[49] of 104 patients with acute onset of right lower quadrant pain, interpretation of plain x-rays changed the management of only six patients and in one case, contributed to an unnecessary laparotomy.

A Petroianu et al (2012)[50] in their study of 470 patients concluded that the radiographic image of faecal loading in the cecum is associated with acute appendicitis and disappears after appendectomy. This sign is uncommon in other acute inflammatory diseases of the right side of the abdomen.

Computed Tomography:

CT has been shown to have a sensitivity of 90% to 100%, a specificity of 91% to 99%, a positive predictive value of 92% to 98%, and a negative predictive value of 95% to 100%.[48] The use of high-resolution multidetector CT (64-MDCT) with or without oral or rectal contrast results in more than 95% accuracy in the diagnosis of acute appendicitis.[51] CT has proved most valuable for older patients[53] in whom the differential diagnosis is lengthy, clinical findings may be confusing, and appendectomy carries increased risk[52].

In the setting of typical right lower quadrant pain and tenderness with signs of inflammation in a young male patient, a CT scan is unnecessary, wastes valuable time, may be misinterpreted, and exposes the patient to risks for allergic contrast reaction, nephropathy, aspiration pneumonitis and ionizing radiation.

Betzalel Reich et al (2011), [54] in their study of 136 patients concluded that, radiologist-operated USG had inferior sensitivity and positive predictive value when compared with CT, though was significantly faster to perform, and avoided radiation and contrast in a majority of patients. A "first-pass" approach using USG first and then CT if USG is not diagnostic may be desirable.

Ultrasonography:

In 1986, Puylaert described a graded compression technique for evaluating the appendix with transabdominal sonography.[55]

Sonographic findings consistent with acute appendicitis include an appendix of 7 mm or more in anteroposterior diameter, a thick-walled, noncompressible luminal structure seen in cross section, referred to as a target lesion, or the presence of an appendicolith

Its greatest utility appears to be in the evaluation of the pediatric or pregnant patient, in whom the associated radiation exposure from CT is undesirable.

Disadvantages of ultrasonography include operator-dependent accuracy and difficulty interpreting the images by those other than the operator.[7]

In a study done by **Mallin M et al (2015)**, [56] concluded that, bedside ultrasound may be an appropriate initial test to evaluate patients with suspected acute appendicitis in the emergency department.

The study by **Zoller WG et al** [57] stated that the rate of negative laparotomies could be decreased to 7%, and possible differential diagnosis could be either confirmed or ruled out by using USG. It is especially useful in women because the list of differential diagnosis for appendicitis is expanded due to many acute gynecological conditions mimicking acute appendicitis.

Maged Ibrahim et al [58] concluded that firstly, graded compression USG provides a highly accurate, specific, and sensitive test for clinically equivocal acute appendicitis, secondly this modality is very useful in the presence of equivocal signs and symptoms of acute appendicitis.

Javidi PP et al (2013)[59] in their study concluded that, Ultrasound is more useful when the patient is female and the result of sonography is positive.

Piyarom P et al (2014)[60] in their study noted that, Greater abdominal wall thickness (18.6 mm vs. 14.9 mm, p = 0.001) and lower pain score (6.6 vs. 7.5, p =0.018) were statistically associated with false negativity.

Among patients with abdominal pain, ultrasonography has a sensitivity of approximately 85% and a specificity of more than 90% for the diagnosis of acute appendicitis.[7]

Hussain S et al[61] showed that US scan has sensitivity of 88%, specificity of 92%, positive predictive value of 94%, negative predictive value of 86%, and overall accuracy of 90%. The most accurate appendiceal finding for appendicitis was a diameter of 7 mm or larger followed by non- compressibility of inflamed appendix.

Khanal BR et al (2008)[62] concluded that acute appendicitis with diameter of appendix having less than 6 mm should be evaluated with other diagnostic

parameters. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy percentage of ultrasonography in the diagnosis of acute appendicitis was 85.7%, 100%, 100%, 6.7% and 85.9% respectively.

In the study by **Wade DS et al**[63] overall accuracy of ultrasonography in the diagnosis of appendicitis was statistically superior to that of the surgeon's clinical impression ($P < .0001$). However, 24% f the patients with normal ultrasound findings were ultimately found to have appendicitis at operation, emphasizing the point that ultrasonography cannot be relied on to the exclusion of the surgeon's careful and repeated evaluation.

Pignatelli V et al[64] suggest that US be performed on all patients with atypical pain in the lower abdominal quadrants, because of its high diagnostic accuracy in many common pathologies mimicking appendicitis, especially urinary and uterine adnexal pathologies.

The value of ultrasound in the diagnosis of acute appendicitis is increasing and, particularly in the hands of experienced investigators, is an important imaging modality which delivers important and decision-making findings. Nevertheless, the final decision for appendectomy depends on the findings of the physical examination.[65]

Ubel P et al[66] in a prospective study we examined sonographical 367 patients with the diagnosis of "appendicitis" at admission. The sensitivity was 75.3%, the specificity 96.2%. In a retrospective analysis of 538 patients with appendectomy, the sensitivity was 50.5% and the specificity 95.4% in pre-operative diagnosis. If the examination was done by a less experienced examiner (less than 500 ultrasound examinations / year) the sensitivity was 45.1% and specificity 93.6%; an experienced doctor (500-1000 ultrasound examinations/year) achieved 57.9 and 92.9% and a highly qualified investigator (more than 1000 ultrasound examinations/year) a sensitivity of 73.9% and a specificity of 97%. If the examination was realized with high frequency ultrasonic scanning (10 MHz), sensitivity (73.9%) and specificity (96.3%) could be increased. Essential for an exact diagnosis was a short-term period between ultrasound examination and intra-abdominal diagnosis.

Fung HS et al[68] in their study to determine the utility and accuracy of USG for the diagnosis of acute appendicitis. The overall rate of visualization of the appendix was 41.7%. The sensitivity, specificity, PPV and NPV of USG of acute appendicitis were 75.9%, 89.7%, 73.2% and 91.0%, respectively, after adjusted calculation for the group with an inconclusive USG diagnosis. Study concluded USG is useful and safe imaging modality for investigation of acute appendicitis.

Worrell JA et al[67] in their study do not recommended USG as the only screening test, but do recommend it, rather in a diagnostic role after the initial clinical screening.

Studies with Modified Alvarado Score and Ultrasonography:

Toprak H et al 2014 analyzed data in 122 pediatric patients with suspected appendicitis who had undergone USG. They concluded that in the case of non-visualization of the appendix without a high Alvarado score, appendicitis can be safely ruled out.[69]

Blitman NM et al (2015)[70] in their study concluded that children with inconclusive focused appendicitis ultrasound findings and a low Alvarado score are extremely unlikely to have appendicitis (NPV, 99.6%).

Sanjot B et al (2008)[71] in their study of 60 patients with suspected appendicitis concluded that Modified Alvarado score is useful tool in clinical decision making. When compared with ultrasonography neither one is advantageous. However, additional information provided by ultrasonography improves diagnostic accuracy.

A study by **Narendra JB et al (2016)**[72] shows that MAS is a better tool at diagnosing appendicitis than USG while USG is better at confirming the diagnosing or to rule out the possibility of appendicitis. So neither one is superior

over the other tool. Any case of appendicitis can be diagnosed as appendicitis on the basis of MAS alone and treated surgically and in the doubtful cases USG can be used to rule out any other cause. Together MAS and USG can reduce the negative appendectomy rate significantly.

Hemant Nautiyal et al (2010)[73] Combined use of modified Alvarado score and high frequency USG not only reduces negative appendectomy but also morbidity and postoperative complications **Shah NA et al (2008)**[74] compared clinical diagnosis (control group) with a diagnostic protocol incorporating Ultrasound and Alvarado score and concluded that Ultrasound and the Alvarado scoring system is a diagnostic tool that leads to an early diagnosis and rapid surgical treatment of acute appendicitis. However it does not prevent complications or reduce the length of hospital stay.

Gupta CC et al (2013)[75] in their study concluded that when the modified Alvarado score was combined with USG, diagnostic accuracy is 92% in females. Specificity of combining both is 100%. When Alvarado score is equivocal, the addition of USG helped to make the diagnosis of acute appendicitis or alternative diagnosis was made.

Douglas CD et al(2000)[76] did a Randomized controlled trial of Ultrasonography in diagnosis of acute appendicitis, incorporating the Alvarado score and concluded that Graded compression ultrasonography is an accurate

procedure that leads to the prompt diagnosis and early treatment of many cases of appendicitis

Hanumaiah A[77] in a study of 100 patients with suspected appendicitis concluded that Alvarado scoring system combined with ultrasonography is a cheap and quick tool that can be applied in emergency department to diagnose acute appendicitis. The Scoring system is dynamic allowing observation and critical re- evaluation of evolution of clinical picture. Its application improves diagnostic accuracy and reduces negative appendectomy without increase in morbidity and /or mortality

Nishikant Gujar et al (2015), [78] in a study of 350 patients concluded that applying Modified Alvarado Scoring system preoperatively as a protocol in patients with suspected appendicitis the sensitivity is 98.44% for MAS and 98.33% for USG.

In acute appendicitis, MAS is a good diagnostic indicator, and it is highly sensitive in diagnosis of appendicitis and when combined with USG, is very effective in diagnosis of appendicitis and it helps in reducing number of negative appendectomy.

Gallindo GM et al[79] evaluated 192 patients with pain in the right lower abdomen by ultra sound and concluded that ultra sound increases the diagnostic accuracy in patients with suspected appendicitis.

DIAGNOSTIC LAPROSCOPY:

Moberg AC et al[80] in a study of 1043 patients concluded that Diagnostic laparoscopy is safe and can be recommended in patients with suspected acute appendicitis, particularly in women.

Lim GH et al (2008)[81] in a study of 691 patients concluded that Diagnostic laparoscopy is useful in evaluating patients with right lower abdominal pain, especially in those with equivocal signs of acute appendicitis. It also has the additional benefit of being therapeutic. Premenopausal women benefit the most from this procedure.

Gomes CA et al(2015)[82] at World Journal of Emergency Surgery (2015) proposed a new grading system for acute appendicitis based on clinical, imaging and laparoscopic findings.

Non-Complicated Acute Appendicitis:

- Grade 0 - Normal Looking Appendix (Endo-appendicitis / Peri-appendicitis).

- Grade 1 - Inflamed Appendix (Hyperemia, edema ± fibrin without or little pericolic fluid).

Complicated Acute Appendicitis:

- Grade 2 –Necrosis

  A - Segmental Necrosis.

  B - Base Necrosis. (without or little peri-colic fluid).

- Grade 3 – Inflammatory

  A - Flegmon.

  B - Abscess less 5 cm without peritoneal free air.

  C - Abscess above 5 cm without peritoneal free air.

- Grade 4 - Perforated - Diffuse Peritonitis with or without peritoneal free air.

They concluded that the goal of this grading system is to aid in determining optimal management according to grade, and to provide a standardized classification system to allow more uniform patient stratification for appendicitis.

MATERIALS AND METHODS

SOURCE OF DATA:

This is a study of 105 patients with provisional diagnosis of acute appendicitis getting admitted in the surgical department of R L JALAPPA hospital, Tamaka, Kolar from December 2015 to June 2017. Modified Alvarado score was applied and ultra sound abdomen was done pre-operatively. Confirmation of diagnosis of appendicitis of patients who underwent appendectomy was done by histopathological findings.

INCLUSION CRITERIA:

1. Patients suspected to have acute appendicitis.

EXCLUSION CRITERIA:

1. Age less than 16 years.
2. Pregnant women.
3. Patients with features of peritonitis, appendicular abscess or mass.

Table 4: Criteria for acute appendicitis by modified Alvarado score:

Clinical feature		Score
Symptoms	Migratory RIF	1
	Anorexia	1
	Nausea/vomiting	1
Signs	Tender RIF	2
	Rebound tenderness	1
	Elevated temperature	1
	Leukocytosis	2
	Total	9

Criteria for acute appendicitis by Ultrasound:

Sonographically, appendicitis is suggested by the presence of pain on graded compression of the area in which abnormal appendix was seen as a tubular, blind ending, aperistalitic bowel loop which is non compressible with a diameter of 7 mm or greater in antero-posterior direction. The presence of a fecolith or prominence of peri-appendicular fat was an indirect sign. Ultrasonography was considered negative when the appendix could not be found or was normal, or if non appendicular pathology was discovered.

USG of every patient was performed with a Philips machine - high frequency 7 MHz - 12 MHz linear array transducer to diagnose appendicitis and with 3.5 – 5 MHz convex transducer to rule out any other abdominal pathology.

Criteria for appendicitis – confirmation by Histopathology:

On histopathology the criterion for the diagnosis of acute appendicitis is polymorphous leukocytic infiltration of the muscularis mucosa

TREATMENT PROTOCOL:

Patients with score of 7-9 who were considered candidates for appendectomy were assessed with ultrasonography, if any other condition mimicking acute appendicitis was found in them, they were treated accordingly. All other cases were operated for appendectomy.

Patients with score of 5-6 were assessed with ultrasonography. Only those who tested positive for appendicitis with ultrasonography were operated.

Patients with score of less than 4 were assessed with ultrasonography. Only those who tested positive for appendicitis with ultrasonography were operated.

STATISTICS

$$\text{Sensitivity} = \frac{\text{number of true positives}}{\text{number of true positives} + \text{number of false negatives}}$$

$$\text{Specificity} = \frac{\text{number of true negatives}}{\text{number of true negatives} + \text{number of false positives}}$$

$$\text{Accuracy} = \frac{(TP + TN)}{(TP + FP + FN + TN)}$$

$$\text{Positive Predictive Value} = \frac{\text{number of true positives}}{\text{number of true positives} + \text{number of false positives}}$$

$$\text{Negative Predictive Value} = \frac{\text{number of true negatives}}{\text{number of true negatives} + \text{number of false negatives}}$$

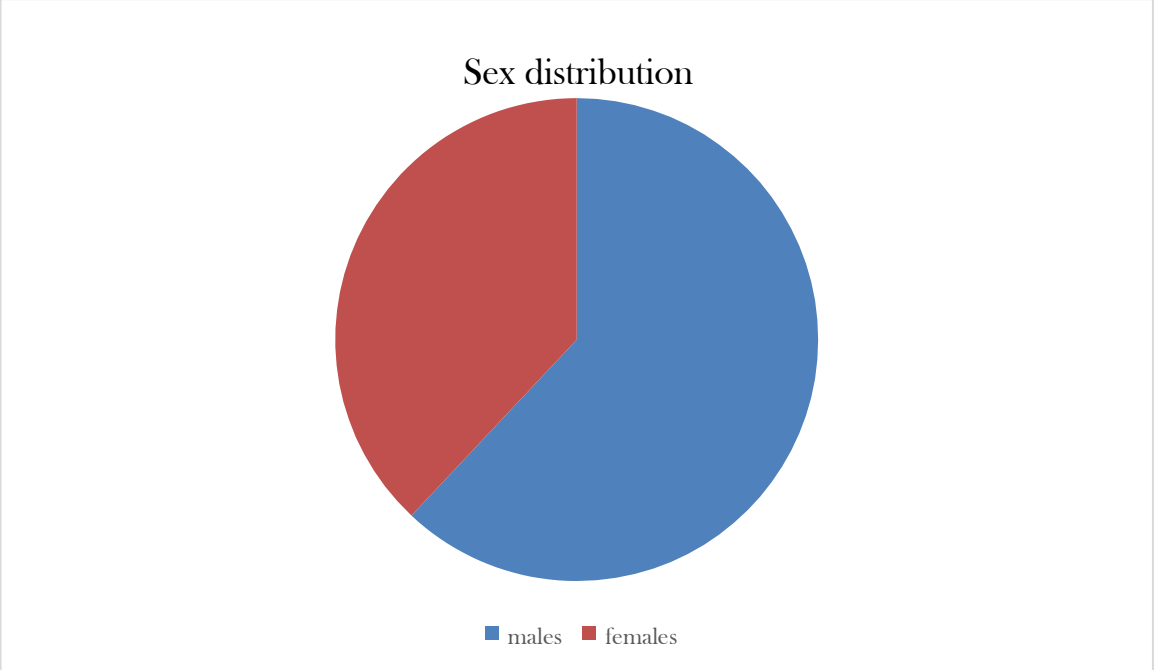
OBSERVATIONS AND RESULTS

A Prospective study of 105 patients with provisional diagnosis of acute appendicitis getting admitted in the surgical department of R L JALAPPA hospital was undertaken to evaluate the accuracy of using combination of modified Alvarado scoring and ultrasonography in acute appendicitis.

Table 5: Sex distribution:

Sex	Percentage
Male	62.8%
Female	37.1%

Graph 1: Sex distribution

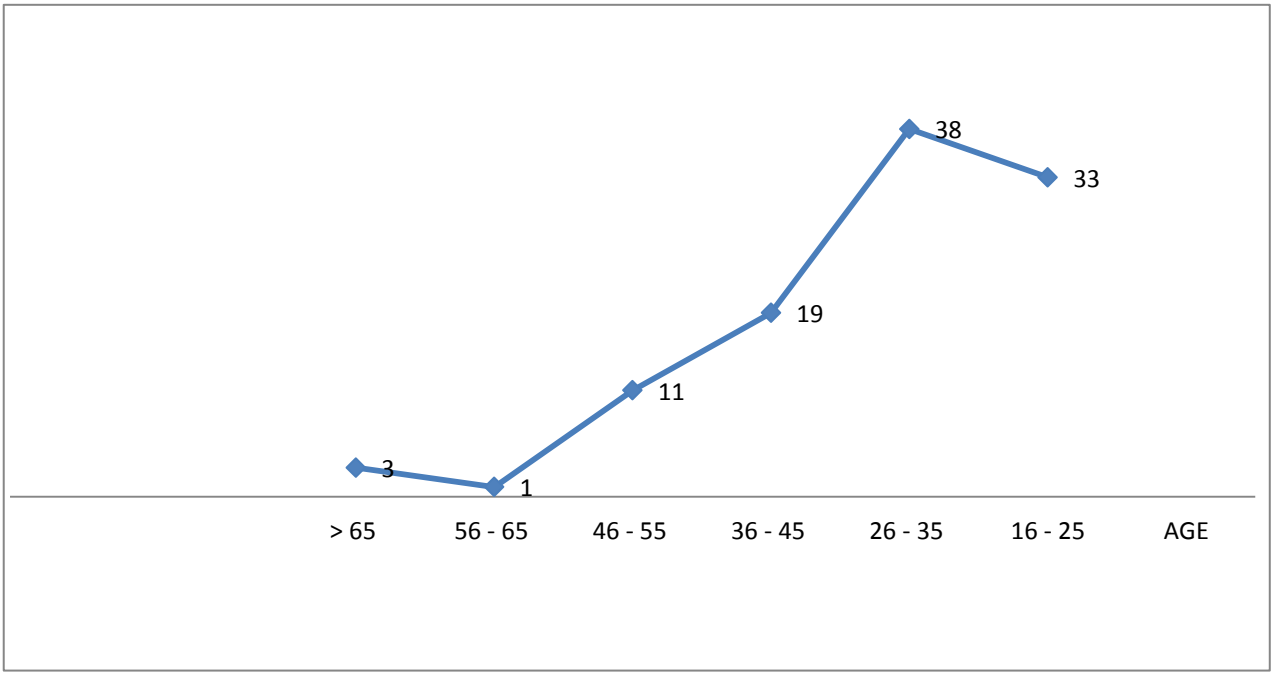


In this study there were 66 males and 39 females showing a male predominance of about 3:2 in cases of suspected appendicitis. When it came to cases of proven appendicitis, the ratio of Males: Females was found to be 1.7:1.

Table 6: Age Incidence:

Age group (in years)	Number of Patients
16–25	33
26-35	38
36-45	19
46-55	11
56-65	1
>65	3

Graph 2: Age distribution



In this study more number of patients were in the 26-35 years group followed by 36-45 years group. Lowest was seen in the age group of 56-65 years.

Table 7: Distribution of cases according to Parameters in MANTREL SCORING:

	Percentage in All Suspected Cases of Acute Appendicitis	Percentage in cases with Proven Appendicitis
Migratory pain	55	53
Anorexia	85	85
Nausea/vomiting	84	82
RIF tenderness	100	100
Rebound tenderness	79	79
Elevated temperature	77	75
Leukocytosis	81	80

Graph 3: Distribution of cases according to Parameters in MANTREL SCORING:

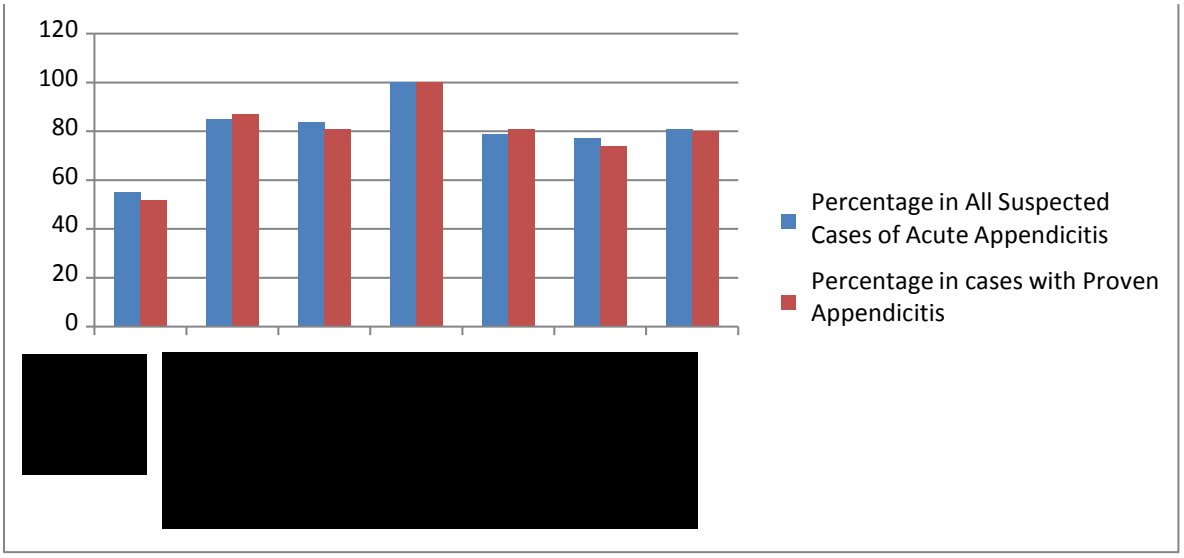


Table 8: Modified Alvarado score:

Modified Alvarado score	No. of patients
9	13
8	42
7	41
6	6
5	-
4	1
3	2
2	-
1	-

In the present study most of the patients were having Modified Alvarado score of about 7 or 8. None of them had a score below 3.

Graph 4: Modified Alvarado score:

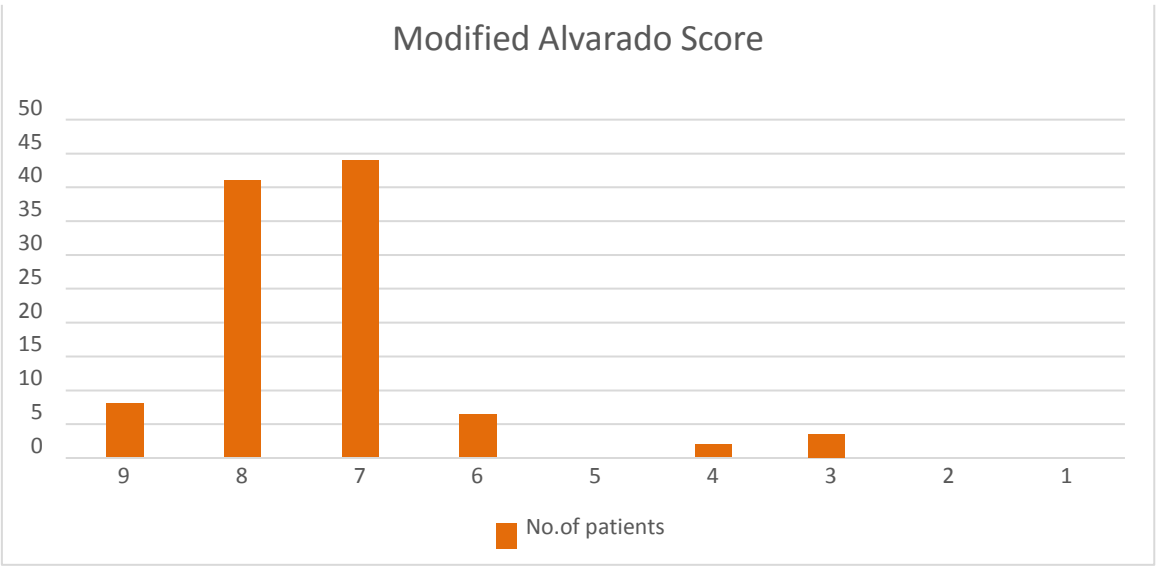
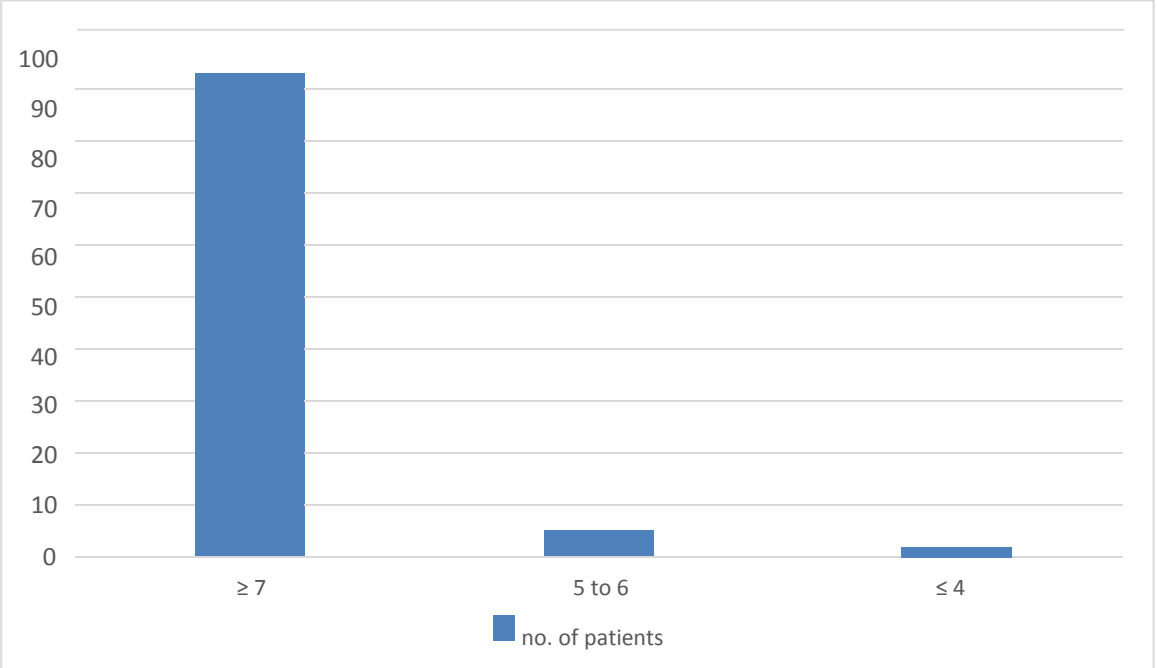


Table 9: Distribution of Suspected and Proven Appendicitis Patients as per MAS:

Modified Alvarado score	No. of patients	Confirmed appendicitis
Score ≥ 7	96	91
Score 5-6	6	5
Score ≤4	3	1

Graph 5: Distribution of Suspected and Proven Appendicitis Patients as per MAS:



Around 96 had a Modified Alvarado score of ≥ 7.

Table 10: USG findings:

USG finding	No. of patients	Percentage
Suggestive of appendicitis	88	83.8%
Negative	17	16.2%

105 cases were assessed with USG for acute appendicitis; USG showed inflamed appendix in 88 cases and negative study was noted in 17 cases which include normal, non-visualized appendix (can be attributed to anatomical position of the appendix, patient body habitus and operator variability) and other causes simulating acute appendicitis.

Graph 6: USG findings:

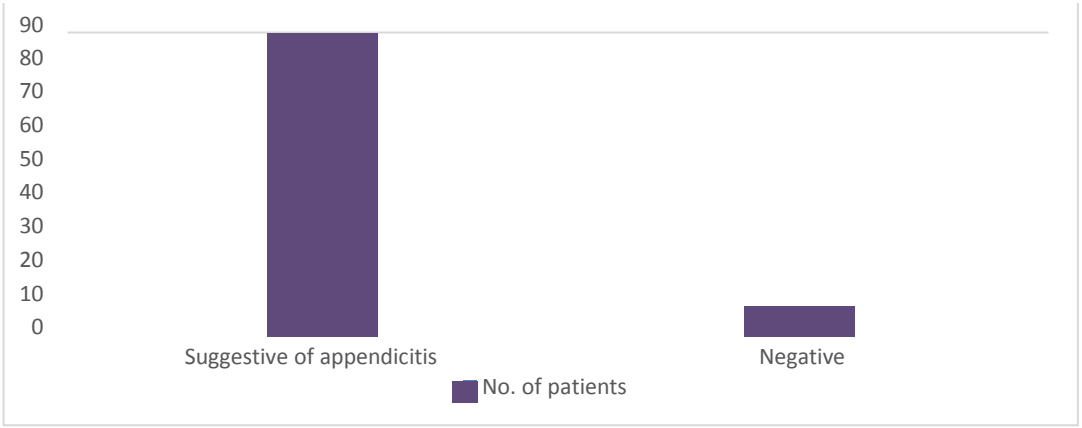


Table 11: Histopathology findings

Histopathology +ve	Histopathology – ve
97	8

Table 12: Histopathology findings

Inflammed Appendix	86
Gangrenous Appendix	7
Perforated Appendix	4
Normal Appendix	8

Table 13: Distribution of patients as per sex group:

Modified Alvarado Score	Male	Female
≥7	60	36
5-6	4	2
≤4	2	1

Graph 7: Distribution of patients as per sex group:

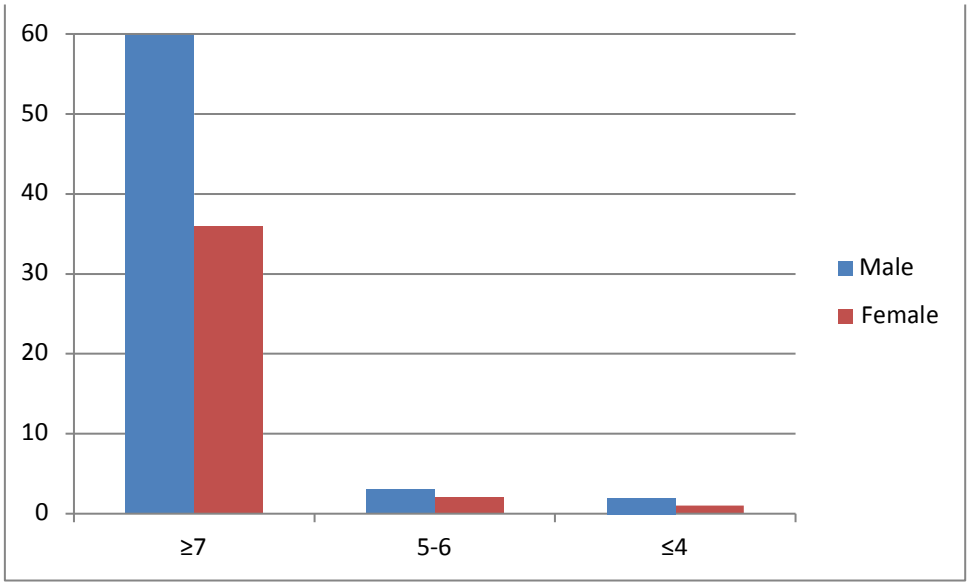


Table 14: Accuracy of MAS:

Modified Alvarado score	Acute appendicitis	Normal Appendix
≥7	93	3
<7	4	5

Sensitivity = $\frac{93 \times 100}{93 + 4}$ = 95.8%

Specificity = $\frac{5 \times 100}{5 + 3}$ = 62.5%

Accuracy = $\frac{(93 + 5) \times 100}{(93 + 5 + 4 + 3)}$ = 93.3%

Positive predictive value = $\frac{93 \times 100}{93 + 3}$ = 96.8%

Negative predictive value = $\frac{5 \times 100}{5 + 4}$ = 55.55%

Table 15: Accuracy of USG:

USG findings	Acute appendicitis	Normal appendix
+ve for appendicitis	86	2
Negative for appendicitis	11	6

Sensitivity = $\frac{86 \times 100}{86 + 11}$ = 88.6%

Specificity = $\frac{6 \times 100}{6 + 2}$ = 75%

Accuracy = $\frac{(86 + 6) \times 100}{(86 + 6 + 11 + 2)}$ = 87.6%

Positive predictive value = $\frac{86 \times 100}{86 + 2}$ = 97.7%

Negative predictive value = $\frac{6 \times 100}{6 + 11}$ = 35.29%

Table 16: Combined accuracy of MAS and USG

Ultrasonography + MAS (≥ 5)	Acute Appendicitis	Normal Appendix
+ ve	96	1
Negative	1	7

Table 17: Combined accuracy of MAS and USG

	Sensitivity	Specificity	Accuracy
Combined MAS + USG	98.9 %	87.5 %	98.1 %

Table 18: Treatment Protocol

MAS	Sex		USG		Treatment Received	Confirmed By HPE	Normal HPE
	M	F	+ve	-ve	Appendectomy		
≥7	60	36	84	14	96	93	3
5-6	4	2	4	2	6	4	2
≤4	2	1	-	1	3	-	3

FIGURES

FIGURE 1: Acute Appendicitis with diameter – 7.86mm

FIGURE 2: Tubular Blind ending Non Compressible Dilated Structure – Acute Appendicitis

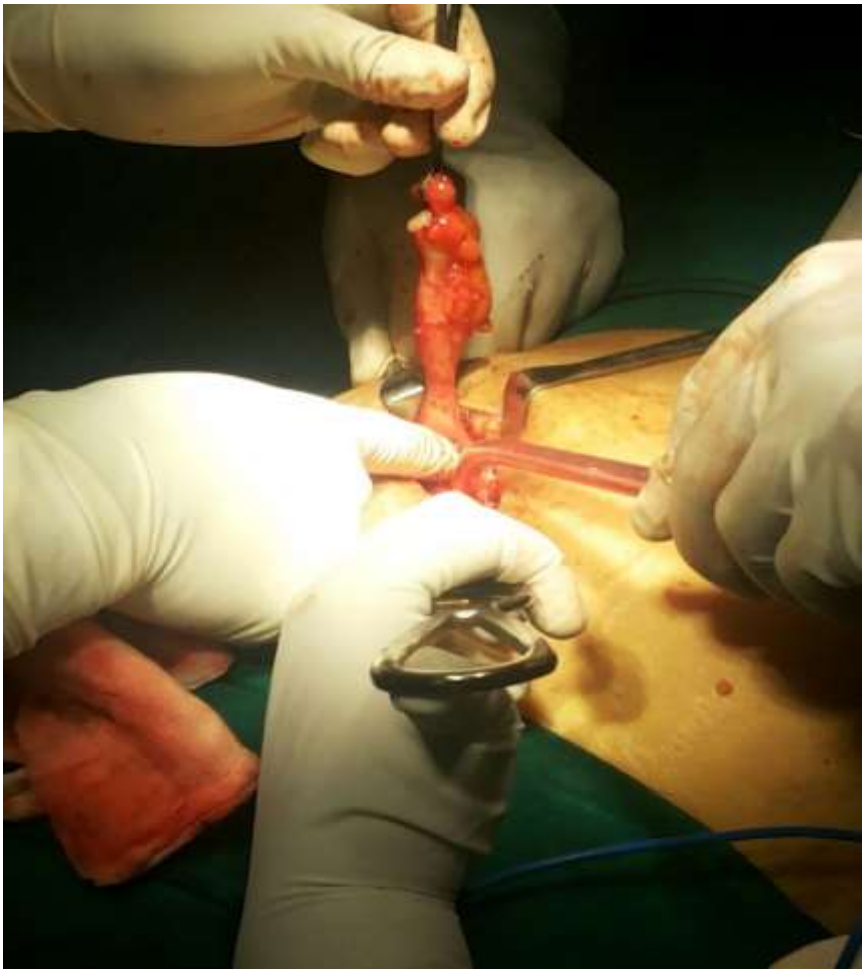


Fig 3: Inflamed appendix

DISCUSSION

A Prospective study of 105 patients with provisional diagnosis of acute appendicitis getting admitted in the surgical department of R L JALAPPA hospital from December 2015 to June 2017 was undertaken to evaluate the accuracy of using combination of modified Alvarado scoring and ultrasonography in acute appendicitis.

It has been over 100 years since **Fitz**[83] presented his classic paper describing the clinical features of appendicitis and recommended early surgical removal of the inflamed appendix and the notion that this disease constituted a surgical emergency was not questioned ever since.

Appendicitis is notorious in its ability to simulate other conditions and in the frequency it can be mimicked by other pathologies. The most important step in the management of patients with suspected appendicitis is reaching the decision about operative intervention and its timing so that both negative appendectomies and complicated appendicitis rate are kept to a minimum.

Despite extraordinary advances in modern radiography imaging and diagnostic laboratory investigations the accurate preoperative diagnosis of acute appendicitis remains an enigmatic challenge. Overall, a negative appendectomy rate of approximately 15-30% is commonly reported.[5] Nowadays

commonly used diagnostic aids for appendicitis are; Diagnostic scores, USG, CECT abdomen, laparoscopy. By using diagnostic aids for acute appendicitis, prolonged observation, negative appendectomy and incidence of perforation can be reduced dramatically resulting in decreased financial cost of the systems employed. But no test can reduce the rate of negative appendectomy to zero, hence some authors have recommended a combination of two or more investigations to increase accuracy even more.[73]

The clinical diagnosis of appendicitis is a subjective estimate of the probability of appendicitis based on multiple variables that individually are weak discriminators; however, used in conjunction, they possess a high predictive value. This process can be made more objective by the use of clinical scoring systems, which are based on variables with proven discriminating power and assigned a proper weight.[12]

Modified Alvarado score is one such widely accepted, simple system based on few symptoms, signs, and a basic laboratory investigation. It is non-invasive, reusable, repeatable and can aptly guide the clinician in establishing diagnosis, selecting patients for further diagnostic work up and subsequent management.[12]

Ultrasound of the abdomen and pelvis is a commonly used radiological procedure. Ultrasound is often used as the initial diagnostic imaging in cases where the clinical diagnosis is equivocal; some authors recommended using it routinely in order to rule out diseases that mimic acute appendicitis[55]. USG is non-invasive, rapidly available and avoids radiation exposure. It is especially useful in women because the list of differential diagnosis for appendicitis is expanded due to many acute gynecological conditions mimicking acute appendicitis[57].

SEX DISTRIBUTION:

In the present study the males were 62.8% and the females were 37.1%. There is a male predominance. The proportion of males was between 56-73% in most of the studies while that of females was between 27-43%.

Clinically males were more susceptible than females with a male: female ratio of 1.7:1.

Hwang and **Krumbhaar**[84] in their study concluded that, the correlation between the amount of lymphoid tissue and the occurrence of acute appendicitis is fairly good and the proportion of lymphoid tissue was more in male appendices than in females, this might well be an important observation but there is no confirmation[85].

Table 19: Sex distribution - Comparison with other studies

Study	Male	Female
Petrosyan[43]	56.8%	43.2%
Rezak et al[86]	72.8%	27.2%
Shreef et al[87]	65.1%	34.9%
Shrivastava UK et al[34]	60%	40%
Tade[88]	67.3%	32.7%
Present study	62.8%	37.2%

Most of the studies show similar male predominance.

AGE DISTRIBUTION:

Acute appendicitis is relatively rare in infants and becomes more common in childhood and early adult life, reaching a peak incidence in the 20's.[6]

BOHROD MG[89], **J.A.H.Lee**[85] in their respective studies suggested that peak in the development of lymphoid tissue which occurs during adolescence, leads to increased liability of appendix to obstruct, and so high incidence of the disease.

In the present study most of the cases were in the 26-35 years age group (38%) followed by 16-25 years age group (19%). More than half the cases were in the ages between 16-35 years

Very few patients were in the old age group. Appendicitis in older patients can be difficult to diagnose because many patients delay seeking care and the presentation may be atypical.

Lewis et al[90], **Thorbjarnson B et al**[91], and **Hubbell et al**[92] in their studies have noted the variation in the clinical presentation, the increase in

incidence of appendiceal rupture and the increase in both number and severity of complications including death in the elderly group.

Omari AH et al (2014)[93] in their study stated that, Acute appendicitis in elderly patients is a serious disease that requires early diagnosis and treatment and suggested that early use of radiological investigations can cut short the way to the appropriate treatment.

Table 20: Mean age - Comparison with other studies

Study	Mean Age
Alvarado A[19]	25.3yrs
Baidya N et al[94]	26.3yrs
Canavosso L et al[95]	26.6yrs
Khan I et al[96]	20.2yrs
Singh K et al[97]	22.6yrs
Present Study	26.5yrs

In the present study the mean age was 26.5 years. A study by Alvarado et al had mean age of 25.3 yrs; **Baidya N et al**[94] had a mean age of 26.3 years and **Canavosso et al**[95] of 26.6 years which are comparable to the mean age of 26.5 years in the present study.

Table 21: Variables of MAS – comparison with other studies

Variables	Berry J et al[98]	Goyal P et al[36]	Present study
Migratory pain	80%	72%	53%
Anorexia	61%	88%	85%
Nausea/vomiting	67.5%	84%	82%
RIF tenderness	95.9%	100%	100%
Rebound tenderness	69.5%	86%	79%
Elevated temperature	34.3%	56%	75%
Leukocytosis	75%	70%	80%

MIGRATORY PAIN

Classic pattern of migratory pain is the most reliable symptom of acute appendicitis.[99] Appendicitis usually starts with periumbilical and diffuse pain that eventually localizes to the right lower quadrant. Although right lower quadrant pain is one of the most sensitive signs of appendicitis, pain in an atypical location or minimal pain will often be the initial presentation. Variations in the anatomic location of the appendix may account for the differentiating presentations of the somatic phase of pain.[100]

The classic visceral–somatic sequence of pain is present in only about half of those patients subsequently proven to have acute appendicitis.[6]

In the present study Migratory pain is present in 53% of patients in whom Histopathological Examination confirmed acute appendicitis which is comparable to the study by **Calder J D et al**[101] 50%, **Omari AH et al**[102] – 47% and **Murali U et al**[103] – 61.3%.

Table 22: Migratory pain – comparison with other studies

MIGRATORY PAIN	PERCENTAGES
Calder JD et al[101]	50%
Omari AH et al[102]	47%
Murali U et al[103]	61.3%
Present study	53%

ANOREXIA

Anorexia is an important and prevalent symptom in acute appendicitis. If a patient has abdominal pain but doesn't have anorexia, the diagnosis of appendicitis becomes doubtful.

Own Td et al[20], in a study, concluded that 78% of the proven appendicitis cases had anorexia, similar to a studies conducted by **Salari et al**[104] where it was 83.75%, **Kalan M et al**[26] where it was 85%, **Faloon et al**[105] where it was more than 95%, suggesting that anorexia increases probability of appendicitis. However, its absence cannot rule out diagnosis of acute Appendicitis.

In this present study, anorexia was noted in 85% of the patients with proven appendicitis.

Table 23: Anorexia – comparison with other studies

ANOREXIA	PERCENTAGES
Own TD et al[20]	78%
Salari et al[104]	85%
Faloon et al[105]	95%
Kalan M et al[26]	85%
Present Study	85%

NAUSEA AND VOMITING

Rasmussen OO[8] stated that the diagnosis of appendicitis should be in doubt when anorexia, nausea and vomiting are absent.

In the present study nausea and vomiting were present in 82% of proven appendicitis, comparable to study done by **Own TD et al**[20] – 78%.

Table 24: Nausea and Vomiting – Comparison with other studies

NAUSEA and VOMITINGS	PERCENTAGES
Own TD et al[20]	78%
Schwartz[12]	75%
Present Study	82%

TENDERNESS – RIGHT ILIAC FOSSA

Gentle superficial palpation of the abdomen, beginning in the left iliac fossa moving anticlockwise to the right iliac fossa will detect muscle guarding over the point of maximum tenderness, classically McBurney's point[6].

Table 25: RIF tenderness – Comparison with other studies

RIF TENDERNESS	PERCENTAGES
Bhattacharjee et al[27]	92%
Kalan et al[26]	95%
Present study	100%

In the present study all cases of proven appendicitis had tenderness in RIF. Comparable to other studies done by Bhattacharjee et al[27] 92%, Kalan et al[26] 95%. The slight variation in figures is attributable to the fact that, tenderness in RIF may vary with atypical positioning of appendix.

REBOUND TENDERNESS:

Rebound tenderness was originally described by J. Moritz Blumberg (1873–1955), a German surgeon and gynecologist, believed that pain in the abdomen after abrupt withdrawal of the hand was a sign of peritonitis. (i.e., Blumberg's sign).[106]

Andersson R (2004)[107] suggested that, the signs found on clinical examination which are associated with a high positive likelihood ratio are

signs of peritoneal irritation (rebound and percussion tenderness, guarding and rigidity).

Table 26: Rebound Tenderness – Comparison with other studies

REBOUND TENDERNESS	PERCENTAGES
Owen TD et al[20]	96%
Goyal P et al[36]	86%
Present study	79%

In the present study Rebound Tenderness is 79% which is comparable with other studies done by Owen **TD et al**[20] - 96%, **Goyal P et al**[36] – 86%.

ELEVATED TEMPERATURE

In the present study temperature greater than 37.3^0c is considered as elevated temperature.

Cardall, **Glasser** and **Guss's**[108] (2004) study evaluated two hundred and ninety three people aged between 7 and 75 who presented to the emergency department with suspected appendicitis. Temperatures were classed at greater than 99°F or less than 99°F. The study showed that 27% of patients who's temperature was <99°F had a confirmed appendicitis compared to 37% of

patients who had a temperature of >99°F. When the results were analyzed in terms of specific temperature intervals, the highest likelihood ratio (3.18) was found in patients with temperatures greater than 102 °F.

However, **Bergeron's (2006)**[109] study on clinical judgement suggests there is no clinical value with temperature as there is minimal sensitivity and specificity in the diagnosis of appendicitis. Therefore temperature as a single entity has little diagnostic utility in the diagnosis of appendicitis unless it is combined with other signs and symptoms[108].

Table 27: Elevated temperature – Comparison with other studies

ELEVATED TEMPERATURE	PERCENTAGES
Calder JD et al[101]	67%
Kalan et al[26]	96%
Present study	75%

Early in presentation body temperature may be minimally altered. In 20% of patients there is no pyrexia in early stages[12]. In the present study Elevation of temperature was present in 75% of patients with acute appendicitis, where as it was 67% in study by **Calder JD et al**[101] and 40% in study by **Kalan et al**[26]**.** The

variation in figures is attributable to the time of presentation and to a minor extent, the temperature considered as base value for the respective studies.

LEUKOCYTOSIS

In the present study WBC elevation >11,000 cells/mm^3 is considered.

The degree of white blood cell elevation has been extensively studied. It is very commonly elevated in patients with acute appendicitis. However, it is not a specific marker and is commonly elevated in patients with other inflammatory conditions (as discussed in differential diagnosis- table1) A complete normal leucocyte count is found in 10% of patients of acute appendicitis. Appendicitis is associated with inflammatory response and the inflammatory response in acute appendicitis is a dynamic process and can be weak early in the process.

With appendicitis the elevated white cell count has been variously reported as either being reliable or unreliable. **Marchand et al**[112] concluded in their study that TLC >10.5×10^9/L was one of the single best tests for diagnosis of acute appendicitis. In contrast **Al-gaithy zk (2012)**[113] concluded in their study that Clinicians should not rely on either elevated WBCs or neutrophils count as appendicitis indicator for appendectomy. Hence where TLC is in variance with clinical features the latter should take precedence.

In the present study elevated white blood cells in true appendicitis cases are 80% comparable with other studies done by **Dueholm et al**[110] 83%, **Peitola et al**[111] 76%, **Rasmussen OO**[8] 81%.

Table 28: Leukocytosis – Comparison with other studies

LEUKOCYTOSIS	PERCENTAGES
Dueholm et al[110]	83%
Rasmussen OO[8]	81%
Peitola et al[111]	76%
Present study	80%

EVALUATION OF MODIFIED ALVARADO SCORE

Modified Alvarado Score is simple to use, easy to apply, and is dynamic since it relies on history, clinical examination and basic laboratory investigations[36]. It allows observation and re-observation regarding clinical behavior of patient, whether or not to intervene for surgery. Its application can avert negative appendectomy or else prevent from complications leading to gangrene, perforation, wound sepsis, and hence use of costly antibiotics and increased hospital stay[31]

In the present study, the Modified Alvarado Score by Kalan et al was used. The patients were grouped into three groups. Group I - A score of 7 or more, Group II - A score of 5-6, Group III - A score of 4 or less. There are 96 patients (60 Males, 36 Females) in Group I, in Group II there are 6 patients (4 Males, 2 Females) and 3 patients (2 Male, 1 Female) in Group III in the present study. A score of 7 or more is strongly predictive of acute appendicitis.

Kohla SM et al (2015)[35] in their study concluded that MAS at the cutoff value of (≥ 7) have a strong indication for urgent surgery.

Out of 97 patients with score of 5 or more and USG suggestive of appendicitis and operated for acute appendicitis, 96 people had histopathological confirmation of appendicitis. There was 1 negative appendectomy, which would have been 5 if MAS was used alone. Out of these 5 negative appendectomies – 3 (60%) were males and 2 (40%) were females.

This observation is supported by **Goonroos and Goonroos**[114] in their study group A (100), 38% males and 62% females patients had negative appendectomies. This observation of MAS showing more false positives or being

less sensitive in females when compared to males is also noted in studies done by **Abhinandan B et al (2016)**[28], **Talukder DB et al (2009)**[30], **Bhattacharjee PK et al (2002)**[27], **Kalan M et al**[26], **Owen TD el al.**[20]

Out of those five negative appendectomies, three patients had mesenteric lymphadenitis, one had Meckel's diverticulitis and another one patient had ovarian cyst. Increased false positives in females is mainly because of more differential diagnosis when compared to male patients. **Lamparelli MJ et al,**[33] **Shrivastava UK et al (2004)**[34]in their studies concluded that, lower sensitive MAS values in female patients were due to presence of diseases in genital system i.e. ovaries, salphinges etc.

As MAS is a scoring system based on history, clinical examination and basic laboratory investigations going by MAS alone, one may wrongly diagnose appendix mimicking conditions as acute appendicitis and more commonly in females and in cases of atypical presentations.

Goyal P et al (2014)[36], **Zahid Ali Memon et al (2013)**[32], **Kanumba S et al (2011)**[29] in their studies concluded that supplementing MAS with an imaging modality may be required to confirm the diagnosis, especially in females and atypical presentations.

In group II and III out of nine patients, four were histopathologically positive for appendicitis.

Andrew C. Meltzer et al (2013)[37], in their study of 261 patients concluded that, a low modified Alvarado score is less sensitive than clinical judgment in excluding acute appendicitis.

In this study, the sensitivity of Modified Alvarado Score of more than 7 in identifying the disease was 95.8%. The specificity was 62.5%. The high sensitivity rates are comparable to various other studies. The low specificity rate may due to less number of patients in the < 7 MAS group. But this low specificity is also seen in studies like the studies done by **Narendra J B et al (2016)**[72] with 33% and **Baidya N et al**[94] with 27%.

Table 29: Sensitivity and Specificity of MAS – comparison with other studies

Study	Sensitivity	Specificity
Narendra J B et al[72]	93%	33%
Gupta CC et al[75]	95%	42%
Baidya N et al[94]	85%	27%
Present study	95.8%	62.5%

In the present study Modified Alvarado Score had a positive predictive value of 96.8% and a negative predictive value of 55.5%. This is comparable to other studies which has had high predictive value for Modified Alvarado Score in the diagnosis of acute appendicitis. The PPV of MAS in study by **Narendra JB et al**[72] was 91.1%, of **Satyajeet et al**[115] was 91.4% and that of **Davis S Wade et al**[116] was 82%.

Table 30: Positive and Negative predictive value of MAS – Comparison with other studies

Study	PPV	NPV
Narendra JB et al[72]	91.1%	40%
Satyajeet et al[115]	91.4%	65%
Davis S. Wade et al[116]	82%	62%
Present study	96.8%	55.5%

The variations in the predictive values is influenced by factors like number of patients distributed in MAS (≥7 and <7), male and female ratio, in respective studies.

The overall accuracy of the Modified Alvarado Score (alone) in this study was 93.3% which was comparable to studies done by **Kohla SM et al (2015)**[35] 84.42 **%, Zahid Ali Memon et al (2013)**[32] 89.8 %. With high accuracy MAS stays a reliable aid in diagnosis of acute appendicitis.

EVALUATION OF ULTRASONOGRAPHY

The diagnosis of acute appendicitis is mainly clinical and to augment the clinical diagnosis ultrasonography of the abdomen is also being used to help in diagnosis of the disease; which carries some inherent limitations. Ultrasonography has high accuracy in diagnosing acute appendicitis. The most accurate appendiceal finding for appendicitis was a diameter of 7 mm or larger followed by non- compressibility of inflamed appendix[61].

Khayal A et al (2007)[117] in their study concluded that, USG is recommended in diagnosing acute appendicitis as part of the initial assessment of the patients presenting with equivocal findings.

In this study Ultrasonography was helpful in many ways. Firstly, it helped in ruling out patients having other pathologies, second it helped in diagnosing cases where Alvarado score was doubtful. Overall by combining ultrasonography with Modified Alvarado Score the accuracy of diagnosing acute appendicitis increased.

Sonography can be performed at the bedside[56].USG involves a short acquisition time, does not use ionizing radiation, and may show evidence of

other causes of abdominal pain. It is possible to do USG on almost all the patients.

With ultrasound, appendiceal detection rates reported at 60% to 89%, the dilemma of the non-visualized appendix or equivocal study is frequently faced by clinicians. A non-visualized appendix may be due to patient body habitus[60] or overlying bowel gas and can be operator dependent[66] Appendix which can be present in different positions can sometimes be missed in USG. In the evaluation of acute appendicitis, the visualization rate varies from institution to institution; from a high of 98% to a low of 22%.[118] In the present study all the cases with non-visualized appendix were assumed to be negative for appendicitis.

In this study USG identified 88 patients as having findings suggestive of appendicitis. This has helped in avoiding unnecessary appendectomies.

In the 88 cases where USG showed findings suggestive of appendicitis, 86 patients had appendicitis. Where as in remaining 17 cases, where USG showed no signs of appendicitis about 11 patients had appendicitis. In the present study all the cases with non-visualized appendix were assumed to be negative for appendicitis.

In the study by **Davis S Wade et al**[116] 24% of the patients with normal ultrasound findings were ultimately found to have appendicitis at operation, emphasizing the point that ultrasonography cannot be relied on to the exclusion of the surgeon's careful and repeated evaluation.

Table 31: Sensitivity and specificity of USG – Comparison with other studies

Study	Sensitivity	Specificity
Nautiyala H et al[73]	88%	86%
Gallindo GM et al[79]	82%	89%
Davis S Wade et al[116]	86%	84%
Present study	88.6%	75%

The sensitivity of USG is 88.6% and specificity is 75% in the study. This is comparable to studies done by **Nautiyala H et al**[73] (88% and 86%), Gallindo **GM et al**[79] (82% and 89%) and **Davis S Wade et al**[116] (86% and 84%).

In the present study, the positive predictive value (PPV) of USG was 97.7% while the negative predictive value (NPV) was 35.3%. The number

of false negative cases were 11. Most of the false negative diagnoses result from non-visualization of the appendix as in this study.

Table 32: Positive and Negative predictive values of USG – Comparison with other studies

Study	PPV	NPV
Narendra J B et al[72]	95.1%	44.4%
Satyajeet et al[115]	80.5%	57.1%
Present study	97.7%	35.3%

The negative predictive value in the present study was 35.3% which was comparable to **Narendra J B et al**[72] and **Satyajeet et al**[115] who got NPV of 44.4% and 57.1% respectively. The PPV of the present study was 97.7% while that of Narendra J B[72] et al and Satyajeet et al[115] was 95.1% and 80.5% respectively. This means when Ultrasonography shows that when a positive finding is there in USG, there is more likely chance of the case being a case of appendicitis while the negative predictive value being low means that we may miss many cases of appendicitis if one goes with USG findings alone.

THE ACCURACY OF COMBINATION OF MAS AND USG:

Accuracy is the proportion of true results, either true positive or true negative, in a population. It measures the degree of veracity of a diagnostic test on a condition.

Though Modified Alvarado Score has been reported to be a cheap and quick diagnostic tool in patients with acute appendicitis, however, differences in diagnostic accuracy have been observed if the scores were applied to various - populations and clinical settings.

Anand Hanumaiah (2016)[77] in a study of 100 patients with suspected appendicitis concluded that Alvarado scoring system combined with ultrasonography improves diagnostic accuracy.

Sanjot B et al (2008)[71] in their study concluded that Modified Alvarado score is useful tool in clinical decision making. When compared with ultrasonography neither one is advantageous. However, additional information provided by ultrasonography improves diagnostic accuracy

This study was conducted to evaluate the diagnostic value of Modified Alvarado Scoring System combined with Ultrasonography in patients with provisionally diagnosed cases of acute appendicitis in our setting.

In the present study the accuracy of Modified Alvarado score was 93.3% while the accuracy of Ultrasonography was 87.6%. The accuracy of combination of Modified Alvarado Score and Ultrasonography was 98.1%.

These findings are more accurate than those of study done by **Gupta CC et al (2013)**[75] who had accuracy of 88% for Modified Alvarado score and 86% for USG and the accuracy of combination of both MAS and USG was 88%.

Table 33: Combined accuracy of MAS and USG – comparison with other study

Accuracy	Gupta CC et al[75]	Present study
MAS	88%	93.3%
USG	86%	87.6%
Combined	88%	98.1%

Hence by combining both MAS and USG the study was able to identify more number of true positives and true negative cases that would not have been possible if only a single diagnostic aid was used.

As far as is known, all patients who had low scores and no findings suggestive of appendicitis on ultrasonography did well and did not subsequently require any appendectomy for appendicitis.

COMBINATION OF MAS AND USG – IN SURGICAL DECISION MAKING

Delayed or incorrect diagnosis has both clinical and economic consequences[119] and this has resulted in considerable research to identify clinical, laboratory and radiological findings that are diagnostic of appendicitis to reduce the delay in diagnosis and to decrease the rates of negative appendectomy. The rate of perforation is reported to increase by 5% per 12 hours period; 36hrs after the onset of symptoms, therefore expedient diagnosis and treatment are required.[120]

Douglas CD et al[76], Shah NA et al[74], in their respective studies concluded that combining MAS and USG leads to an early diagnosis and rapid surgical treatment of acute appendicitis.

In the present study all the patients who had modified Alvarado score more than 7 (except those who were diagnosed to have other pathology via USG) were operated. And in those who had modified Alvarado score less than 7, USG helped in early diagnosis. If in the study only those with MAS more than 7 were operated, it would have delayed the diagnosis in four cases. While if only USG findings were used, assuming only those with positive findings had appendicitis and non- visualization/and no findings suggestive of appendicitis as negative, then that would have resulted in a delay of diagnosis in eleven patients.

As in this study a combination of both Modified Alvarado Score and Ultrasonography were used, the delay in diagnosis was reduced in 10 cases (10.3% of acute appendicitis)

COMBINATION OF MAS AND USG - NEGATIVE APPENDECTOMY RATE

The negative appendectomy rate (NAR) is a quality metric in the management of appendicitis. The definition of a negative appendectomy that is most often used in the surgical literature is that it involves a normal appendix or is a medically unnecessary appendectomy.

Studies with Alvarado or its modification alone had high negative appendectomy rates when compared to studies which used both MAS and USG.

Table 34: Negative appendectomy rates in studies with Alvarado score or its modification alone

Study	Percentage of negative appendectomy rate
Alvarado A[19]	18%
Kalan et al[26]	14.6%
Kamran H et al[121]	10.4%
Fengo G et al[122]	17.5%

Table 35: Negative appendectomy rates with combination of MAS and USG

Nautiyala H et al[73]	8.1%
Present study	10.3%

The negative appendectomy rate in various studies was in the range from 10.4-18% using Alvarado score or its modification alone. Significant reduction in negative appendectomies can be noted in studies using both MAS and USG.

Nishikant Gujar et al (2015)[78],in a study of 350 patients concluded that applying Modified Alvarado Scoring system preoperatively as a protocol in patients with suspected appendicitis and combining it with USG is very effective in diagnosis of appendicitis and in reducing number of negative appendectomies.

Blitman NM et al (2015)[70] and **Toprak H et al (2014)**[69] in their studies concluded that patients with low modified Alvarado score and negative USG findings for acute appendicitis are extremely unlikely to have appendicitis. A study by **Narendra JB et al (2016)**[72] showed that MAS is a better tool at diagnosing appendicitis than USG while USG is better at confirming the

diagnosis or at ruling out the possibility of appendicitis and they concluded that, together MAS and USG can reduce the negative appendectomy rate significantly.

In the present study the negative appendectomy rate was 7.6%. If only Alvarado score was used with cutoff of 7 for appendectomy, the negative appendectomy rate would have been 9.6%. Hence it is clear that by adding USG to Modified Alvarado Score of 7, the negative appendectomy rate was brought down.

CONCLUSION

The study was done on 105 patients presenting with features of Acute Appendicitis. MAS and USG was done preoperatively and confirmation was done by histopathology.

Acute appendicitis was most commonly found in young males with RIF tenderness being the most common clinical finding.

With high accuracy MAS is a reliable aid in diagnosis of acute appendicitis and combining USG to MAS further increases the accuracy. Also, combining MAS and USG appears to have reduced the negative appendectomy rate.

Hence, combination of MAS and USG appears to be a feasible process which aids in early diagnosis, ruling out other pathologies and in decreasing rate of negative appendectomies.

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INFORMED CONSENT FOR SURGERY AND FURTHER MANAGEMENT

Patient name – **Address –**
Age –
Sex –
Hospital number – **Ward –**
Date – **Time –**
Study number –

If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. We will collect the treatment and relevant details from your hospital record. This information collected will be used for only dissertation and publication. This study has been reviewed by the institutional ethical committee. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

I understand that I remain free to withdraw from the study at any time and this will not change my future care. I have read or have been read to me and understood the purpose of the study, the procedure that will be used, the risk and benefits associated with my involvement in the study and the nature of information that will be collected and disclosed during the study. I have had the opportunity to ask my questions regarding various aspects of the study and my questions are answered to my satisfaction. I, the undersigned agree to participate in this study and authorize the collection and disclosure of my personal information for dissertation.

Subject name-

(Patients / Guardians name)
DATE: SIGNATURE /THUMB IMPRESSION

Attendants name –
SIGNATURE /THUMB IMPRESSION
Relation to patient –

PERFORMA

Name: HOSP NO.:
Age/ Sex:
Address: DOA:

Chief Complaints:

1. Pain
2. Vomiting/nausea
3. Fever
4. Diarrhea/constipation
5. Distention of abdomen
6. Other complaints

History of Presenting illness:

1. PAIN

a) Duration
b) Time and onset
c) Site of pain: RIF/epigastric/periumblical/diffuse
d) Shifting of pain
e) Migration or radiation of pain
f) Character of pain
g) Aggravating factors
h) Relieving factors

2. VOMITING

a) Episodes
b) Relation to pain
c) Frequency and quantity
d) Character: projectile/effortless
e) Colour and nature of vomitus

3. FEVER

a) Mild/moderate/severe
b) Continuous/intermittent/remittent

4. BOWELS

a) Diarrhea
b) Constipation
c) Tenesmus

5. MICTURITION

a) Painful/burning
b) Frequency
c) Quantity
d) Colour

6. OTHER COMPLAINTS

Past History:

Personal History:

Family History:

Menstrual history:

GENERAL PHYSICAL EXAMINATION:

Vital Data: Temp: Pulse:

BP : RR:

BMI: Weight (kg)/Height $(m)^2$:

Pallor: Icterus: Cyanosis:

Clubbing: Lymphadenopathy: Pedal edema:

SYSTEMIC EXAMINATION**:**

EXAMINATION OF ABDOMEN:

1. Inspection:

2. Palpation:

3. Percussion:

4. Auscultation:

5. Digital Rectal Examination:

6. Vaginal examination:

CVS**:**

RS:

CNS:

INVESTIGATIONS:

Hb%: TC: DC: ESR:

BT: CT: Blood grouping and typing:

Blood urea: Serum Creatinine:

RBS: FBS: PPBS:

Urine routine:
Albumin: Microscopy:

ECG: HIV: HbsAg:

Erect X-ray abdomen:

USG abdomen:

Others:

Pre-Operative diagnosis:

Surgery: Emergency/ Elective:

Operative findings:

Anaesthesia: Spinal/General/Epidural

Sample for HPE: YES/NO

HISTOPATHALOGICAL REPORT:

KEYS TO MASTER CHART

Sl.No - Serial Number

H.No - Hospital Number

M - Male

F - Female

USG - Ultrasonography

HPE - Histopathological examination

M - Migratory Pain

A - Anorexia

N - Nausea

T - Tenderness (RIF)

R - Rebound tenderness

E - Elevated Temperature

L	- Leukocytosis
I	- Inflamed Appendix
G	- Gangrenous Appendix
P	- Perforated Appendix
N	- Normal Appendix
S	- Suggestive of Appendicitis
NS	- Not Suggestive of Appendicitis

MASTER CHART

Sl.No. No.	H. No.	Age	Sex	M	A	N	T	R	E	L	Score	USG	HPE
1.	377986	21	M	1	1	1	2	1	1	2	9	S	I
2.	386232	31	M	1	1	1	2	1	1	2	9	S	I
3	333042	18	F	1	1	1	2	1	1	2	9	S	I
4	415879	24	M	1	1	1	2	1	1	2	9	S	I
5	335563	45	F	1	1	1	2	1	1	2	9	S	I
6	283796	27	F	1	1	1	2	1	1	2	9	S	I
7	442247	23	M	1	1	1	2	1	1	2	9	S	P
8	410077	40	M	1	1	1	2	1	1	2	9	S	G
9	437539	18	M	1	1	1	2	1	1	2	9	S	I
10	286939	29	F	1	1	1	2	1	1	2	9	S	I
11	305744	25	F	1	1	1	2	1	1	2	9	S	P
12	397006	39	M	1	1	1	2	1	1	2	9	NS	I
13	323536	22	F	1	1	1	2	1	1	2	9	S	I
14	431876	41	M	1	0	1	2	1	1	2	8	S	I
15	326250	25	F	1	1	1	2	1	0	2	8	S	N
16	419310	30	M	1	1	1	2	1	1	0	8	NS	G
17	435088	41	M	1	0	1	2	1	1	2	8	S	I
18	343735	31	F	1	1	1	2	1	0	2	8	NS	I
19	348199	18	M	1	1	1	2	1	1	0	7	S	I
20	424744	22	M	1	0	1	2	1	1	2	8	S	I
21	326216	24	F	1	1	1	2	1	0	2	8	S	I
22	421878	36	M	1	1	1	2	1	1	0	7	S	I
23	359439	20	M	1	0	1	2	1	1	2	8	S	I
24	335145	25	F	1	1	1	2	1	0	2	8	S	N
25	323046	40	M	1	1	0	2	1	1	2	8	S	I
26	341379	28	M	1	0	1	2	1	1	2	8	S	P
27	389616	19	M	1	1	1	2	1	0	2	8	NS	I
28	335749	47	M	1	1	1	2	1	1	0	7	S	I

29	343641	40	F	1	0	1	2	1	1	2	8	S	I
30	256052	25	F	1	1	1	2	1	0	2	8	S	I
31	240687	38	F	1	1	1	2	1	1	0	7	S	N
32	388232	30	M	1	0	1	2	1	1	2	8	S	I
33	397542	23	M	1	1	1	2	1	0	2	8	NS	I
34	240679	36	F	1	1	1	2	1	1	0	7	S	I
35	361323	20	M	1	0	1	2	1	1	2	8	S	G
36	389587	31	M	1	1	1	2	1	0	2	8	NS	I
37	424221	45	M	0	0	1	2	1	1	2	8	S	N
38	371483	23	M	1	0	1	2	1	1	2	8	S	I
39	361756	30	M	1	1	1	2	1	0	2	8	NS	I
40	300921	17	M	1	1	1	2	1	1	0	7	S	I
41	236009	20	F	1	0	1	2	1	1	2	8	S	I
42	392409	41	M	1	1	1	2	1	0	2	8	S	I
43	428507	24	M	1	1	1	2	1	1	0	7	NS	I
44	380196	37	M	1	0	1	2	1	1	2	8	S	P
45	236086	64	M	1	1	1	2	1	0	2	8	S	I
46	353809	25	F	1	0	1	2	1	1	2	8	NS	I
47	243930	21	M	1	0	1	2	1	1	2	8	S	I
48	261361	62	M	1	1	1	2	1	0	2	8	NS	I
49	261504	34	M	1	1	1	2	1	1	0	7	S	I
50	261455	52	M	1	0	1	2	1	1	2	8	S	I
51	371340	55	F	1	1	1	2	1	0	2	8	S	I
52	261444	45	M	1	1	1	2	1	1	0	7	S	I
53	263172	31	M	1	0	1	2	1	1	2	8	S	I
54	263757	29	M	1	1	1	2	1	0	2	8	S	I
55	268930	41	M	1	1	1	2	1	1	0	7	S	I
56	374711	51	F	1	0	1	2	1	1	2	8	S	G
57	275505	25	M	1	0	1	2	1	1	2	8	S	I
58	268189	18	M	1	1	1	2	0	0	2	7	S	I

59	377347	47	F	1	0	1	2	0	1	2	7	S	G
60	258027	25	M	1	1	1	2	1	0	0	6	S	I
61	283302	60	M	1	0	1	2	0	1	2	7	NS	N
62	430321	22	F	1	1	1	2	1	1	0	7	S	I
63	284684	36	M	1	0	1	2	0	1	2	7	S	I
64	430057	21	F	1	1	1	2	1	1	0	7	S	I
65	309070	31	M	1	0	1	2	0	1	2	7	S	I
66	323046	25	M	1	1	1	2	1	1	0	7	S	I
67	335749	32	M	1	0	1	2	0	1	2	7	S	I
68	413328	46	F	1	1	0	2	1	0	2	7	S	I
69	335940	23	M	1	0	1	2	0	1	2	7	S	G
70	341379	25	M	1	1	1	2	1	0	0	6	S	I
71	388636	32	F	1	0	1	2	0	1	2	7	S	I
72	350544	26	M	1	1	1	2	0	0	2	7	S	I
73	335563	60	F	1	0	1	2	0	1	2	7	NS	I
74	361756	30	M	1	1	1	2	1	1	0	7	S	I
75	361323	47	M	1	0	1	2	0	1	2	7	S	N
76	343641	50	F	1	1	1	2	1	1	0	7	S	I
77	380206	24	F	1	0	1	2	0	1	2	7	S	I
78	357834	18	M	1	1	1	2	1	1	0	7	S	I
79	377667	40	M	1	0	1	2	0	1	2	7	S	I
80	326216	51	F	1	1	1	2	0	0	2	7	S	I
81	377986	23	M	1	0	1	2	0	1	2	7	NS	I
82	382562	36	F	1	1	1	2	1	1	0	7	S	I
83	380196	25	M	1	0	1	2	0	1	2	7	S	I
84	323536	18	F	1	1	1	2	1	1	0	7	S	I
85	386556	22	M	1	0	1	2	0	1	2	7	S	I
86	421474	42	M	1	1	1	2	1	0	0	6	S	I
87	332955	26	F	1	0	1	2	0	1	2	7	S	I
88	388232	35	M	1	1	1	2	1	0	0	6	S	I

89	321402	18	F	0	1	1	2	1	1	2	8	S	I
90	389616	36	M	0	1	1	2	1	1	2	8	NS	I
91	321059	40	F	0	1	1	2	1	1	2	8	S	I
92	389587	26	M	0	1	1	2	1	1	2	8	S	I
93	392409	26	M	0	1	1	2	1	1	2	8	S	I
94	392943	24	F	0	1	1	2	1	1	2	8	S	I
95	365644	20	F	0	1	1	2	1	1	2	8	S	I
96	394535	55	M	0	1	1	2	1	1	2	8	NS	I
97	341081	23	F	0	0	1	2	1	1	2	7	S	I
98	424221	34	M	0	1	0	2	1	1	2	7	S	I
99	349716	43	F	0	0	1	2	1	1	2	7	S	G
100	428507	22	M	0	0	1	2	1	1	2	7	S	I
101	405218	31	F	0	0	0	2	1	1	2	6	NS	I
102	437539	26	M	0	0	0	2	1	1	2	6	S	N
103	462246	42	F	0	0	0	2	0	1	0	3	S	N
104	439376	21	F	0	0	0	2	0	1	0	3	NS	I
105	460572	45	M	0	0	0	2	1	1	0	4	NS	I