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"ACCURATE DIAGNOSIS OF ACUTE APPENDICITIS BY NEW SCORING SYSTEM, A ONE YEAR STUDY"

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This is to certify that the dissertation entitled **"ACCURATE DIAGNOSIS OF ACUTE APPENDICITIS BY NEW SCORING SYSTEM, A ONE YEAR STUDY 2010-2011"** is a bonafide research work done by **REG NO. BH0110006.**

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LIST OF ABBREVIATIONS USED

AA	Acute appendicitis
CI	Confidence interval
CT	Computed tomography
CRP	C- reactive protein
IL-6	Interleukin -6
MALT	Mucosa associated lymphoid tissue
MRI	Magnetic resonance imaging
NOTES	Natural orifice transluminal endoscopy surgery
PID	Pelvic inflammatory disease
RLQ	Right lower quadrant
RIF	Right iliac fossa
SPSS	Statistical package for the social sciences software
TLC	Total leucocyte count
USG	Ultrasonography
UTI	Urinary tract infection
HPR	Histopathological report

ABSTRACT

Background

Acute appendicitis is common surgical emergency. Accurate diagnosis and timely intervention is very important to reduce the morbidity and mortality. The diagnosis of acute appendicitis is primarily clinically based on signs and symptoms supported by investigations. In an attempt to increase the diagnostic accuracy numerous scoring systemshave been developed. The new scoring system was formulated to develop as a simple and reliable scoring system with high diagnostic accuracy.

Objective

The objectives of the study were to evaluate the predictability of new scoring system in diagnosis of acute appendicitis and compare its accuracy with histopathological report.

Methods

A prospective non ranadomized study was conducted in 100 patients with clinical diagnosis of acute appendicitis undergoing emergency appendectomy over a period of 1 year. The new score was obtained at the time of admission. Histological diagnosis of acute appendicitis was considered as final diagnosis.

Results

New score (≥13) was 82.9% sensitive and 81.1% specific , positive predictive value of 79.5% and negative predictive value of 84.3%, in diagnosing acute appendicitis with an overall diagnostic accuracy of 82%.

Conclusion

Acute appendicitis is a common surgical emergency. Good clinical judgment aided by investigation, scoring system can help to reduce the negative appendectomy rate. The new scoring system can be used as effective modality to establish the accurate diagnosis of acute appendicitis.

Key Words

Acute Appendicitis; Total Leucocyte Count; Right Iliac Fossa Tenderness; Rebound Tenderness; Ultrasonography .

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INTRODUCTION

Acute appendicitis is the most common surgical condition in non traumatic acute abdominal pain. The lifetime risk of AA for men and women is 8.6% and 6.7%, respectively[1-3]. The cornerstone of the diagnosis of AA has traditionally been the combination of history and physical examination. However at times, the clinical evaluation of patients with suspected AA become complex. Prompt and accurate diagnosis is imperative to decrease the frequency of complications, such as appendicular perforation, appendicular abscess and phlegmon formation which are associated with increase morbidity and mortality. Complication are more common in extreme age group of patients who have greater perforation rate with more chances of intraoperitonial spread of infection due to their poor localizing capability[4,5].

Acute appendicitis is one of the most common reasons for emergency laparotomy. The lifetime risk of having an appendectomy is 12% for men and 25% for women[1-3]. In one aspect of the disease there is a fear of perforation due to delay in the diagnosis which can lead to increase morbidity and length of hospital stay. On the other is a high negative appendectomy rate of approximately 10% to 15% for the total population and as high as 26% in females of reproductive age[1]. This is also a cause for concern with significantly longer hospital stay, high fatality rate, higher rate of infectious complications and unnecessary hospital expenses[1]. One should both decrease the rate of perforation and the negative appendectomy rate by increasing the diagnostic accuracy.

The most accurate means of diagnosing AA is still a source of debate. It has historically been a clinical diagnosis. A constellation of history, physical signs, radiographic investigation, and laboratory analysis is used to balance the risk of delay

in operative intervention against the removal of a normal appendix (non therapeutic laparotomy). The overall accuracy of the clinical examination in diagnosing AA has been reported to be 70% TO 87% (54% to 70% in children and 50% to 70% in women of childbearing age) [6, 8].

The classical history of AA is a vague periumbilical pain that localizes to the right lower quadrant, followed by anorexia, nausea, and vomiting, which evolves over 12 to 24 hours. The symptom most consistently present are abdominal pain and anorexia[3]. Other symptoms are more variable, as are the physical findings of tachycardia, low grade fever, and the laboratory values of leucocytosis with a left shift. Tenderness to palpation, Obturator sign, and Rovising' s sign is less common. Approximately 20% to 30% of patients with suspected acute appendicitis arewith atypical findings[8].

Routine laboratory blood examination is mandatory in all but not always very helpful with normal finding in some patients. Both leukocytosis and raised C- reactive protein (CRP) levels are non specific and only indicate that the patient may have inflammatory pathology in the body. However a rise of repeated leukocyte count is more specific in diagnosing AA[9, 10].

Radiological investigation like X-ray of the abdomen has an abnormal finding in only 8% of patients. These include presence of fecoliths, dilated sentinel loop of bowel and blurring of psoas shadows[10].

Ultrasonography (USG) has significantly improved the diagnostic accuracy in suspected appendicitis with an overall accuracy of 85 -96%. The main limitation is that it is operator dependent with lower diagnostic rates with inexperienced radiologist[11, 12].

Computed tomography (CT) scan has also been widely studied for the diagnosis of inflamed appendix with high accuracy of 89 -98%. Limited availability and high costs limit it use in daily practice[13].

Diagnostic laparoscopy is useful in evaluating patients with right lower abdominal pain, especially in those with equivocal signs of AA. It has the additional benefit of being therapeutic. Premenopausal women benefit the most from this procedure. In one study selective laparoscopy has reduced the rate of negative appendectomy rate from 37% to 31%; by contrast, routine laparoscopy has reduced the negative appendectomy rate to 5%. Its unavailability, invasiveness and the need for expertise are its limitations in our context[14].

Early and accurate diagnosis is essential to reduce the morbidity and mortality as a consequence of delayed appendectomy and to reduce the negative appendectomies. The new scoring[69] system was formulated in attempt to develop a simple and reliable scoring system with high diagnostic accuracy.

It is a combination of clinical evaluation, ultrasonography and laboratory marker of inflammatory response. Therefore this study was conducted to find out the usefulness ofnewscoring system in diagnosis of AA. This hopefully will lower the negative appendectomy rate in our setup.

OBJECTIVE OF THE STUDY

- To evaluate the role of new scoring system in diagnosis of acute appendicitis and compare its accuracy with histopathological report.

REVIEW OF LITERATURE

Appendicitis refers to the inflammation of vermiform appendix. Vermiform is a Latin word which means a worm shaped object. Literally speaking appendix denotes to an appendage to a larger or major part as atail or limb. The vermiform appendix is a worm shaped tubular structure arising from caecum.

Historical aspect

Right iliac fossa pain and its consequence have been a common problem since ancient times. But it took centuries to establish appendicitis as the most important cause for this phenomenon. It was Berengarius Carpus, professor of surgery at Pavia and Bologna, who gave the first description of the structure in 1522. He found at the end of the caecum a certain “additmentum” empty within, and in breadth less than the smallest finger of the hand, and of a length of three inches or thereabouts.[15]Vesalius writing twenty one year later, augmented this description and gave several illustrations. Much confusion appeared to exist at that time between the caecum and the appendix.

Fallopius, writing in 1561, appears to have been the first writer to compare the appendix to a worm; and Bauhin (1579) to ascribe thereto a function. He proposed the ingenious theory that the appendix served in intrauterine life as a receptacle for the faxes[15]. In 1888, Treves described the possible positions of the appendix in the form of clock face[16]. Since the close of the eighteenth century the gross anatomy of the appendix has been fairly well known; it’s three coats; its mucous glands, and their abundant secretion; the meso-appendix and the folds produced by the peritoneum in this region were discussed in more or less detail by all anatomical writers.

An aphorism of Hippocrates "Suppuration upon a protracted pain of the parts about the bowels is bad has led many to believe that he knew and spoke of appendical abscess. In fact, Peter Lowe, in 1612, said in quoting Lonicerius, "Hippocrates did die of this disease"[15].

In 1866, Reginald H, Fitz of Boston, showed that the symptoms in 209 cases of typhilitis or perityphilitis were identical with those observed in 257 cases of perforation of the appendix, and convinced the medical world of the practical contention than in all inflammation of the right iliac fossa, the "fons et ortigomali" was the vermiform process of the caecum[15].

Acute appendicitis was described by WihelmBallonius in 1734, James Parkinson (1775- 1824) described peritonitis as an important complication of acute perforated appendicitis[17]. Lawson Trait in 1880 removed an inflamed but intact appendix[18].

Claudius Amyand, F.R.S. recorded the first removal of the human appendix in 1735, during the course of operation for hernia and Mestivier in 1759 was the first to willfully open an appendical abscess. Hancock in 1848 performed the first deliberate laparotomy for peri-appendicular suppuration, and proposed such treatment for all cases with abscess before pointing or fluctulation had occurred, or even before adhesion to the anterior abdominal wall had formed. In 1888 Treves had done the first interval appendectomy. Since 1890 the history of appendicitis has been one of refinement in technique and diagnosis.

Charles McBurney in New York pioneered early diagnosis and early operative intervention in acute appendicities[19]. In 1899 he described the migratory pain and demonstrated that in a case of acute appendicitis the site of maximum tenderness lies

one-half to two inches inside the right anterior spinous process of the ileum on the line drawn to the umbilicus[20].This point is now known as the McBurney's point. He also devised the muscle splitting incision for appendectomy. Later Rutherford Morrision in 1896 modified it to muscle cutting incision[21].

In 1905, Murphey described the appropriate sequence of symptoms in acute appendicitis. It comprised of pain followed by nausea and vomiting with fever, known as Murphy's triad[22]. In the modern era with the availability of good diagnostic tools, improved antisepsis and antibiotics, mortality rate is 0.25% if all ages are considered[23, 24]. Surgery has now become the standard treatment of acute appendicitis with good outcome and low complication rates.

Epidemiology

Acute appendicitis is a common cause of non traumatic surgical acute abdomen. The incidence of acute appendicitis in the United States population to be 11 cases per 10,000 populations annually. Incidence of appendicitis seems to have greatly increased in the first half of this century, particularly in Europe, America and Australia with incidence up to 16% of the population undergoing appendectomy [25.] In the past 30 years the incidence has fallen dramatically in these countries, such that individual life time risk of appendectomy is 8.6% and 6.7% respectively [26, 27.] The disease is slightly more common in males, with a male: female ratio of 1.4:1. In a lifetime, 8.6% of males and 6.7% of females can be expected to develop acute appendicitis. Young age is a risk factor, as nearly 70% of patients with acute appendicitis are less than 30 years of age[18]. The highest incidence of appendicitis in males is in the 10- to 14-year-old age group (27.6 cases per 10,000 populations), while the highest female incidence is in the 15- to 19-year-old age group (20.5 cases

per 10,000 populations) [18]. Patients at extremes of age are more likely to develop perforated appendicitis. Overall, perforation was present in 19.2% of cases of acute appendicitis. This number was significantly higher, however, in patients under 5 and over 65 years of age. Although less common in people over 65 years old, acute appendicitis in the elderly progresses to perforation more than 50% of the time[18].

Anatomy

The vermiform appendix is a narrow, vermian (worm-shaped) tube which arises from the posteromedial caecal wall 2 cm below the end of the ileum. It may occupy one of several positions. Thus it may be retrocaecal, retrocolic (behind the caecum or lower ascending colon respectively), pelvic or descending (when it hangs dependently over the pelvic brim, in close relation to the right uterine tube and ovary in females). These are the commonest positions seen in clinical practice. Other positions are occasionally seen especially when there is a long appendix mesentery allowing greater mobility. These include subcaecal (below the caecum); preilial (anterior to the terminal ileum); postileal (behind the terminal ileum) [18].

The three taeniae coli on the ascending colon and caecum converge on the base of the appendix, and merge into its longitudinal muscle. The anterior caecaltaenia is usually distinct and can be traced to the appendix, which affords a guide to its location in clinical practice. The appendix varies from 2 to 20 cm in length: it is often relatively longer in children and may atrophy and shorten after mid-adult life. It is connected by a short mesoappendix to the lower part of the ileal mesentery. This fold is usually triangular, extending almost to the appendicular tip along the whole viscus[18, 29].

The lumen of the appendix is small and opens into the caecum by an orifice lying below and slightly posterior to the ileocaecal opening. The orifice is sometimes guarded by a semilunar mucosal fold forming a valve. The lumen may be widely patent in early childhood and is often partially or wholly obliterated in the later decades of life. The appendix usually contains numerous patches of lymphoid tissue although these tend to decrease in size from early adulthood.

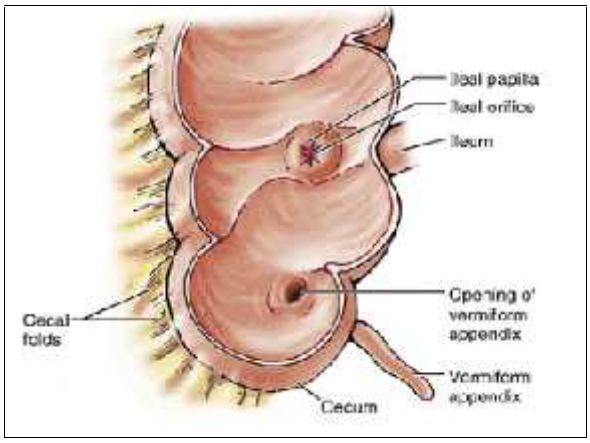


Figure 1: The major positions of the appendix encountered at surgery or postmortem. Source –Clinically oriented anatomy. 4th ed. Philadelphia

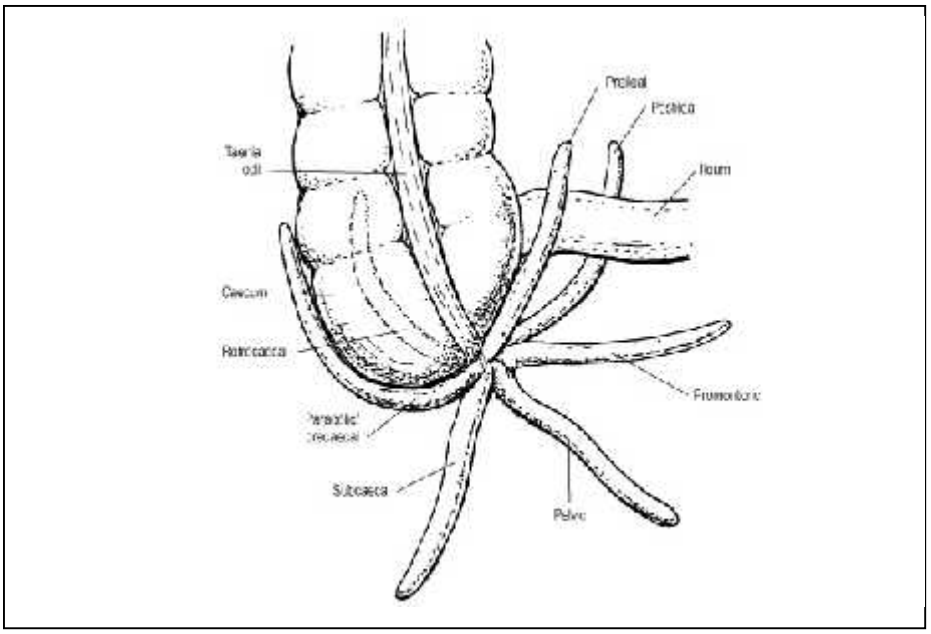


Figure 2: Endoscopic appearance of the appendix orifice Source –Gray's anatomy 39th edition

Histologically, its wall consists of four layers similar to that of large intestine. The mucosa is lined by columnar epithelium. The lamina properia is rich in gland and lymphoid tissue which are aggregated to form lymphoid follicles that extend to the submucosa. These lymphoid tissues aggregated are considered as a part of mucosa associated lymphoid tissue (MALT). Such follicles increase in number when individuals are 8-20 years. Muscularispropria consists of longitudinal and circular muscle layers. Except at the line of attachment of mesoappendix the appendix is completely invested by serosa[18].

The vermiform appendix is a vestigial organ without any known function in human. It's well developed vascularity with great amount of lymphoid tissue hint towards the probability of it being a specialized organ[29]. It may have immunological function. Recently it's being used as a conduit for permanent continent urinary diversion. It is also being used for table lavage of large bowel[18].

VASCULAR SUPPLY AND LYMPHATIC DRAINAGE

APPENDICULAR ARTERY

The main appendicular artery, a branch from the lower division of the ileocolic artery, runs behind the terminal ileum and enters the mesoappendix a short distance from the appendicular base. Here it gives off a recurrent branch, which anastomoses at the base of the appendix with a branch of the posterior caecal artery. The main appendicular artery approaches the tip of the organ, at first near to, and then in the edge of, the mesoappendix.. Accessory arteries are common, and many individuals possess two or more arteries of supply[29].

APPENDICULAR VEINS

The appendix is drained via one or more appendicular veins into the posterior caecal or ileocolic vein and thence into the superior mesenteric vein[18,29].

LYMPHATICS

Lymphatic vessels in the appendix are numerous: there is abundant lymphoid tissue in its walls. From the body and apex of the appendix 8-15 vessels ascend in the mesoappendix, and are occasionally interrupted by one or more nodes. They unite to form three or four larger vessels which run into the lymphatic vessels draining the ascending colon, and end in the inferior and superior nodes of the ileocolic chain[4].

INNERVATION

The appendix and overlying visceral peritoneum are innervated by sympathetic and parasympathetic nerves from the superior mesenteric plexus. Visceral afferent fibers carrying sensations of distension and pressure mediate the symptoms of 'pain' felt during the initial stages of appendicular inflammation. In keeping with other structures derived from the midgut, these sensations are poorly localized initially, and referred to the central (periumbilical) region of the abdomen. It is not until parietal tissues adjacent to the appendix become involved in any inflammatory process that somatic nociceptors are stimulated, and there is an associated change in the nature and localization of pain[29].

Pathophysiology

Acute appendicitis is an inflammation of vermiform appendix. According to the Pathogenesis acute appendicitis are of two types:

1. Obstructive appendicitis
2. Catarrhal appendicitis

Obstructive Appendicitis

It is widely accepted that the inciting event in most instances of appendicitis is obstruction of the appendiceal lumen. The causes of the obstruction include lymphoid hyperplasia, fecal stasis and fecoliths, parasites or, more rarely, foreign bodies and neoplasm. Obstruction of the lumen leads to continued mucus secretion, increased intraluminal pressure, bacterial overgrowth and subsequently lymphatic, venous and then arterial occlusion. Ultimately necrosis and bacterial translocation through appendiceal wall occurs. This is typical of gangrenous appendicitis[29]. Without intervention the gangrenous appendix perforates and leads to the development of appendicular abscess, localized or generalized peritonitis according to the body's immune response to inflammation[30].

Catarrhal Appendicitis

Catarrhal appendicitis is associated with inflammation of only mucosa. It is a milder form of attack with less incidence of perforation and hence lesser complication rates. The inciting event in catarrhal appendicitis might be an infective agent, possibly viral, which initiates an inflammatory response[21]. Initially the appendix appears normal or hyperemic, but the mucosa is thickened, edematous, and reddened. Asthe disease progresses it may become dark and brownish with hemorrhagic infarct

andpatches of ulcers. Subsequently the appendix is swollen, turgid and serosa becomes roughly coated with exudates. Because lumen of appendix is not obstructed it rarelyprogresses to gangrene. In most of the cases it resolves spontaneously. Due to repeatedattacks the appendix may be kinked and due to local adhesion it may develop into obstructive appendicitis[21, 30].

Bacteriology

The flora in the non-inflamed appendix is similar to that of colon with a variety of Facultative aerobic and anaerobic bacteria; hence the bacteria involved in acute appendicitis are the same as for other colonic diseases[30]. Escherichia coli is the commonest aerobic bacteria and Bacteroidesfragilis is the most common anaerobic bacteria implicated. Other bacteria isolated are Klebsiella spp., Proteus spp., Streptococcus faecalis, and Clostridium perfringes[29]. The incidence of obtaining positive cultures from the peritoneal cavity depends on the stage of appendicitis. In non perforated appendicitis peritoneal fluid cultures bacteria in fewer than half of the patients[31]. However peritoneal cultures are positive in more than 85% patients with gangrenous or perforated appendicitis[31]. The usefulness of routine peritoneal cultures in perforated appendicitis is of limited value, because the flora are generally known, results take several days, and many a times no change in treatment plan is made despite culture reports[29].

Clinical Manifestation

Acute appendicitis is a clinical diagnosis based on history and physical findings with Laboratory and radiological assistance. The accuracy rate of the clinical diagnosis of AA has been reported to be approximately 70% to 87%[18,19].

Symptoms Pain

Patients with AA typically presents with initial vague generalized abdominal pain, which becomes more prominent in epigastrium or periumbilical region which later shifts to the right iliac fossa and localizes there (sensitivity 81%, specificity 53%) [20, 32]. The initial vague pain is due to the early obstruction, dilation, and infection of the appendix. As this segmental supply of appendix corresponds to that of the umbilicus the pain is referred to the umbilicus. When the disease process progresses, transmural inflammation occurs with the involvement of parietal peritoneum. At this stage patient has a localized right iliac fossa pain which is somatic pain. The McBurney's point is the area of greatest pain.

Anorexia, Nausea & Vomiting

Pain is followed by anorexia (sensitivity 84%, specificity 66%) and nausea (sensitivity 58-68%, specificity 37-40%) [33]. Vomiting (sensitivity 49-51%, specificity 45-61%) [33] may develop at this time. Anorexia is one of the most constant symptoms of appendicitis and hence the diagnosis of appendicitis should be questioned in a hungry patient[20].

Fever

Fever is not present early in the course of illness. A low grade fever can be present in simple appendicitis; however high grade fever after the onset of illness points towards complicated appendicitis like perforation or abscess formation [33].

Diarrhea

Diarrhea is a less common symptom, which may occur early or late in the course of the disease. Early in the course of appendicitis patient may have one or two loose motion, or they may have an episode of massive evacuation of normal stool. This sequence represents a response to visceral pain. Later in the course of appendicitis, diarrhea may return because of irritation of the rectum by an inflamed pelvic appendix or development of pelvic abscess. This diarrhea is mucoid and persistent. It is accompanied by tenesmus and can easily be mistaken for gastroenteritis [20].

Signs

Tenderness in the right iliac fossa (RIF) is an important sign in acute appendicitis. It is present in more than 90% of the patients. Classically, the area of maximum tenderness will be at McBurney's point. However, tenderness is non specific, and may be absent early in the course of the disease. The degree and point of tenderness may vary according to the position of the appendix with lesser degree of tenderness in retrocaecal appendix. In pelvic appendix there may not be abdominal tenderness, but tenderness in the right wall of the rectum on rectal examination. Presence of rebound tenderness in the right iliac fossa indicates inflammation of the parietal peritoneum and is thought to have sensitivity of 63% and specificity of 69% in diagnosis of acute appendicitis [33].

Demonstration of localized muscular guarding and rigidity (sensitivity 39-74%, specificity 57-84%) indicates more severe degree of inflammation and often indicate localized peritonitis as a result of perforation [32, 20]. Many patients in the early stage of appendicitis demonstrate little or no rigidity of the abdominal wall.

Rovsing's sign is positive when patient experiences pain in the right iliac fossa upon application of pressure in the left lower abdomen (sensitivity 68%,specificity 58%) [33].

Psoas sign (sensitivity 16%, specificity 95%) [33] is an indicator of retrocaecal appendix, overlying the psoas major muscle. This sign is elicited by extending the right thigh with the patient lying on the left side of the body.

Obturator sign[20] is elicited with the patient lying supine with the passive internal rotation of the flexed right hip. Positive sign indicates the inflamed appendix lying above the obturatorinternus muscle in pelvic position.

Positive cough sign (right lower abdomen pain on coughing) [33] indicate localized peritoneal inflammation.

Patients who present late with generalized abdominal pain, generalized tenderness and rigidity with initial features of AA points towards appendicular perforation peritonitis.

Fever (sensitivity 67%, specificity 69%) [20] is a late physical findings in AA. Before perforation, body temperature is usually no more than 39-39.5 degree centigrade but may rise to 40-41 degree centigrade when complications like abscess or perforation occurs.

Diagnosis of acute appendicitis

Though many clinical and lab parameters have been described, early and accurate diagnosis of AA at times become difficult. Delayed diagnosis and intervention increased morbidity and mortality. The mortality rate in non perforated appendicitis is less than 1%, but it may be as high as 5% or more in young and elderly patients, in whom diagnosis may often be delayed, thus making perforation more

likely[34] .Clinical history and physical examination remain the most important diagnostic tools. Additional information are provided by lab and radiological studies and hence the combination of all of these increase the overall diagnostic accuracy of AA. The diagnostic value of different lab parameters appeared to b dependent on the degree of inflammation and perforation[35].

Hematological Investigation

Total Leucocytes Count

Estimation of TLC is a preliminary, easy to perform and a cheaper investigation used to aid in the diagnosis of acute appendicitis. It is an important marker of inflammation. Approximately 79-90% of patients with acute appendicitis have a raised TLC[36, 37.] An elevated TLC is a sensitive but not diagnostic test because of its low specificity[24, 38]. Up to 60% of patients with only non specific abdominal pain can have increased counts initially[39]. When the counts are repeated after some interval of time remain high or increases further in patients with acute appendicitis, but decreases significantly in patients with non specific abdominal pain[40]. The sequential rise in TLC has a better diagnostic accuracy than a single high count (sensitivity 92vs 69% and specificity 100vs 83%) [41].

Some reports indicate that high TLC with differential count is a reliable indicator of the severity of AA and signifies a more advanced stage [42, 43], whereas others find it a very poor predicator of severity of the disease [44]. The rate of infection increases as the total counts rises above the upper normal limit indicating that the raised counts also has some prognostic value[45]. The percent of neutrophil is also important in diagnosing appendicitis. More than 78% of the patients with Acute Appendicitis have various degree of neutrophilia[46]. Total and differential leukocyte

count is inexpensive, rapid and widely available; however, the findings are non specific.

C- reactive protein (CRP)

CRP is an acute phase protein synthesized in the liver in response to bacterial infection and its elevation indicates ongoing inflammations in the body. Serum levels begin to rise within 6-12 hrs of acute tissue inflammation. Physiologically, CRP enhances cell-mediated immunity by promoting phagocytosis, accelerating chemotaxis, and activating platelets. It's a non specific marker of inflammation. The value of raised CRP in diagnosis of Acute Appendicitis has been extensively studied[38], [47]. The diagnostic accuracy of CRP has shown a wide range of variations in different study with sensitivity of 40-99% and specificity 27-90%[48, 49]. The level of circulating CRP correlates with the severity of appendical inflammation with higher levels recorded in more advanced disease [41, 37]. CRP levels were elevated in 71-75% of patients with early appendicitis and in 83-90% with gangrenous appendicitis[41]. High level of CRP (>0.8 mg/dl) with leukocytes and neutrophilia are the most important lab findings in Acute Appendicitis [50]. CRP results do not distinguish between various types of bacterial infection.

Other marker of inflammation

Interleukin-6 (IL-6), tumor necrosis factor α (TNF-α) and acid α1-glycoprotein (α1 GP), are some of the other inflammatory markers tested in Acute Appendicitis. In one study the IL-6 was found to be superior to CRP and TLC in predicting Acute Appendicitis, with sensitivity of 84%, specificity of 79% and diagnostic accuracy of 82% [51].

Urine Analysis

Urinalysis is commonly obtained in patients with lower abdominal pain to rule out urinary tract pathology. It's not helpful for confirming or refuting the diagnosis of Acute Appendicitis. Graham reported abnormal urinalysis in 10 of 62 patients with Acute Appendicitis before appendectomy[52]. Hematuria, pyuria and proteinuria can be present in 40% of patients with Acute Appendicitis[53]. Pyuria may result from irritation of the ureter by a retrocaecal appendix or irritation of the bladder by a pelvic appendix. The diagnosis of appendicitis should not be dismissed due to the presence of urological symptoms or abnormal urinalysis.

Radiological Studies

Plain abdominal X-ray

The role of plain x- ray abdomen in the diagnosis of Acute Appendicitis is poorly appreciated[54]. Abdominal radiograph has virtually no role in diagnosis of Acute Appendicitis. However it may be useful when the patient has atypical features to rule out other mimicking pathologies like urtherolithiasis. Plain abdominal radiograph obtained in the evaluation of the patients with acute abdomen usually include supine and erect films of the abdomen. Brooks and Killen have listed following radiological signs for AA[53] :

1). Fluid levels localized to the caecum and terminal ileum, indicating inflammation in the right lower quadrant,

2). Localized ileus with gas in the caecum, ascending colon and terminal ileum,

3). Increased soft tissue density of the right lower quadrant,

4). Blurring of the right flank stripe and presence of a radiolucent line between the fat of the peritoneum and tansversusabdominis,

5). Fecolith in the right iliac fossa,

6). Gas filled appendix,

7). Intraperitoneal gas,

8). Deformity of the caecal gas shadow due to adjacent inflammatory mass

9). Blurring of the psoas shadow on the right side. These signs are non specific as to be of no value in the diagnosis of appendicitis.

Barium contrast studies

Historically role of Barium enema has been studied for the evaluation of possible appendicitis. Cecal spasm, extrinsic compression of the cecum, non visualization of the appendix, and partial visualization of the appendix appear to be useful signs, either singly or in combination, in diagnosing Acute Appendicitis[55]. Barium enema is no longer done today for diagnosis of Acute Appendicitis because of invasiveness of the test, the time required to perform the tests, low diagnostic yield and the need for special preparation and the availability of high resolution USG and CT scan. Barium enema complements USG and CT examinations in defining mucosal lesions of the cecum and appendix. It should be considered in settings of chronic or recurrent abdominal pain. It can be used for Acute Appendicitis when diagnosis is suspected but unclear and when both CT and USG are not helpful.

Ultrasonography (USG)

Abdominal USG is often used as an initial diagnostic imaging study in patients suspected of Acute Appendicitis. USG is performed with high resolution linear array transducers (usually 5-MH). USG criteria for the diagnosis of Acute Appendicitis

areprobe tenderness, a non-compressible appendix of 7 mm or greater in anteroposterior diameter, the presence of an appendicolith, and interruption in the continuity of the echogenic submucosa, periappendicularfluid or mass and atypical target sign[57]. A fecolith in combination with localized right iliac fossa pain is highly diagnostic of AA[58]. False negative results are usually due to non visualization of retrocaecal appendix due to caecal gas. The sensitivity is usually considerably lower in patients with perforated appendicitis, as the rigidity of the abdominal wall prevents its adequate compression. Recent developments in the technique and interpretation of USG have made this a valuable adjunct to physical examination especially in young women and in patients with atypical symptoms. USG has significantly improved the diagnostic accuracy in suspected appendicitis with an overall accuracy of 85-96%[59, 60]. For differential diagnosis of AA, USG demonstrates other diseases that mimic Acute Appendicitis. It's possible to reduce the negative appendectomy rate particularly in children by revealing mesenteric lymphadenitis or terminal ileitis and in young women by directing attention to gynecological diseases.

Advantages of USG include its noninvasiveness, short acquisition time, lack of radiation exposure, and potential for diagnosis of other causes of abdominal pain, particularly in the subset of women of child bearing age. The principal disadvantage is that its operator dependent. Because non visualization is interpreted as a non inflamed appendix, technical expertise and commitment to a thorough examination are essential in obtaining maximum sensitivity. If graded compression USG is positive for appendicitis, appendectomy should be performed. If negative, consideration should be given to further observation and CT scan is possible.

Computed Tomography (CT)

With the growing availability and resolution, contrast-enhanced computed tomography (CECT), has been reported as an accurate tool in the diagnosis of AA. CT scan has been reserved for the patients with an equivocal history, physical and lab findings. These atypical patients benefit from CT scanning. CECT, oral and intravenous contrast-enhanced is used for the highest diagnostic accuracy. Fine (5mm) cuts images should be obtained in the region of the appendix[57]. A CT scan is read as positive for AA if one or more of the following feature are identified: inflamed pericaecal fat, an irregular semiliquid fluid-filled pericaecal lesion with or without the presence of a gas bubble, the visualization of a fecolith, or a distended appendix (≥7 mm in diameter) [57]. In general, CT findings of AA increase with severity of the disease. CT scan has accuracy of 89-98%[50]. This is likely due to CT scan being less dependent on body habitués and presence of intestinal gas.

Advantages of CT scanning include its superior sensitivity and accuracy compared with those of other imaging techniques, non invasiveness, and potential to reveal alternative diagnosis. Disadvantages include limited availability, high cost, radiation exposure, and potential for anaphylactic reaction if intravenous contrast agent is used, lengthy acquisition time if oral contrast is used, and patient discomfort if rectal contrast is used.

Magnetic Resonance Imaging (MRI)

MRI is an emerging promising technique for the diagnosis of Acute Appendicitis. Itsspecially useful in patients with non diagnostic ultrasound and in patients where radiation is a clinical concern, such as pregnant and pediatric patients[63]. MRI is most useful for evaluating pregnant patients with acute lower

abdominal pain believed to have an extra uterine cause, such as appendicitis or ovarian torsion. A single retrospective study assessed the accuracy of MRI in 51 pregnant patients with suspected appendicitis in whom ultrasonography was non diagnostic. Sensitivity, specificity, positive and negative predictive values, and accuracy for MRI was 100%, 93.6%, 91.4%, 100%, and 94%, respectively[64]. Disadvantage of MRI include its high cost, the limited availability of MRI system and trained radiologists.

Nuclear medicine

Radionuclide scanning has been studied in patients with suspected Acute Appendicitis with atypical features. The test is based on the localization of technetium-99m labeled leukocyte and IgG at the site inflammation[57]. Whole blood is withdrawn for radionuclide scanning. Neutrophills and macrophages are labeled with technetium-99m albumin and administrated intravenously. Images of the abdomen and the pelvis are obtained serially over 4 hrs. Localized uptake of tracker in the right lower quadrant (RLQ) suggests appendical inflammation. Four early studies in adults with suspected appendicitis shows a sensitivity of 80-90% and specificity of 92-100%[64, 65]. Two studies of newer labeling techniques achieved sensitivity of 98% for the presence of appendicitis[66, 67]. It may be potentially useful in patients with persistent symptoms and negative radiological findings[57]. The acquisition time of 5 hrs and the lack of availability are disadvantage to its use as a high sensitivity emergency department screening test for appendicitis.

Diagnostic Laparoscopy

It is useful when the diagnosis of appendicitis is unclear[57]. The previous philosophy of when in doubt, take it out has been changed to when in doubt check it out[67] Laparoscopy provides the surgeon with the tool to rule out appendicitis and then inspect other organs to determine the real cause of symptoms. Diagnostic Laparoscopy is useful in evaluating patients with right lower abdominal pain, especially in those with equivocal signs of acute appendicitis. It has the additional benefit of being therapeutic. Premenopausal women benefit the most from this procedure. In one study selective laparoscopy has reduced the rate of negative appendectomy rate from 37%-31% by contrast; routine laparoscopy has reduced the negative appendicectomy rate to 5%[28]. Its unavailability, invasiveness and the need for the expertise are its limitations in our context.

Scoring systems

Diagnosis of acute appendicitis is difficult & its complications more in young children & the elderly. Acute appendicitis is a clinical diagnosis and no laboratory or radiological tests are 100% accurate. Delay in diagnosis and management may increase the morbidity& costs.

Lots of efforts have been directed toward early diagnosis and treatment of acute appendicitis. A number of scoring systems have been used for aiding in early diagnosis of acute appendicitis and its prompt management. Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and non specific abdominal pain[68].

During the last 20 yrs there has been a growing trend toward the use of formal probabilistic reasoning or quantative data as a guide to clinical decision making[63]. In this respect, several scoring systems, computer based models, and algorithms[70, 71] have been developed for supporting the diagnosis of Acute Appendicitis on the basis of grading medical history, clinical symptoms and signs, and indicators of inflammatory response. The main aim of these score is to support the diagnosis of Acute Appendicitis and reduce the negative appendectomy. Among several scoring systems Alvarado scoring system has been widely used.

Alvarado scoring system

Alvarado scoring system[72] was formulated in 1986 by Alvarado. This system is based on clinical evaluation and lab markers of inflammatory response and has been validate in adult surgical practice.There are all together 10 points and a score of 7 or more is considered as diagnostic of Acute Appendicitis and needs operation[73]. With the score of less than 7 patients is observed and reevaluated to rule out other cause of right iliac fossa pain. The reported sensitivity and specificity of Alvarado score ranges from 73-90% and 87-92% respectively[74, 75].

Table 1: The Alvarado Score

	Parameters	Points
Symptoms	Migration of pain to right iliac fossa	1
	Anorexia	1
	Nausea, Vomiting	1
Signs	Tenderness in RLQ	2
	Rebound tenderness	1
	Elevation of temperature	1
Laboratory	Leukocytosis	2
	Shift to the left of neutrophil	1
Total score		10

Modified Alvarado scoring system

The classic Alvarado score included left shift of neutrophil maturation (score 1) yielding a total score of 10. However in 1994 Kalan omitted this parameter and produced a modified score. MAS is a simple aid for the diagnosis of acute appendicitis and patients with MAS of 7 or above will have more chances of having acute appendicitis than patients having MAS of 6 or below[76].

In the diagnosis of acute appendicitis, the modified Alvarado score is a fast, simple, reliable, noninvasive**,** repeatable and safe diagnostic modality without extra expense and complications. It is very handy in peripheral hospitals where backup facilities are sparse. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendicectomy and thus reduces complication rates. Talukder DB et al[77] found that higher the score, more of its sensitivity. Patients with the Alvarado score ranges 8-10, 5-7 and 1-4 have the accuracy 95%, 78%, and 0% respectively. Fengo et al[78] reported a sensitivity of 90.2% and others reported a sensitivity of 73% with negative laparotomy rate of 17.5%. In this series the sensitivity of the patients with the score 7 and above was 93% in male and 84% in female and the combined sensitivity was 89%. Whereas it was 73% and 60% in male and female respectively and the combined sensitivity is 68% in the patients with score less than 7. In a study of Lone et al[79] has shown the sensitivity of the patients with the score 7 and above was 94% in male and 81% in female and the combined sensitivity was 88%. Whereas it was 69% in male and 63% in female and the combined sensitivity was 67% in the patients with score less than 7

Table 2: The Modified Alvarado Score

	Parameters	Points
Symptoms	Migration of pain to right iliac fossa	1
	Anorexia	1
	Nausea, Vomiting	1
Signs	Tenderness in RLQ	2
	Rebound tenderness	1
	Elevation of temperature	1
	Extra sign(s), e.g. cough test and/or Rovsing's sign and/or rectal tenderness	1
Laboratory	Leukocytosis	2
Total score		10

Interpretation of the Modified Alvarado score was as follows:

Score 1-4: acute appendicitis very unlikely

Score 5-7: acute appendicitis probable

Score 8-10: acute appendicitis definite

New system of scoring

This scoring system was formulated in an attempt to develop a simple and reliable scoring system with high diagnostic accuracy[69]. It was developed by Nikolas E.Tzanakis and colleages in 2004. This score is a combination of the clinical evaluation, USG and lab marker ofinflammatory response. There are altogether 4 variables and 15 points and a score of 8 or more is taken as a cutoff value for the diagnosis of acute appendicitis and needs operation. Patient with a score below 8 is

less likely to have acuteappendicitis[69]. This scoring system has the sensitivity, specificity and accuracy of 95.4%, 97.4% and 96.5% respectively[69].

Table 3: The New Score

Variables	Points
Positive USG for AA	6
Tenderness in rt lower quadrant	4
Rebound tenderness	3
Leukocyte count>12000/ul	2
Total score	15

Differential Diagnosis of Acute Appendicitis

The differential diagnosis of AA is often a clinical challenge because appendicitis can mimic several abdominal conditions. The differential diagnosis include Meckel's diverticulitis, typhilitis, omental torsion, psoas abscess, ureteric colic, gastroenteritis, enterocolitis, diverticulitis, perforated duodenal ulcer, acute pancreatitis, acute cholecystitis, biliary colic and UTI. Small bowel obstruction, Crohn's disease, carcinoma of caecum or ascending colon, and rectus sheath hematoma are more rare conditions that mimic appendicitis[44].

In pediatric patients, mesenteric lymphadenitis, intussusception and Henoch-Schonleinpurpura, should be considered.

In women of child bearing age, the differential diagnosis should include ovarian cyst torsion, mittelschmerz, ectopic pregnancy, and pelvic inflammatory disease.

Morbidity and Mortality

The mortality and morbidity in AA depends on the stage of illness, whether early or complicated by perforation. The mortality rate in non perforated appendicitis is less than 1%, but it may be as high as 5% or more in young and elderly patients, in whom diagnosis may often be delayed, thus making perforation more likely[38]. The morbidity rate varies between 15-20% in most reports of appendicitis, with wound infection from a gangerous or perforated appendix being the most common complication[82]. Preoperative antibiotic therapy has greatly improved the morbidity rate of appendicitis, but perforation of the appendix is not prevented by antibiotics.

METHODOLOGY

Design and setting

Source of data: Participants are those suspected clinically as acute appendicitis, coming to K.L.E. Hospital, Belgaum between January 2011 TO December 2011 Prior to the start of the study, approval from the institutional review board was taken.

Study design: It was a Nonrandomised study.

Consent: Written informed consent was taken from the patients who fell into the inclusion criteria of the study.

Sample size: Proposed sample size was 100.

Place of study: JNMC, Belgaum

Period of study: JANUARY 2011 to **DECEMBER 2011**

Inclusion criteria

Participants with clinical diagnosis of acute appendicitis and undergoing surgery and willing to participate in study.

Exclusion criteria

Following patients were excluded from the study

1. Patients with generalized peritonitis.
2. Patients with appendicular abscess
3. Patients with appendicular lump
4. Patients with blunt trauma abdomen
5. Patients who have undergone GI surgeries in the past

DATA ANALYSIS:

Analysis of the Scoring system against

1. SESITIVITY
2. SPECIVITY
3. POSITIVE PREDICTIVE VALUE
4. NEGATIVE PREDICTIVE VALUE

Initials evaluation of patients was in the emergency department and Surgery department ofK.L.E. Ultrasound of abdomen and pelvis, total and differential leucocyte count, routine microscopic examination of the urine and other necessary investigation were sent. Detailed history, physical examination findings and investigation report were recorded on a preformed Performa. The diagnosis of acute appendicitis was done on the basis of clinical judgment. Subsequently new scoring was done and recorded. Even when the new score was less than 8, if clinical suspension was high patient were subjected for appendectomy.

Ultrasound of abdomen and pelvis was done by the radiology resident. The radiologist was blinded to the result of physical examination and blood tests, but not to the patient's symptoms. Standard 5 MHz linear transducer was used. Well established ultrasonography criteria were applied to discriminate an acutely inflamed appendix from a normal one.

Total leucocyte count above 12000/ul was considered raised count in New scoring system.The intra-operative findings were recorded and the removed appendix was sent in a 10% formalin containing jar for histological examination. Hematoxylin and eosin stain was used for the staining purpose. When there was focal collection of neutrophil within the lumen and lamina propria, appearance of Neutrophills at the

base of the crypts adjacent to small defect in the epithelium along with focal erosion, ulceration, cryptitis and crypt abscess extending up to submucosa diagnosis of acute appendicitis was made. When there was extensive neutrophilicinfiltrate extending deep in to or through the appendical wall along thefibrinous purulent coating of the serosa, histological diagnosis of acute suppurative appendicitis was made. If the mucosa was absent, the wall was necrotic and thrombosed vessels were present it was diagnosed as gangrenous appendicitis.

Histological reports were followed up and recorded in the preformed Performa sheet. The final diagnosis of acute appendicitis was based on histological diagnosis.

STATISTICAL ANALYSIS

1. Data was analysed using Microsoft excel 2007 and SPSS version 16
2. Frequencies, percentages, mean with standard deviation and p values were calculated.
3. Finding presented as tables, bar diagrams, pie chart and line diagram.
4. Significance of the results was tested by using the independent T- test, chi-square test and Fisher's Exact Test.
5. The ‘p’ value of less than 0.05 was regarded as significant.

RESULTS

Between January 2011 and December 2011, 109 patients with the clinical diagnosis of acute appendicitis were assessed for eligibility; of these 5 refused to participate and 4 had an alternative diagnosis during operation (2 twisted right ovarian cyst, 1 salpingitisand 1 carcinoma caecum). Finally a total of 100 patients underwent emergency appendectomy and were selected for this study (Fig. 3)

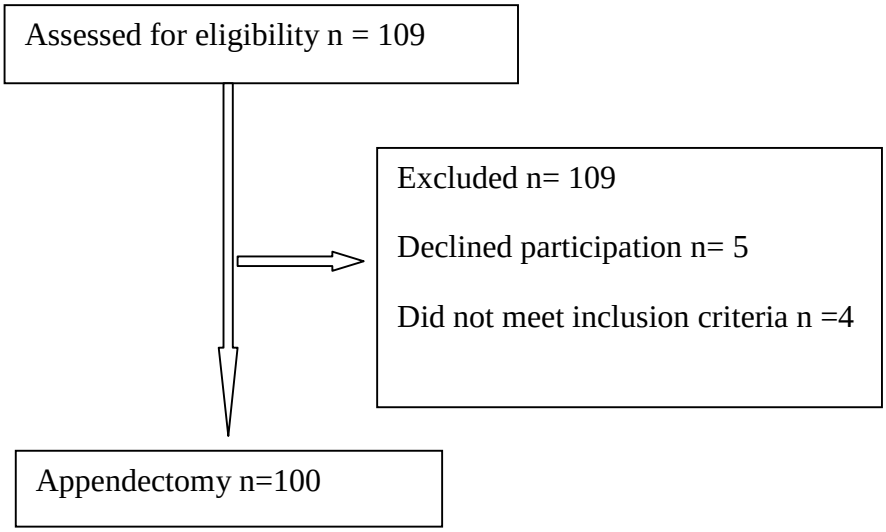
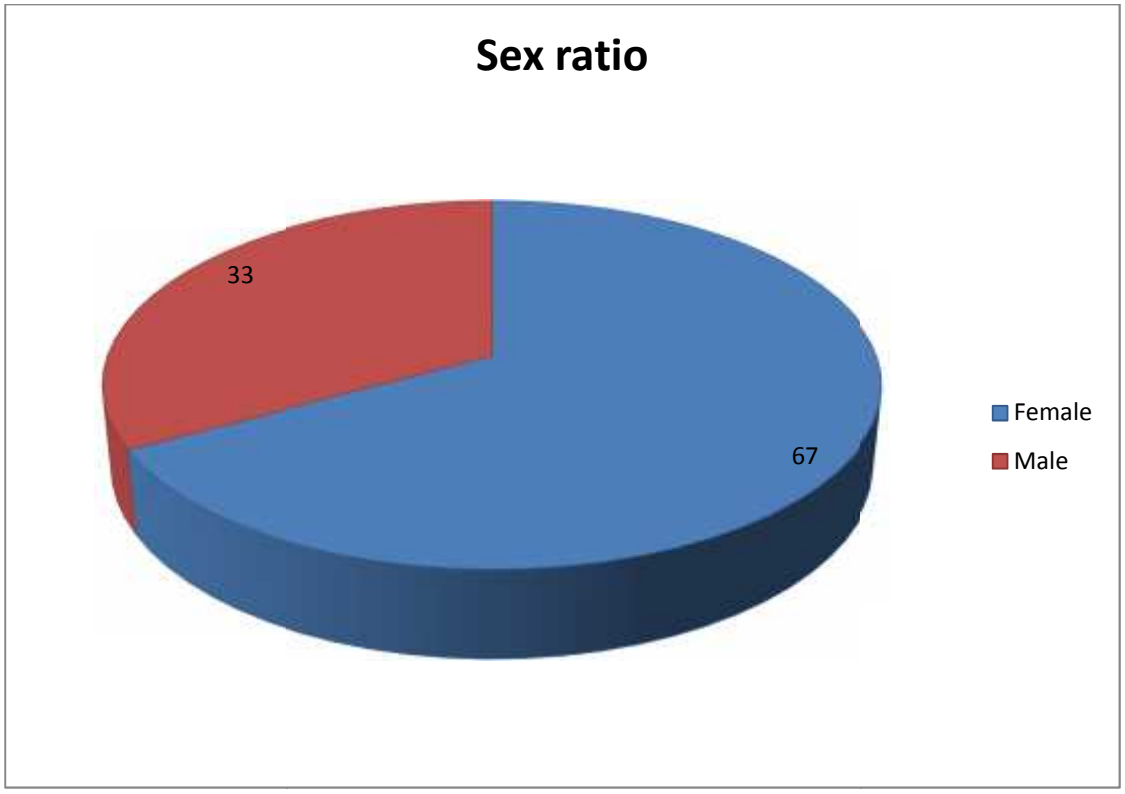


Figure 3: Diagram showing patient recruitment

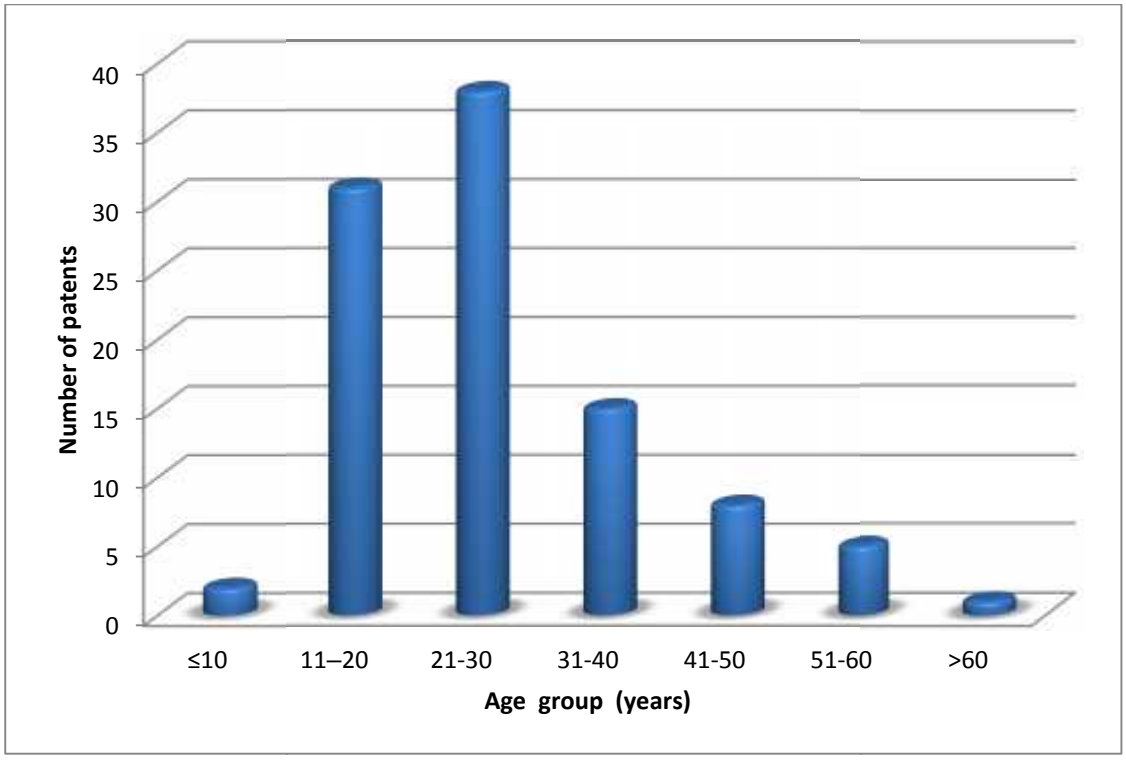
Table 4: Demographic data

The study group consisted of 67 females and 33 males with the female: male ratio of 2.03:1. The mean age of patients were 27.88± 12.24 years with age ranging from 10 -70 year.

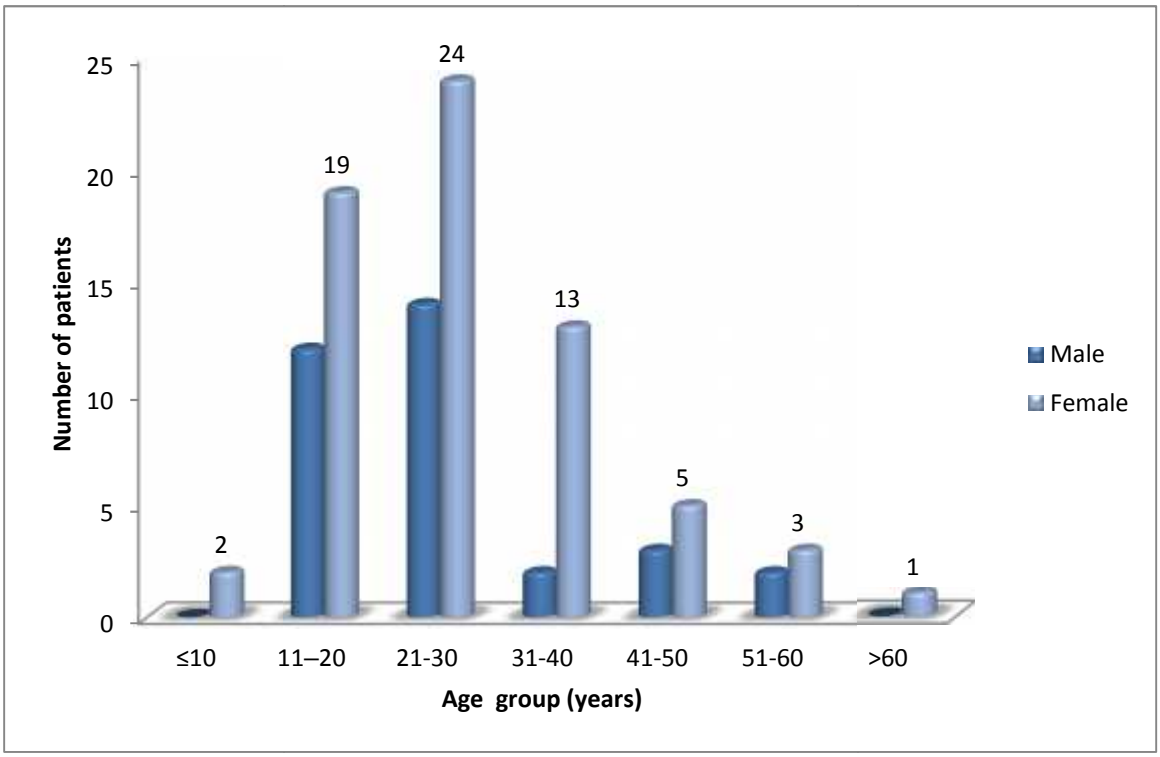
Total no of patients	**100**
Female:Male	2.03:1(67:33)
Age in years	27.88± 12.24



Graph 1: Gender distributions of patients



Graph 2: Age distribution of patients

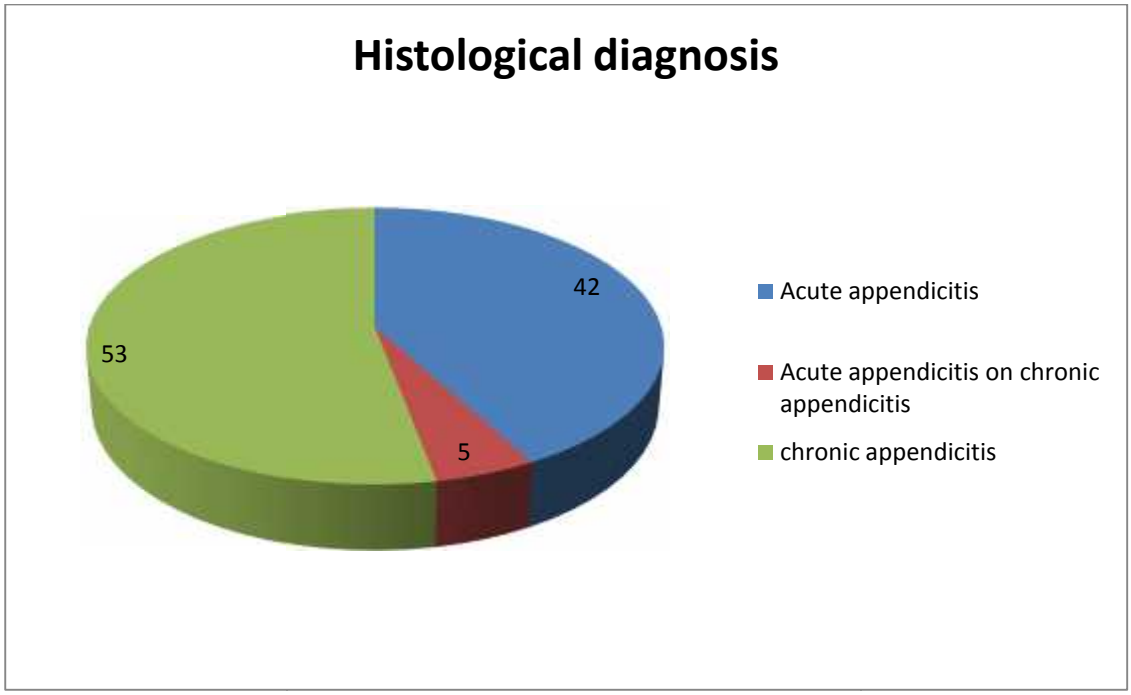


Graph 3: Age distribution of patients

Table 5: Histological diagnosis

Patients had acute appendicitis, acute on chronic appendicitis and chronic appendicitis accounting to 42%, 5% and 53% of the total patients respectively.

Histological diagnosis	n	Frequency
Acute appendicitis	42	42
Acute on chronic appendicitis	5	5
Chronic appendicitis	53	53



Graph 4: Histologicaldistributions of patients

Table 6: New score

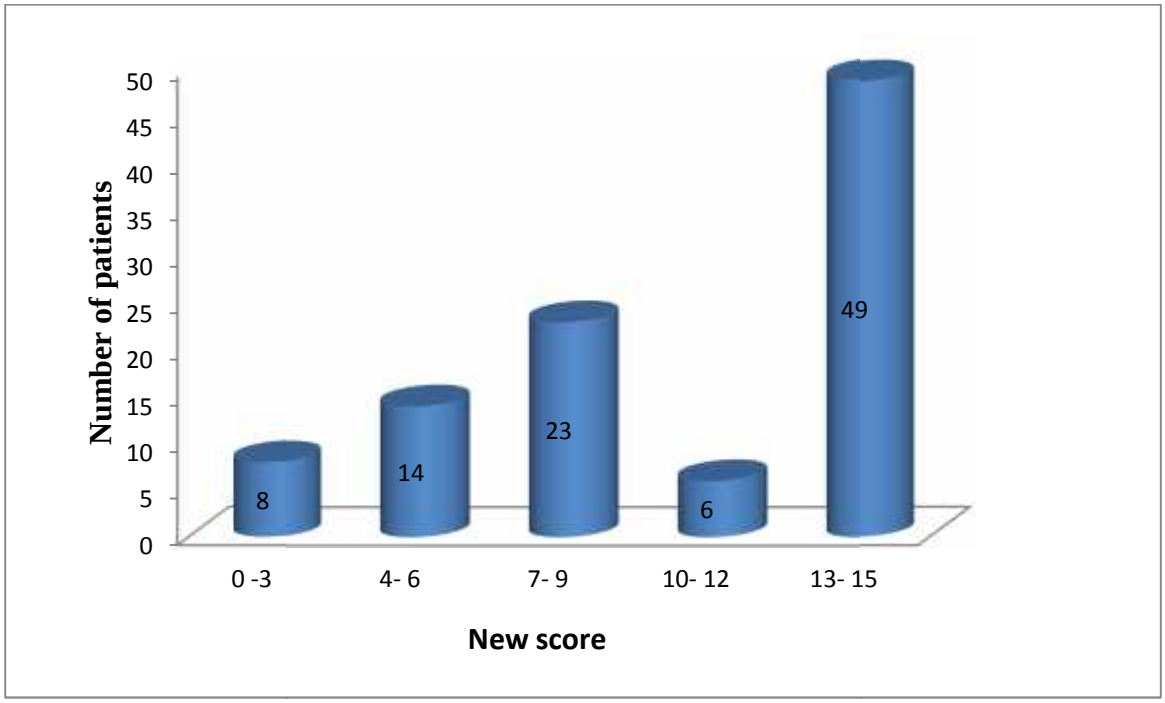
New score varied from minimum of 3.0 to a maximum of 15.0 with a mean New score of 10.03.

	N	Minimum	Maximum	Mean	Std. Deviation
New score	100	3.00	15	10.03	4.06

Table 7: Patients distribution according to new score

Out of 100 patients, 8(8%) had New score less than or equal to 3 while 14(14%) hadNew scorebetween 4 and 6, 23 (23%) had New score between 7 and 9,6(6%)had New score between 10 and 12 and 49(49%) had had New score more than13 .

New score	Frequency(n)	Percentage (%)
0 -3	8	8
4 -6	14	14
7 -9	23	23
10 -12	6	6
13 -15	49	49



Graph 5: Patients distribution according to New score

Table 8: New scores in acute appendicitis ,acute on chronic appendicitis and chronic appendicitis group

The minimum value of New scorein the acute appendicitis group was 4 and a maximum of 15 with a mean of 12.9 while the minimum value of New score in the acute on chronic appendicitis group was 9 and a maximum of 13 with a mean of 12.2 and the minimum value of New score in the chronic appendicitis group was 3 and a maximum of 13 with a mean of 7.51.

		New scores			
	N	Minimum	Maximum	Mean	Std. Deviation
acute appendicitis	42	4	15	12.9	2.42
acute on chronic appendicitis	5	9	13	12.2	1.78
chronic appendicitis	53	3	13	7.51	3.56

P<0.001

Table 9: Cross tabulation of new score with histological diagnosis

In this study 8 patients had New score equal to 3, out of which 0 patients had histological evidence of acute appendicitis, in New scores between 4-6, 7-9,10-12 and 13-15 patients had histological evidence of acute appendicitis were 1,6,0 and 35 respectively

New score	Histological Diagnosis			Total patients
	Acute appendicitis	Acute on chronic appendicitis	Chronic appendicitis	
0 – 3	0	0	8	8
4 – 6	1	0	13	14
7 – 9	6	1	16	23
10 -12	0	0	6	6
13 -15	35	4	10	49
Total patients	42	5	53	100

P<0.001

Table 10: Cross tabulation of new score with histological diagnosis

Acute appendicitis was significantly high in patients with new score ≥ 13 (p value =<0.001).

New score	Histological Diagnosis		Total patients
	Acute appendicitis	Chronic appendicitis	
≤ 13	8	43	51
≥13	39	10	49
Total patients	47	53	100

Table 11: Diagnostic indices for New score

The sensitivity and specificity of New score ≥13 in diagnosis of acute appendicitis was 82.9% and 81.1% respectively. The overall diagnostic accuracy was 82% with positive predictive value of 79.5% and negative predictive value of 84.3%.

Index	New score
Sensitivity	82.9%
Specificity	81.1%
Positive predictive value	79.5%
Negative predictive value	84.3%
Diagnostic accuracy	82%

DISCUSSION

Diagnosis of acute appendicitis is often challenging job to the surgeon. On one hand there is fear of negative appendectomy and on the other delayed diagnosis can lead to complications, like perforation which has higher morbidity and mortality compared to non perforated appendicitis. A higher negative appendectomy rate of 15 - 25% has been accepted in the past in the cost of preventing appendiceal perforation[4,88]. But with the use of CT scan negative appendectomy rate as low as 2% and appendiceal perforation rate of 9% have been achieved[13].

Negative appendectomy is not without complications. Though the mortality is low, it can be associated with morbidity of 10-15%[1]. Negative appendectomy is associated with a significantly longer hospital stay and total admission charges compared with patients with appendicitis. The rate of hospital readmission directly related to adhesions following appendectomy is reported to be 0.9%, and hence negative appendectomy should be lowered as low as possible[88].

Diagnosis of acute appendicitis is primarily based on surgeon's clinical impression. The accuracy rate of the clinical diagnosis of acute appendicitis has been reported to be approximately 70% to 87%[44].

Besides clinical evaluation, various laboratory parameters of inflammation (TLC and CRP), USG, CT scan and laparoscopy are used to establish an accurate diagnosis of acute appendicitis. This armamentarium has definitely increased the diagnostic accuracy and help to reduce negative appendectomy rate[46, 47, 50, 61]. However these techniques are not available universally.

Numerous scoring systems have been developed, Alvarado score being widely used one[69]. TheNew scoring system was found to be superior to the previously formulated scoring systems including Alvarado scoring system in diagnosing acute appendicitis. This scoring system has the sensitivity, specificity and diagnostic accuracy was 95.4%, 97.4% and 96.5% respectively[73]. The sensitivity, specificity and diagnostic accuracy in our study was 82.9%, 81.1% and 82%respectively and the positive predictive value and negative predictive value were 79.5 and 84.3 respectively.

Negative appendectomy rate was low in our institute and the current study has also supported this fact. Previously the negative appendectomy rate was ten percent whereas this study has shown a negative appendectomy rate of six percent. Majority of our patients have delayed presentation which increases rate of positive clinical findings as well as laboratory parameters for AA. This has probably led to more accurate pre operative diagnosis and hence the lower rate of negative appendectomy in our setup.

This study had some limitations. Both clinical and ultrasonographic evaluations were done by different residents, allowing place for interobserver differences in findings. Similarly the histological examination of the appendix was also done by different pathologist, in which opinion might differ, especially with regard to grading of severity of inflammation of the appendix.

CONCLUSION

Acute appendicitis is a common surgical emergency. Good clinical judgment aided by investigation scoring system can help to reduce the negative appendectomy rate. New scoring system can be used as effective modality to establish the accurate diagnosis of acute appendicitis.

SUMMARY

Acute appendicitis is common surgical emergency. Accurate diagnosis and timely intervention is very important to reduce the morbidity and mortality. The diagnosis of acute appendicitis is primarily clinically based on signs and symptoms supported by investigations. In an attempt to increase the diagnostic accuracy numerous scoring systemshas been developed. The new scoring system was formulated to develop as a simple and reliable scoring system with high diagnostic accuracy.The objectives of the study were to evaluate the predictability of new scoring system in diagnosis of acute appendicitis and compare its accuracy with histopathological report. A prospective non ranadomized study was conducted in 100 patients with clinical diagnosis of acute appendicitis undergoing emergency appendectomy over a period of 1 year. The new score was obtained at the time of admission. Histological diagnosis acute appendicitis was considered as final diagnosis. New score (≥13) was 82.9% sensitive and 81.1% specific , positive predictive value of 79.5% and negative predictive value of 84.3%, in diagnosing acute appendicitis with an overall diagnostic accuracy of 82%.

Acute appendicitis is a common surgical emergency. Good clinical judgment aided by investigation, scoring system can help to reduce the negative appendectomy rate. The new scoring system can be used as effective modality to establish the accurate diagnosis of acute appendicitis.

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ANNEXURE - I

CONSENT FOR PARTICIPATION IN RESEARCH

Mr./Mrs._____ we are requesting you to enroll yourself in study titled " **ACCURATE DIAGNOSIS OF ACUTE APPENDICITIS BY NEW SCORING SYSTEM ,A ONE YEAR STUDY "**

Objective / purpose of this study:

You have been requested to participate in research because we find your profile matching with our study group.

Your participation in the research is absolutely voluntary. Your decision to participate in the study or otherwise will not affect your relationship with J.N.M.C. If you decide not to participate, you are free to withdraw at any time.

This study is being done to evaluate the accuracy of the new scoring system and compare the result with the histopathological report.

Procedure:

The score/result obtained by the proposed scoring system will be compared with the histopathological report.

Risk and benefits:

There is no increased risk involved in becoming a part of this study. This study will help us to evaluate the new scoring system to diagnose acute appendicitis. The results derived at the end of study will benefit all similar patients admitted in this hospital.

Withdrawing / Removal from the study:

The participant has full freedom to withdraw from the study whenever he/she wishes and without prior notice. Even if you decline to participate, there will not be any change in the line of your management or the relationship with your doctor. You will be told about all the new information that may affect your decision to participate in the study. The Investigator may also exclude a participant from the study at anytime.

Privacy and Confidentiality:

The only people to know that you are a research subject are the members of research team. No information about you or provided by you during the research will be disclosed to others without your written permission except:

1. In emergency to protect your rights and welfare.
2. If required by law.

Institutional / Sponsors policy:

If any unforeseen complications or injury occurs during the period of study the participant will be given the best available treatment within the limitations of KLE's Prabhakar Kore Hospital General ward.

Financial incentives for participation:

The participant will neither get any financial incentives during the period of study nor will be asked to pay for the purpose of this study.

Authorisation to Publish Results:

When the results of the research are published or discussed in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with you will remain confidential

Consent Statement:

I, the undersigned, have been explained in my own vernacular language about the study. I am aware that my participation in this study is voluntary and I could withdraw at any time. Also I had been given enough time to comprehend and clarify my doubts about the study and my rights as a study participant.

Signature or the left thumb impression of the participant or legally authorized representative

Participant's name_____ Signature_____

Witness's name _____ Signature_____

Investigator's name _____ Signature_____

Place _____

Date _____

ANNEXURE – II

PROFORMA

For Study Purposes	
Record No:	
Score	

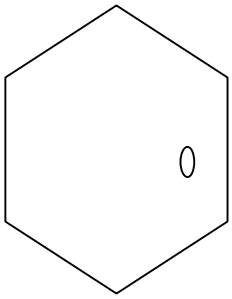
Patient Details	
Name:	**Age:**
Sex: M / F	**Registration no:**
Date of Admission:	**Address:**
Date of Discharge:	

Examination

Systemic Examination

P/A:

	Y/N	SCORE
RIGHT ILIAC FOSSA TENDERNESS		
RIGHT ILIAC FOSSA REBOUND TENDERNESS		



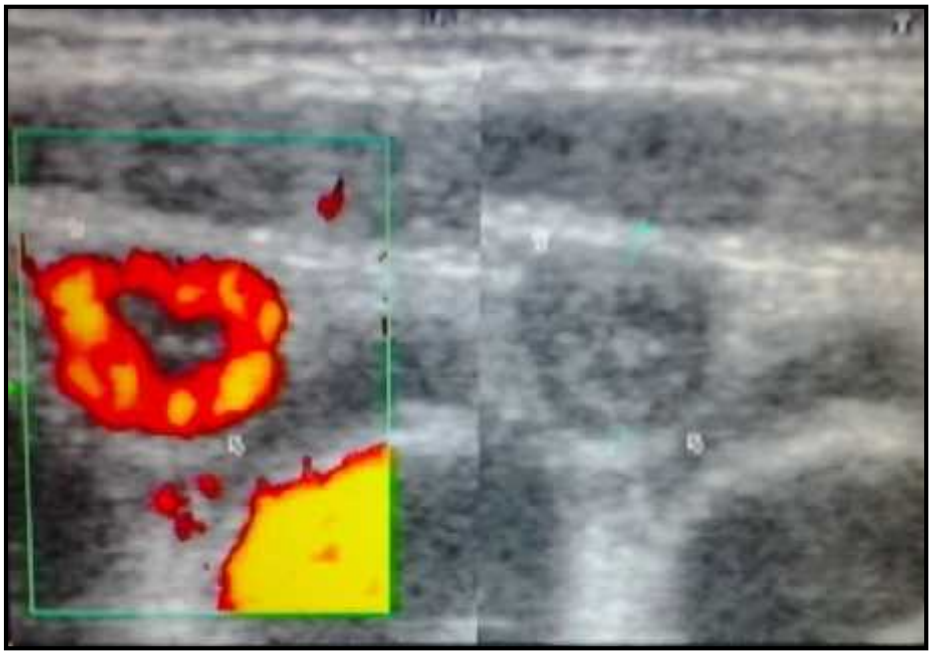
INVESTIGATION		SCORE
TLC		
USG Abdomen & Pelvis		
PROVISIONAL DIAGNOSIS		

Histopathological Report

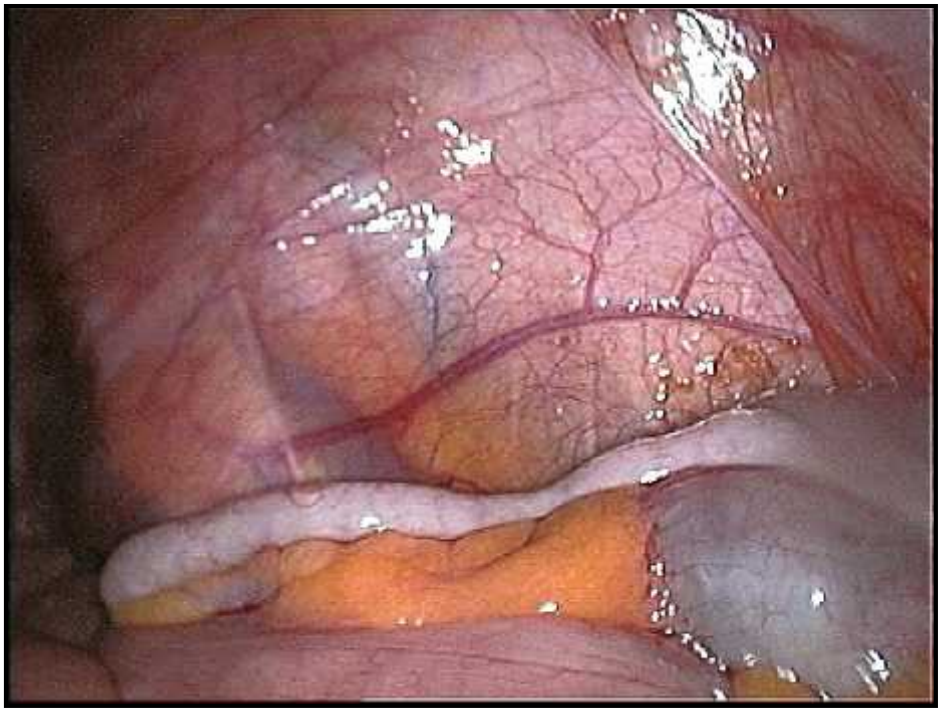
FINAL SCORE BY TZANAKIS SCORE	SCORE
RIGHT ILIAC FOSSA TENDERNESS	
RIGHT ILIAC FOSSA REBOUND TENDERNESS	
ULTRASONOGRAPHY FINDING	
TOTAL LEUCOCYTE COUNT	
TOTAL SCORE	

ANNEXURE – III

PHOTOGRAPHS



Target Sign of acute appendicitis



Intra operative picture of inflamed appendix

Intra operative picture of inflamed appendix

Specimen of appendix

Inflamed appendix for HPR

ANNEXURE - IV

KEY TO MASTER CHART

Pt. no	Patient number
Reg. no	Registration number
Yr	Year
M	Male
F	Female
RIF Tend	Right Iliac Fossa tenderness
Reb Tend	Rebound Tenderness
TLC	Total Leucocyte Count
USG	Ultrasonography
New Scr	New Score
P. D	Provisional Diagnosis
HPR	Histopathological Report

Pt.no	Reg no	Sex	Age(yr)	RIF Tend	Reb Tend	TLC	USG	New scr.	P.D	HPR