COMPARATIVE STUDY OF ALVARADO SCORE AND ULTRASOUND IMAGING IN THE DIAGNOSIS OF ACUTE APPENDICITIS

By

Dr. MANJUNATH METRI

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In
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Under the guidance of

Prof.Dr.RUDRESH.H.K **M.S**

DEPARTMENT OF GENERAL SURGERY

M.S.RAMAIAH MEDICAL COLLEGE Bangalore – 54

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, BANGALORE

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RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, BANGALORE

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DATE: Signature of the Candidate

PLACE: Bangalore **Dr. MANJUNATH METRI**

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, BANGALORE

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DATE:

PLACE: Bangalore

Dr.RUDRESH.H.K

M.S, Professor

Department of General Surgery

M.S.Ramaiah Medical College

RAJIVGANDHI UNIVERSITY OF HEALTH SCIENCES, BANGALORE

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Signature of the HOD

Dr. S.V.KULKARNI
Professor and Head
Dept. of General Surgery
M .S. Ramaiah Medical College
Bangalore.

DATE:

PLACE: Bangalore.

Signature of the Principal

Dr.A.C.ASHOK
Principal & Dean
M.S. Ramaiah Medical College
Bangalore.

DATE:

PLACE: Bangalore.

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, BANGALORE

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DATE: **Dr. MANJUNATH METRI**

PLACE: Bangalore

ABSTRACT

BACKGROUND

Acute appendicitis is still the most common abdominal surgical emergency, but its diagnosis remains a challenge. The procedure is plagued by a high rate of negative explorations.In conditions like acute appendicitis it is impractical to have definitive diagnosis by gold standard test (histopathology) before surgery, we would like a simple assessment like Alvarado scoring system which depends on the presence and absence of certain variables and which provides an accurate guide to whether or not the patient has the acute appendicitis.

Graded compression ultrasonography is one of the new diagnostic technique that is reported to have improved the diagnostic accuracy and clinical outcome. Hence a study on Alvarado score and USG imaging in management of Acute appendicitis will aid in early detection and reduction of negative explorations.

OBJECTIVES

1. To correlate Alvarado score with USG imaging in diagnosis of Acute Appendicitis.
2. To study the usefulness of incorporating USG imaging in patients with low /equivocal Alvarado Score in improving the diagnostic accuracy in acute appendicitis.
3. To avoid negative laparotomies.

METHODS

A prospective study of 90 patients suspected of suffering from acute appendicitis requiring emergency surgery for the same were evaluated from Nov 2012 to July 2014 at

M.S.RAMAIAH MEDICAL COLLEGE.

All patients were evaluated by the Alvarado scoring system and Ultrasonogram of the abdomen was performed in patients and subjected to surgery.

Appendix specimen sent for HPE for final confirmation for diagnosis.

INCLUSION CRITERIA

1. All patients presenting with right iliac fossa pain were included in this study.
2. Patients 18 years and above were included in the study.

EXCLUSION CRITERIA

1. Clinically patients with gynaecological and urological diseases were excluded from this study.
2. Patients who were managed conservatively were excluded.
3. Patients with recurrent appendicitis were excluded.
4. Patients with appendicular mass on usg were excluded.

RESULTS

Of the 90 patients studied, among the patients with Alvarado score of more than 7,59/60 i.e 98.33% had histopathological evidence of acute appendicitis and USG showed features of acute appendicitis in 40/60 (66.66%)

In patients with a score between 5 and 7,21/22 i.e 95.45% had histopathological evidence of acute appendicitis and USG showed features of acute appendicitis in 20/22 (90.9%)

In patients with score between 1-4,6/8 i.e 75% had histopathological evidence of acute appendicitis and USG showed features of acute appendicitis in 4/8 (50%)

CONCLUSION

Alvarado's scoring system is a good diagnostic tool for predicting acute appendicitis in a score of >5 and USG imaging was not beneficial in patients with score of >7.

Alvarado score and USG imaging is not a good diagnostic tool to exclude Acute Appendicitis nor predicting Acute Appendicitis in a score between 1-4.

KEY WORDS-ACUTE APPENDICITIS,ALVARADO SCORE,USG IMAGING IN ACUTE APPENDICITIS

LIST OF ABBREVIATIONS

WBC- White blood cells

USG- Ultrasonogram

Cu.mm- Cubic millimeter

HPE- Histo pathological examination

CT- Computerized tomography

Tc 99m- Technetium 99 molybdate

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INTRODUCTION

INTRODUCTION

Acute appendicitis, though one of the commonest emergencies in surgical practice, can at times confuse the best of clinicians[1].

"Diagnosis of appendicitis is usually easy" thus wrote Sir Zachary Cope, but with the order, "but there are difficulties which need to be discussed". The "difficulty" alluded to by Cope relates to our inability to reliably diagnose appendicitis on clinical ground.[1]

Nothing can be so easy or as difficult as the diagnosis of acute appendicitis. Acute appendicitis is a common cause of abdominal pain for which a prompt diagnosis is rewarded by a marked decrease in morbidity and mortality.[2]

The question does this patient have appendicitis? Is an important question for the following reasons

- Appendicitis is one of the common causes of abdominal pain
- Western literature report that 6% of population have risk of suffering from appendicitis during their lifetime[3]
- The mortality rate has dropped due to early surgical intervention and antibiotics from 26% to less than 1%
- The morbidity due to perforation ranges from 17 – 40 % .The perforation rate is higher in elderly and children [4]
- Failure to diagnose early appendicitis converts acute appendicitis to perforated appendicitis, a disease with potential complication including abdominal wall abscess, wound infection and death[6]
- The negative laparotomy ranges from 15- 35 % and is associated with significant morbidity [4,5]

The routine diagnosis of appendicitis is by eliciting typical history of migrating abdominal pain followed by anorexia and nausea. Physical examination reveals tenderness in right iliac fossa and rebound tenderness.

The routine laboratory examination of blood and urine is necessary to rule out other causes of right iliac fossa pain. C reactive protein may be used to assist in the diagnosis of appendicitis[7,8]. Ultrasonography and Computerised tomography may be used to assist in the diagnosis of appendicitis but are often an expensive tool in developing countries

Even with these diagnostic aids the rate of negative appendicectomy of 15 – 25% has been accepted. However the complication of unnecessary operation is 13 %, close to that of a genuinely inflamed appendix. Removing a normal appendix carries a mortality rate of 0.65 for every 100 operations. Prolonged clinical observation in an attempt to minimise unnecessary operations may mean a delayed operation in 28% of cases and an unnecessary risk of perforation.

Several scoring systems have been introduced to increase the diagnostic accuracy of appendicitis with the Alvarado scoring system being the most popular. . However these were developed in the western countries and several studies have shown reduced sensitivity and specificity when applied to a population with a completely different ethnic origin[9].

AIM OF THE STUDY

1. To correlate Alvarado score with USG imaging in diagnosis of Acute Appendicitis.

2. To study the usefulness of incorporating USG imaging in patients with low or equivocal Alvarado Score in improving the diagnostic accuracy in acute appendicitis.

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REVIEW OF LITERATURE

REVIEW OF LITERATURE

ACUTE APPENDICITIS

The word appendicitis refers to inflammation of appendix vermiformis. The literal meaning of appendix is an appendage- anything that is attached to a large or a major part as a tail or a limb. The Latin word vermiform means worm like structure.

HISTORY

The existence of the appendix was known even when the pyramids were being built because certain Coptic jars containing bowels inscribed with references to the "worm of the bowel" and hermatic books of Thoth and "Books of the dead" contain statement which probably refer to the appendix.[10]

Berengas Da Corpi1[10] (1524) gave the first full account of the appendix and appendicular perforation. Morgagni[10] in his ' Adversaria Anatomica' has devoted some portion of his work to the appendix, to describe its normal size, site and its relations to other structures.

In 1735, on December 6th, Claudius Amyand performed the first appendicectomy. He operated on a boy, Hanvil Anderson, aged 11 yrs, at St.George's hospital, London. The child was suffering from an inguinal hernia and faecal fistula discharging in the groin. At operation, appendix was found in the hernial sac and fistula was traced to a perforation of the appendix by a pin. Claudius Amyand excised the appendix during the operation and the boy recovered for penetrating intestinal trauma.

In 1839, Bright and Addison[10], published the first textbook, giving description of the signs and symptoms, accompanying inflammation and perforation of the appendix.

Jeffrey et al, studied 250 cases of appendicitis and laid down sonographic criteria for diagnosis.[12]

In 1884, Mikulicz in Krakow recommended and performed surgery for appendicitis, kronlein in Germany did likewise.

The classic signs and symptoms of the acute appendicitis were first reported by Fitz, in 1886. Fitz suggested that appendicectomy would be essential for cure.[11]

Mcburney in Newyork, in 1889, gave description of clinical features of acute appendicitis and pioneered the removal of acutely inflamed appendix before perforation occurred and also devised the muscle splitting incision (Grid iron), named after him.

In 1894 ,July- Mcburney outlined the grid iron incision and named his ‘point’

In 1902, Oschner and sherren suggested a conservative regimen to prevent infection spreading, making subsequent surgery safer.

ALVARADO in 1986 proposed his scoring system to diagnose acute appendicitis on the basis of certain clinical parameters and investigations. He suggested operations for

score 7 or above out of 10. Later it was modified by KALEN ET AL who excluded one variable from the original Alvarado, so that the total score becomes 9. Its usefulness in reducing the rate of negative appendicectomies has been established and refuted in different studies.

In 1977, Dekok used a scope to assist in removing an appendix through mini - laparotomy site.

Semm first performed true non acute laparoscopic appendicectomy in 1983.

In 1987, first Laparoscopic appendectomy for acute appendicitis was done by Schreiber.

EMBRYOLOGY

Only a few Diverse Mammals Possess an Appendix.

Appendix is not present in any invertebrate. Among the vertebrate, it is absent in fish, amphibians, reptiles, birds and most mammals. In fact, the vermiform appendix recognized as a worm-like, narrow extension beginning abruptly at the caecalapex is only present in a few Marsupials Such as the wombat and South American Opossum, a few rodents (rabbits and rats) and few primates (only the anthropoid apes and man). Note that monkeys do not have such an organ.

The caecal bud is a diverticulum that arises from the post arterial segment of the mid-gut loop. The caecum and appendix are formed by enlargement of this bud. The proximal bud enlarges to form the caecum. The distal part forms the appendix. During the greater part of fetal life the appendix arises from the apex of Caecum. Subsequently the lateral wall of the Caecum grows much more rapidly than the medial wall with the result the point of attachment of appendix comes to lie on medial side into a retrocaecal and intraperitoneal position.

Development Anomalies

1. Absent appendix 1:100,000. Thalidomide, a known teratogen is implicated.

2. Duplication - 3 types

Type A : duplication arising from a common base and a single Caecum, partial duplication with bifurcation at tip.

Type B : two separate appendices with distinct bases arising from single caecum

Type C : represents double caecum each with its own appendix – associated with the organ duplications

3. Malposition : may be rare and associated with congenital malrotations of intestine. It can occur with maldescent of caecum resulting in subhepatic appendix and caecum.

4. Diverticulosis: may be congenital or acquired. Acquired diverticula are more Common and arise by herniation of mucosa and sub-mucosa through a defect in the muscular wall.

Congenital diverticula are rare and associated with Trisomy D1 Syndrome.

ANATOMY

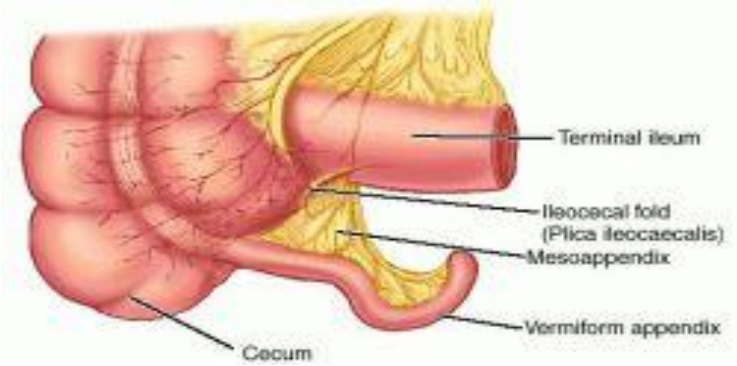


FIGURE 1- ANATOMY OF APPENDIX

The vermiform appendix is a tubular extension of the caecum that originates from the posteromedical aspect below and within 3cm of the ileocaecal junction. It varies in length from 3-15 cms. This structure can be affected by a variety of developmental, infectious and neo-plastic conditions. The mesoappendix anchors the base of the appendix onto the posterior abdominal wall but the appendiceal tip is free.

The canal of the appendix is small and opens into the caecum below and behind the ileo-caecal opening. The appendicular orifice is sometimes guarded by a semilunar fold of mucous membrane known as “Valve of Gerlach”.

POSITIONS OF APPENDIX

The position of the appendix can be anywhere along the arc with the centre at the caecum .[13]

Wakeley's analysis of 10,000 cases revealed[14]

Retrocaecal - 65.28%

Subcaecal -2.26%

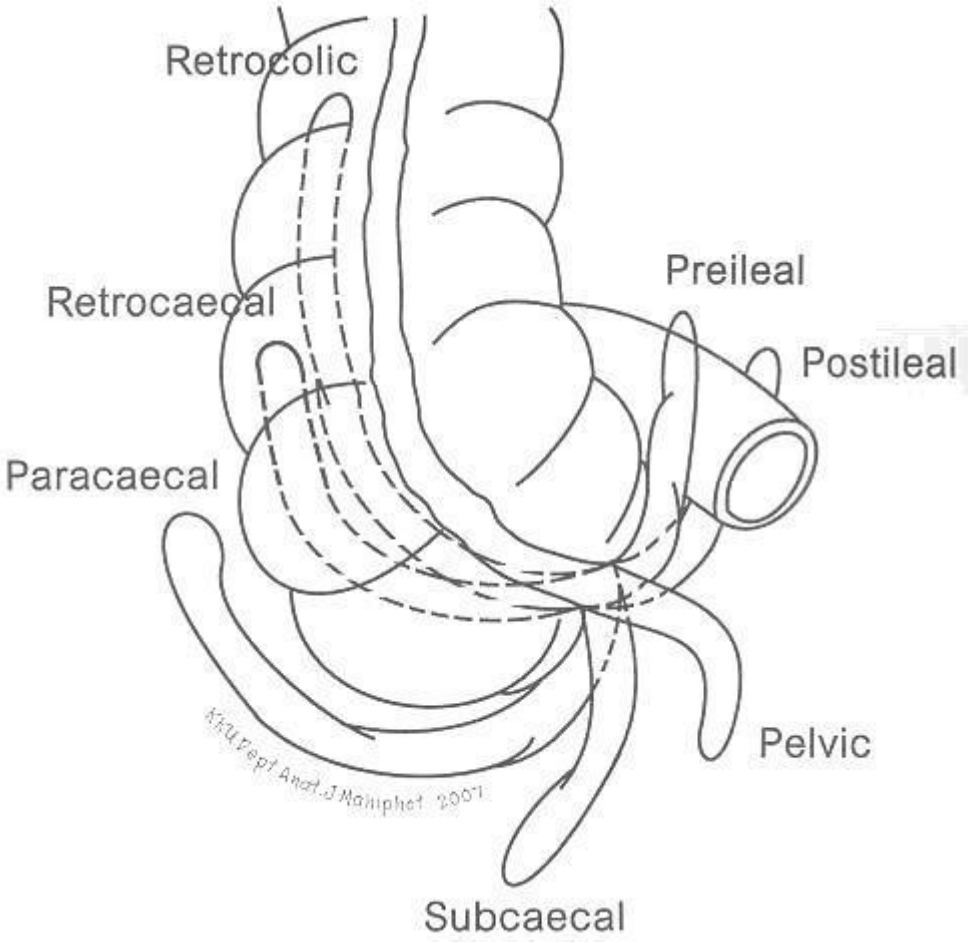


FIGURE 2- POSITIONS OF APPENDIX

Pelvic - 31.01%

Pre ileal - 1.0%

Para colic - 0.4%

Post ileal - 0.4%

ARTERIAL SUPPLY

The branch of the ileocolic artery, the appendicular artery courses through the mesoappendix and provided blood to the appendix. It may arise from ileal, anterior caecal, posterior caecal, branches of ileocolic artery.[15]

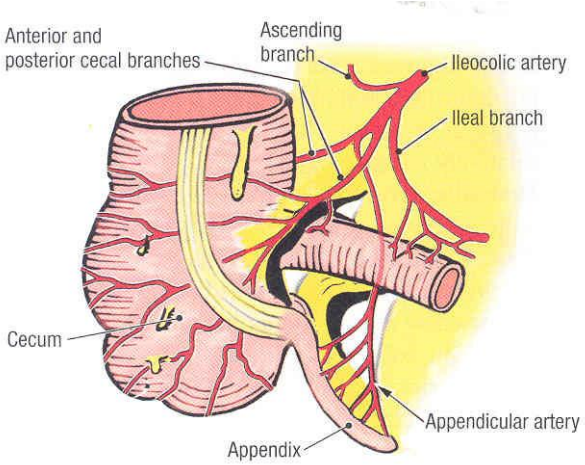


FIGURE 3- ARTERIAL SUPPLY OF APPENDIX

VENOUS DRAINAGE

Drained by branches of the ileocolic vein drain the appendiceal venous network into the superior mesenteric vein which in turn drains into the portalsystem.[15]

LYMPHATIC DRAINAGE

The appendicular lymphatics drain into lymph nodes in the mesoappendix and then into the right para-arotic lymphnodes.[15]

INNERVATION

It is derived from the superior mesenterix plexus (sympathetic) and branches of the vagus (parasympathetic).[15]

HISTOLOGY

Histologically, the appendix has the same four layers as the remainder of the gut. Mucosa, submucosa, muscularis propria and serosa.

Mucosa

Single layer of surface epithelial cells including columnar cells with basally located nuclei, goblet cells, apical mucin and absorptive cells. The Lamina propria is moderately cellular and contain crypts of Lieberkunn which are contiguous with the surface epithelium. There are also prominent lymphoid follicles with germinal centers.

Sub-mucosa

Contains a rich network of arterioles, venules, capillaries and lymphatics in a connective tissue framework. The meissner's plexus found in sub mucosa, and consists of collections of ganglion cells and associated neuronal processes and Schwann cells.

Muscularis propria

Consists of an inner circular layer and an outer longitudinal layer of smooth muscle between these two muscle band lies Auerbach's plexus.

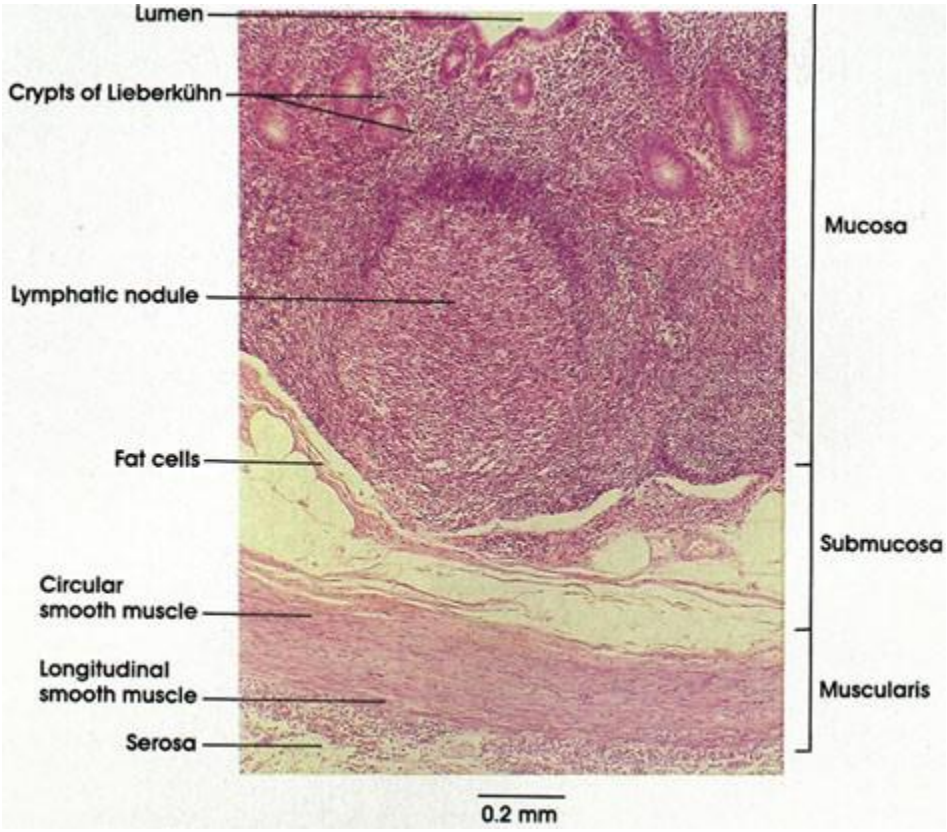


FIGURE 4- HISTOLOGY OF APPENDIX

Scrosa

Consists of a slender band of fibrous tissue over which lies a single layer of cuboidal epithelial cells.

Functions of the appendix:

The human vermiform appendix is usually referred to as a vestigial organ with no known functions. The appendix, as per current concept participates in the secretory immune system in the gut. Secretory immunoglobulins produced by Gut associated lymphoid tissue (GALT) function as a very effective barrier that protects milieu interior against the hostile milieu exterior. Removal of the appendix produces no detectable change in immune function[16]

It can be used a conduit for permanent urinary diversion.

INCIDENCE OF APPENDICITIS

Acute appendicitis is the most common cause of 'acute surgical abdomen'[17,14] and appendicectomy is the commonest emergency operation being performed. 6% of the population will suffer from acute appendicitis during their lifetime. At present, appendicectomy represents about 1% of all surgical operations.[10]

Age incidence:

Acute appendicitis is relatively rare in infants, and becomes increasingly common in childhood and early adult life, reaching peak incidence in the teens and early 20s. After middle age, the risk of developing appendicitis in the future is quite small.[16]

Sex incidence:

The incidence of appendicitis is equal among males and females before puberty. In teenagers and young adults the male – female ratio increases to 3:2 at age25, thereafter the greater incidence in males decline.[16]

Geographic Distribution:[10]

The recent trend is a fall in the incidence of true appendicitis and appendicectomies, and it appears to be continuing. The decline has been noted in many countries particularly the USA, UK, Wales and Scandinavia

AETIOLOGY AND PATHOGENESIS[16]

There is no unifying hypothesis regarding the aetiology of acute appendicitis.

DIET:

Decreased dietary fibre and increased consumption of refined carbohydrates may be important. As with colonic diverticulitis, the incidence of appendicitis is lowest in societies with a high dietary fibre intake.

BACTERIAL FACTORS:[18,14,19,20]

While appendicitis is clearly associated with bacterial proliferation within the appendix, no single organism is responsible. A mixed growth of aerobic and anaerobic organisms is responsible. The initiating event causing bacterial proliferation is controversial.

A variety of anaerobes, aerobes or facultative bacteria have been cultured from peritoneal fluid, abscess contents, appendiceal tissue. An average of 10 different organisms was recovered per specimen. Peritoneal cultures are positive in more than 85% of patients with perforated appendicitis. Bacteroides fragilis and E.Coli were isolated from almost all specimens.

Other frequent isolates were

- Pepto streptococus (80%)
- Pseudomonas (40%)
- Bacteroides splanchnicus (40%)
- Lactobacillus (37%)

OBSTRUCTION:

Wilkie[10] in 1914 has documented appendicitis following obstruction of the appendix in experimental animals. Wangensteen et al[10] showed that combined obstruction and bacterial infection resulted in acute appendicitis whereas obstruction of a bacteria free lumen of the appendix resulted in mucocele.

The obstruction may be

1. In the lumen:

    Faecoliths, Parasites (Pinworm, Ascaris, Taenia), Foreign bodies (rare cause including vegetable and fruit seeds, inspissated barium, pins, leadshot, bones,eggshells, glass)

2. In the wall:

    Lymphoid hyperplasia, stricture, tumors, carcinoid appendix, appendicular metastasis.

3. Outside the wall :

    Adhesions and kinks, congenital and post- inflammatory strangulation in a hernial sac, carcinoma of caecum and ascending colon.

A faecolith is composed of inspissated faecal material, calcium, phosphates, bacteria and epithelial debris. Rarely, a foreign material is incorporated into the mass. The incidental finding of faecolith, is a relative indication for prophylactic appendicectomy.[16]

Intestinal parasites, particularly Oxyuris Vermicularis(synonym: pin worm) can proliferate in the appendix and occlude the lumen.

PATHOGENESIS

Following obstruction, an increase in mucus production occurs, and this leads to increased pressure. With increased pressure and stasis from obstruction, bacterial overgrowth ensues. The mucus then turns into pus that causes a further increase in luminal pressure. This leads to distension of the appendix and visceral pain, which is typically located in the epigastric or periumbilical region.

As the luminal pressure continues to increase, lymphatic obstruction occurs, leading to an edematous appendix. This stage is known as **Acute or focal appendicitis**. The overlying parietal peritoneum becomes irritated, and the pain now localizes to the right lower quadrant (RLQ). This series of events results in the classic migrating abdominal pain described in patients with appendicitis.

Further increase in pressure leads to venous obstruction, causing edema and ischemia of the appendix. At this stage, bacterial invasion of the wall of the appendix occurs and is known as **Acute suppurative appendicitis**.

Finally with continued pressure increases, venous thrombosis and arterial compromise occur, leading to **gangrene and perforation** . If the body successfully walls off the perforation, the pain may actually improve. However, symptoms do not completely resolve. Patients may still have underlying right lower quadrant pain, decreased appetite, change in bowel habits (eg, diarrhoea, constipation), or intermittent low-grade fever. If the perforation is not successfully walled off, then diffuse peritonitis will develop.[21]

The entity of chronic appendicitis is controversial. It has been well said that "the appendix does not grumble, it either screams or remains silent" both clinical and experimental data support the belief that a some patients have repeated attacks of appendicitis .

It is not unusual for one or more such episodes to precede a full blown appendicitis. In such cases surgical specimen have shown chronic inflammatory cells depending on whether the surgery was performed during the attack or in between bouts.[22]

Thus the term chronic appendicitis has been used. But it does not mean prolonged abdominal pain for weeks to months.

CLINICAL DIAGNOSIS

The diagnosis of acute appendicitis is the classical example of the application of clinical skills by the surgeon. It remains one of the last bastions of clinical medicine.

Sequence of events:

The sequence of events in acute appendicitis is usually characteristic and is of utmost importance[23]. It begins with diffuse abdominal pain, followed by anorexia, nausea and vomiting. Later, the pain shifts to right side of the abdomen, accompanied by a slight rise in body temperature. This is known as Murphy's syndrome (triad).

If vomiting occurs before pain then the diagnosis of acute appendicitis is questionable and a peaceful night is assured to the surgeon[16]

Murphy stated "the symptoms occur almost without exception in the above order. And the order varies I always question the diagnosis"

Anorexia:

This is a useful and constant clinical feature, particularly in children.[16]

Visceral pain:

This is steady, sometimes intermittent, cramping and usually lasts for 4-6 hours. This pain is felt around the umbilicus, in the epigastrium or it may be generalized. It is due to distension of the appendix and irritation of visceral peritoneum and hence it is vague.

Somatic pain:[16]

With progressive inflammation of the appendix, the parietal peritoneum in right iliac fossa becomes irritated, producing more intense, constant and localized somatic pain that begins to predominate. Patients often report this is an abdominal pain that has shifted and changed in character.

Atypical pain:

Atypical presentations include pain, which is predominantly somatic or visceral and poorly localized. Atypical pain is more common in the elderly, in whom localization to the right iliac fossa is unusual. An inflamed appendix in the pelvis may never produce somatic pain but may instead cause suprapubic discomfort and tenesmus. In this circumstances, tenderness may be elicited only on rectal examination and is the basis for recommendation that a rectal examination should be performed on every patient who presents with acute lower abdominal pain.

Nausea:

Nausea of some degree is present in 9 out 10 patients with appendicitis

Vomiting:

This varies, depending on the age. Frequent in children and teenagers, it may be absent in older adults. Incidence of vomiting is about 75% of patients with appendicitis.

Change in Bowel and Bladder Habits:

Change in bowel will retrieve their abdominal pain. Diarrhoea occurs in some, especially in children, probably due to proximity of the inflamed appendix to ileum, rectum or sigmoid

PHYSICAL EXAMINATION:[10,16]

Appearance:

Patient is usually flushed and in obvious pain.

Posture:

The patient prefers to lie supine, with the thighs, particularly right, drawn up because any motion increases the pain due to irritation of the parietal peritoneum.

Tongue:

Initially furred, progressively gets coated and the breath becomes foul.

Temperature:

Rarely rises above 38 degree Celsius in uncomplicated appendicitis. Temperature above 38 degree should always suggest the presence of perforation and peritonitis. If temperature is considerably high at the beginning of attack then appendicitis is unlikely unless there is perforation. Perforation is unusual before 24-36 hours of onset of symptoms[23]

Pulse rate:

This will be normal or slightly elevated, especially in complicated appendicitis.

Tenderness:

There cannot be acute appendicitis without tenderness, which may be mild and diffuse in the early stages of the disease, later on localization according to position of appendix. Rebound tenderness is often, but not invariably present.

Muscle guarding and rigidity:

It indicates the severity of inflammatory process. Especially in younger patients, early in the disease, resistance felt is because of voluntary guarding. As the peritoneal irritation progresses, muscle spasm increases guarding.

Cutaneous hyperasthesia:

Over the area supplied by spinal nerves T 10, T 11, T12 on the right is a frequent, but not constant component of appendicitis.

Pointing sign:[16]

The patient is asked to point to where the pain began and where it moved.

Rovsing's sign:

Deep palpation of the left iliac fossa may cause pain the right iliac fossa.

Psoas sign:

Occasionally, an inflamed appendix lies on the psoas muscle and the patient, often a young adult, will lie with the right hip flexed for pain relief.

Obturator sign:

If an inflamed appendix is in contact with obturator internus, flexion and internal rotation of right hip joint, will cause pain in the hypogastrium.

Baldwin's test:

This test is to detect retrocaecal appendicitis. While maintaining finger tip pressure over the right flank, the patient asked to raise the right lower limb off the bed, keeping the knee extended. The test is positive if patient complains of pain or drops the limb with an expression of agony on the face.

Dunphy's sign:

Increased pain with coughing

Rectal examination:

It is indicated primarily to exclude lesions such as ovarian cyst or tubal pathology in females and to elicit tenderness in cases of pelvic appendicitis. Rectal examination is of little value in establishing the diagnosis of acute appendicitis but can be useful to determine the presence or absence of a mass.[24]

SPECIAL FEATURES, ACCORDING TO POSITION OF THE APPENDIX:

Retrocaecal - Rigidity in often absent

- Deep palpation may fail to elicit Tenderness

- Psoas spasm due to inflammed appendix in contact with the muscle may cause flexion of hip.

Pelvic - Early diarrhea due to contact with rectum

- When it lies completely within the true pelvis no pain, tenderness, rigidity at McBurney's point.

- Rectal examination may reveal tenderness in rectovesical pouch or pouch of Douglas.

- When inflamed appendix is in contact with Bladder, may cause frequency of micturition.

Post-Ileal - Presents great difficulty in diagnosis

- The pain may not shift, diarrhoea is a feature, marked retching may occur.

- Cause ill-defined tenderness immediately right of umbilicus.

LABORATORY INVESTIGATIONS

This is very much true of acute appendicitis, as only laboratory investigations, without any clinical grounds, do not establish diagnosis.

I. Total WBC count and differential count:[10,25,26]

Moderate leucocytosis, ranging from about 10,000 – 18,000 cells/cu.mm, with neutrophilia, is the common picture in acute appendicitis. With normal total and differential counts, the diagnosis of acute appendicitis is still a possibility. If the WBC count is more than 18,000 cells/ cu.mm and shift to the left is extreme, perforated appendicitis or an acute inflammatory disease of a greater magnitude than appendicitis is more possible.

Pieper et al [27] noted that 66.7% had WBC count of 11000/cu.mm or more and only in 5.5% it was raised above 20,000/cu.mm. However Coleman C et al reported that WBC is a poor predictor of severity of the disease in the diagnosis of acute appendicitis[28]

II. IMAGING MODALITIES:

1. Plain Radiography:

Plain radiography has been used in the diagnosis of appendicitis since 1906. However, it lacks specificity, findings being found in normal patients as well as in other conditions. The incidental finding of a faecolith a relative indication for prophylactic appendicectomy.[16]

This should not be considered “routine” or “mandatory” components of the evaluation of patients with acute abdominal pain. Pneumoperitoneum on a upright abdominal radiograph suggests a diagnosis other than appendicitis. Rarely does a perforated appendix present with pneumoperitoneum in about 1 to 2% ofcases.[14,29]

Other signs are:-

- Fluid level localised to caecum and terminal ileum
- Localised ileus with gas in caecum
- Increased soft tissue density in right lower quadrant
- Blurring of Flank stripe ,the radiolucent line produced by the fat between peritoneum and transverses abdominus
- Fecolith
- Blurring of right psoas shadow
- A gas filled appendix
- Free peritoneal gas

On a review of 200 cases, 80% of acute appendicitis patients on surgery had 3 or more signs positive. 37% of normal appendix had similar x ray findings .

Thus "if the diagnosis of appendicitis remains in doubt take the appendix out"[30]

2. Ultrasound:

Ultrasonagraphy is often used as the initial diagnostic imaging study in the majority of patients in whom the clinical diagnosis of appendicitis is equivocal. Ultrasound is non invasive and rapidly available and avoids radiation exposure.[31,32,33]

Deutsch et al was the first to report ultrasonic visualization of an inflamed appendix, in 1981, in a child suffering from acute leukemia.[34]Abdominal ultrasound examination is more useful in children and in thin adults, particularly if gynaecologic pathology is suspected, with a diagnostic accuracy in excess of 90%.

Jeffrey et al studied 250 cases of acute appendicitis and laid down sonographic criteria for diagnosis.[35]

Currently, diagnostic criteria used for the diagnosis of acute appendicitis by ultrasound are

1. Blind ending, immobile, non-compressible, aperistaltic, tubular structure. Mural thickness is assessed by measuring the distance from the echogenic mucosa to the outer edematous wall that shows few echoes.

2. Cannot be displaced on pressure.

3. Bull's eye or target lesion visualized in the transverse plane with diameter > 6 mm.

4. Faecolith in the lumen.

5. Periappendiceal collection.

6. Hypo or hyperperistaltic loops in the right iliac fossa.

7. Miscellaneous signs:

'Cockade' around target lesion. Tubular structure > 50 mm in length.

Graded compression ultrasonography performed in 139 patients, the sensitivity and specificity of ultrasonography for diagnosing appendicitis was 95% and 89% respectively.[36]

Jeffrey et al [12], in a study, pointed out the sonographic pitfalls in the diagnosis of acute appendicitis, in which they observed a that a dilated fallopian tube or hypertrophied fibers of the psoas muscle could be mistaken for a target lesion, while a gas containing appendix could be mistaken for a bowel loop.

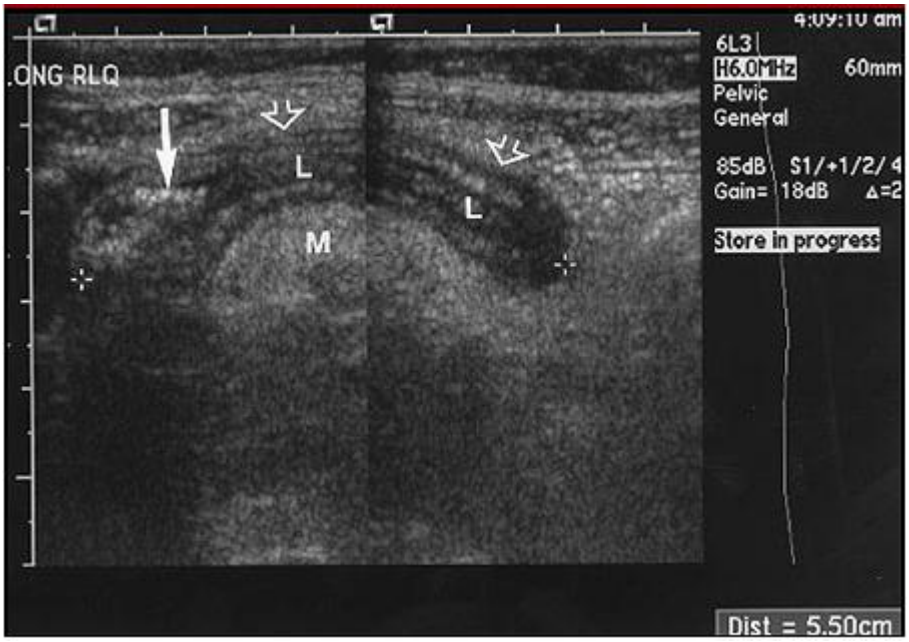


FIGURE 5- USG IMAGING OF ACUTE APPENDICITIS

Conclusion:

Ultrasound is highly specific for the diagnosis of appendicitis in the hands of experts and also has the advantage of non invasively excluding diseases which do not require surgical intervention like ureteric colic or gynaecological disorders. It is non invasive and can also be used safely in pregnant patients and children with no radiation hazard.

3. Colour Doppler:

Colour Doppler examination is based on the principle that acute inflammation of the appendix is associated with increased blood flow to the region.

Quillin et al, in 1992, imaged 100 children concurrently with colour Doppler and gray scale ultrasonography, and found a sensitivity of 87% and a specificity of 97%, with an accuracy of 90% by gray scale ultrasonography. A finding of increased vascularity was considered positive for appendicitis and a hyparaemic right lower quadrant mass suggestive of an abscess.

4. Computerised tomographic scanning :

Contrast enhanced CT scan is most useful in patients in whom there is diagnostic uncertainty, particularly older patients, in whom acute diverticulitis, intestinal obstruction or neoplasm are likely differential diagnosis. Intravenous contrast helps to highlight inflammation around the appendix. Selective use of CT scanning may be cost effective by reducing both the negative appendicectomy and length of hospital stay.[16]

Enhanced CT scan is a good imaging diagnostic tool for suspected appendicitis, having sensitivity of 87% and specificity of 86%.[36]

Improved image resolution to the 0.5 cm to 1.0 cm range has improved the accuracy of CT scanning. In the absence of signs of inflammation, the diagnosis is less certain and in this situation a CT scan might be of value.[37]

In a study of 38 patients, Gale et al found that CT scan had a sensitivity of 92% and a specificity of 79%. They described the common findings in acute appendicitis on CT as:

a. Peri- caecal inflammation. (68%)

b. Abscess formation. (55%)

c. Calcified appendicolith. (23%)

d. Abnormal appendix. (18%)

The accuracy of CT is greatest when a deliberate effort is made to visualize the appendix. CT is used in conjunction with repetitive examination and clinical observation in patients with equivocal findings, high risk populations for false positive examinations. Using this approach, the frequency of negative explorations has been significantly reduced.[38.39.40.41,42,43,44,45]

IV. Miscellaneous investigations:

1. Urine analysis:

The presence of haematuria or pyuria in acute appendicitis has been demonstrated. Graham et al found microscopic haematuria and pyuria in 9 patients out of 62 positive appendicectomies. An appendiceal tip being close to ureter or bladder can cause haematuria and pyuria.[46]

2. C- reactive protein levels:

C- reactive protein is basically an acute phase reactant which has been shown by Groonroos et al to stay persistently elevated in cases of acute appendicitis, unlike the total count which progressively decreases with time.[47]

Eriksson et al, studied 227 patients, found that C- reactive protein had a sensitivity of 87% and specificity of 50%.[48]

The clinical diagnosis of appendicitis rests on a combination of localised pain and tenderness accompanied by signs of inflammation such as fever, leucocytosis and elevated C- reactive protein levels.[49,50,51,52,53]

C- reactive protein has been studied and correlated with clinical and pathologic findings.[54]

The readings of CRP were ranging between 0 and 11.7 mg/l (mean 5.6mg/l) in patients with normal appendix and between 6 – 93.4 mg/l in patients with acute appendicitis.12

CRP estimation required specialized laboratory equipment, which has now been resolved by using CRP kits.

Conclusion:

CRP is elevated in any cause of acute inflammation. But if clinical suspicion of appendicitis is not confirmed, CRP estimation provides the clue for acute appendicitis.

3. Phospholipase A 2 levels:

Group II phospholipase A2, in the serum, is an acute phase reactant.

Groonroos et al [47] prospectively studied 186 patients, also using CRP and leucocyte count. Where as leucocyte count was the investigation of choice in acute uncomplicated appendicitis, C- reactive protein and phospholipase A2 correlated better with protracted inflammation and appendicular perforation.

4. Interleukin- 6 levels:

Assessment of IL-6 levels has been found to correlate well with acute appendicitis, although specificity is uncertain.

5. Radio- isotope scanning:

Two types of scanning studies have been used: radio labelled white blood cells (Tc 99m WBC) and immunoglobulin G (Tc 99 Ig G)[55,56,57]

After a report in 1985, that there was rapid accumulation of radio isotope labelled leucocytes at sites of infection, radio- isotope studies for the diagnosis of acute appendicitis were attempted.

This involved withdrawing 30- 90 ml of patients blood, separating leucocytes by differential sedimentation and labelling them with radio isotope indicator, usually Technetium 99 or Iridium 111. Scanning was done 2 hours after injection of the mixture.

Navaratto et al used Iridium 111 and found a sensitivity of 93% with an overall accuracy rate of 91%.[58]

III. SCORING SYSTEM :

1. Alvarado Score:[62]

The classical signs and symptoms of acute appendicitis were first reported by Fitz in 1886. The Alvarado score was described in 1986 and has been validated in adult surgical practice. The classical Alvarado score included left shift of neutrophil maturation yielding a total score of 10.

ALVARADO (MANTRELS) SCORE		SCORE
SYMPTOMS	MIGRATORY RIF PAIN ANOREXIA NAUSEA AND VOMITING	1 1 1
SIGNS	TENDERNESS RIF REBOUND TENDERNESS ELEVATED TEMPERATURE	2 1 1
LAB INV.	LEUCOCYTOSIS SHIFT TO LEFT	2 1
	TOTAL	10

FIGURE 6- ALVARADO SCORE

A score of 5 or 6 is compatible with the diagnosis of acute appendicitis.

A score of 7 or 8 indicates a probable appendicitis.

A score of 9 or 10 indicates a very probable acute appendicitis.

2. MODIFIED ALVARADO SCORE:

Kalan et al omitted the left shift of neutrophil maturation parameter and produced a modified score. The modified Alvarado score yields a total of 9. Patients with a score of 1 – 4 are considered unlikely to have acute appendicitis. Patients with a score of 5 – 6 have possible diagnosis of acute appendicitis, not convincing enough to have urgent surgery. Those with a score of 7 – 9 are regarded as patients with acute appendicitis.

TREATMENT[63,64,65,66]

Patients with acute, non perforated appendicitis should undergo urgent appendicectomy. There have been few studies examining the role of antibiotic therapy alone for appendicitis. Erikkson and Granstrom performed randomized trial of antibiotic therapy versus surgical therapy for patients with appendicitis. In a small number of patients, the initial success was 85 %, but recurrence rate of 35% with short follow up.

Owing to high recurrence rate, the current standard is operative treatment. The answer for treatment of acute appendicitis and its complication, is SURGERY, and the only dilemma it carries with it is the timing of surgical intervention.

There has been a difference of opinion, however, concerning the optimal timing for ruptured appendicitis with frank periappendiceal abscess formation. Expectant treatment was advocated by A.T. OCSHNER1 in 1901. If progression occurs, the abscess is drained. If the patient improves, conservative treatment is continued.

With these measures, the majority of appendiceal abscesses resolve satisfactorily, although many days of hospitalization are required. An elective appendicectomy 6 weeks to 3 months later is strongly advised, since the recurrence rate is very high.

PREOPERATIVE PREPARATION:[67]

An intravenous infusion should be commenced and a preoperative dose of broad spectrum antibiotic is administered to all patients to cover aerobic and anaerobic organisms, it should be continued if there is significant peritonitis.

Consideration should be given to the use of subcutaneous calcium heparin and anti embolism stockings in adults, particularly if there is a history of previous deep vein thrombosis. An indwelling urinary catheter should be inserted in patients with peritonitis all others should be encouraged to void before surgery.

ANAESTHESIA:[67]

A fasting time of 4 hours is preferred. After premedication, the patient is transferred to the operating theatre where general anaesthesia is induced, spinal anaesthesia can also be used.

OPERATION:

Position of patient:

The patient is placed in the supine position. Calf compressors or muscle stimulators, if available, are used in adults and an adhesive diathermy pad applied to thigh.

Examination under anaesthesia:

With the patient under effect of anaesthesia, the abdomen should be carefully and systematically palpated once more.

INCISION:

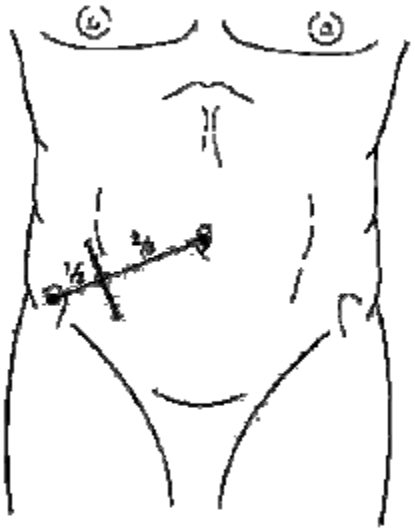
CONVENTIONAL APPENDICECTOMY:

There are a number of choices for an incision, each of which has their own advantages and disadvantages. The incision should be the one that gives sufficient exposure, permits the needed exposure with the least amount of tissue injury, and allows easy extension, should it become necessary.

McBurney's incision (Grid iron incision):[16]

When the preoperative diagnosis is considered reasonably certain, the incision that is widely used for appendicectomy is the so called GRID IRON incision(Grid iron: a frame of cross beams to support a ship during repairs).

The Grid iron, described first by McArthur, is made at right angles to a line joining anterior superior iliac spine to the umbilicus, its center being along the line at McBurney's point. The external oblique is incised in the line of its fibers along the length of incision. The fibers of the internal oblique and transversus abdominis are split. And with suitable retraction peritoneum is opened. If better access is required, it is possible to convert the Gridiron to a Rutherford Morrison incision by cutting internal oblique and transversus abdominis in the line of incision.



Grid iron incision for appendicectomy

FIGURE 7- GRID IRON INCISION

LANZ INCISION:

In recent times, a transverse skin crease has become more popular, as the exposure is better and extension, when needed, is easier. The incision, approximate in length to the size and obesity of the patient, is made approximately 2cm below the umbilicus centred on the mid clavicular to mid inguinal line. The muscles are split in the direction of its fibers.

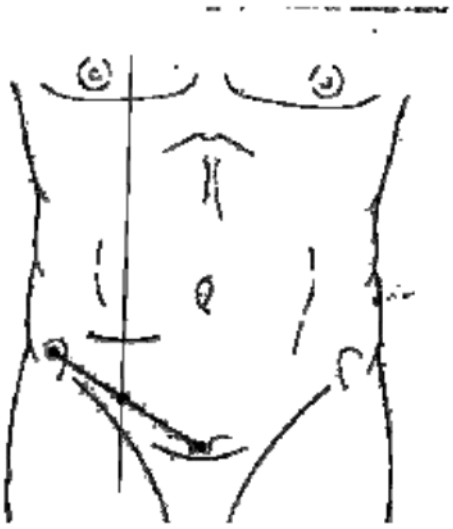


FIGURE 8- LANZ INCISION

PROCEDURE:[15,68]

If taeniae coli is immediately visible, it may be traced by index finger to the inferior pole of caecum. The appendix may be immediately palpable and lie free, or it may lie behind the terminal ileum, pass down the pelvis, or more commonly pass superiorly behind the caecum.

A turgid appendix may be felt at the base of the caecum. Inflammatory adhesions are gently broken with a finger, which is then hooked around the appendix to deliver it into the wound. The appendix is conveniently controlled using a Babcock or Lane's forceps applied and yet not damage it. The base of the mesoappendix is clamped in a haemostat, divided and ligated. When the mesoappendix is broad, the procedure must be repeated with a second or, rarely a third haemostat. The appendix ,now completely freed, is crushed near its junction with the caecum in a haemostat, which is reapplied just distal to the crushed portion. An absorbable 2/0 ligature is tied around the crushed portion close to the caecum. The appendix is amputated between the haemostat and the

ligature. An absorbable 2/0 or 3/0 purse string sutures may then be inserted into caecum about 1.25 cm from the base. The stitch should pass through the muscle coat, picking up the taeniae coli.

RETROGRADE APPENDICECTOMY:[16]

When the appendix is retrocaecal and adherent, it is an advantage to divide the base between haemostats. The appendiceal vessels are then ligated, the stump ligated and invaginated and gentle traction of the caecum will enable the surgeon to deliver the body of the appendix, which is then removed from base to tip.

WOUND CLOSURE:

After removal of the appendix, each fascial layer is closed with 2/0chromic catgut. Skin is closed using non absorbable sutures.

LAPARASCOPIC APPENDICECTOMY:[15,68,69,70]

An open technique should be used to establish a pneumoperitoneum and for insertion of the laparoscopic ports as it is safer then the closed technique using veress needle.

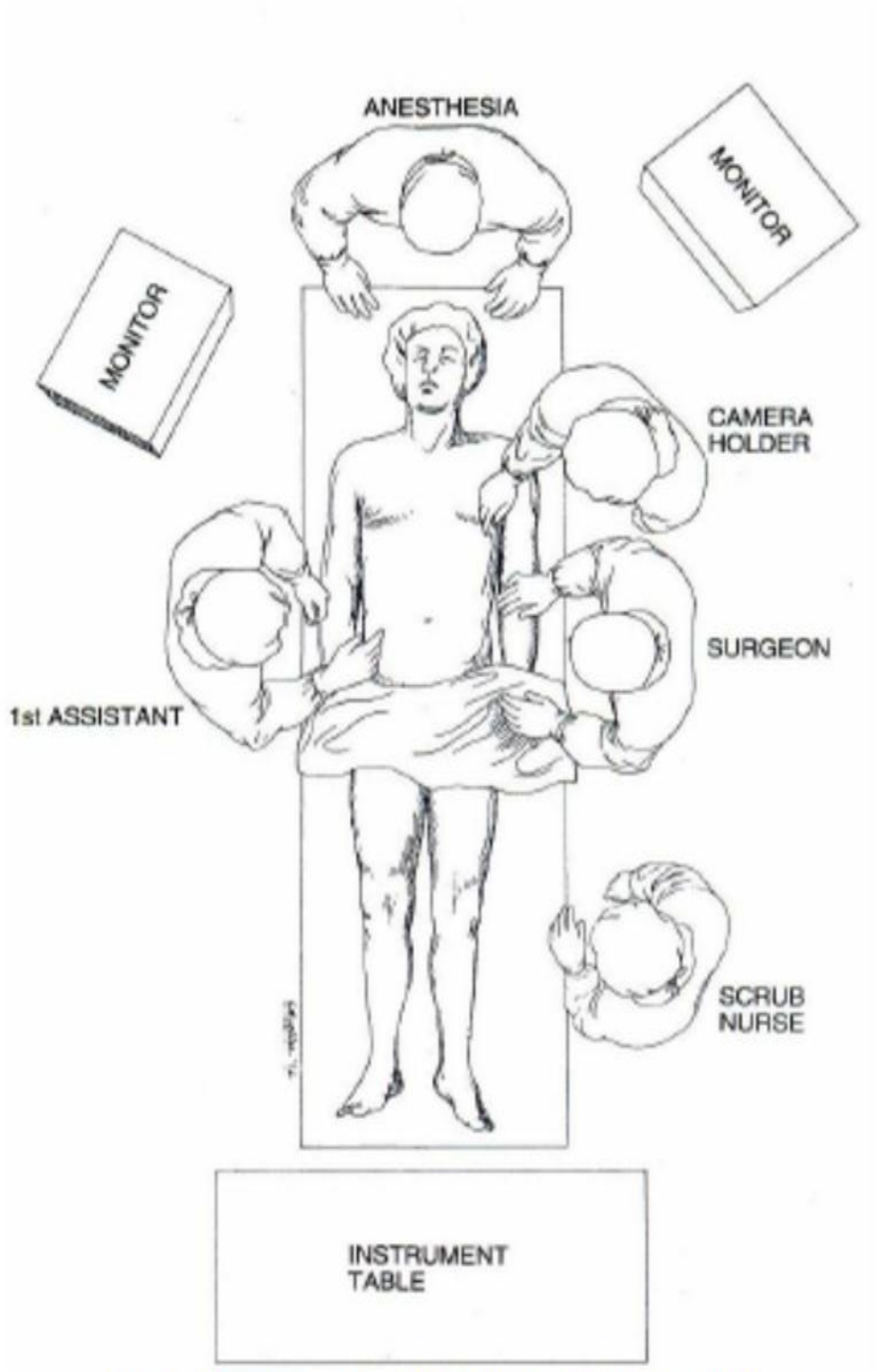
A moderate Trendelenburg tilt of the operating table assists delivery of the loops of the small bowel from the pelvis. The appendix is found in the conventional manner. By elevating the appendix, the mesoappendix is displayed. A dissecting forceps is used to create the window in the mesoappendix to allow the appendicular vessel to be coagulated or ligated using a clip applicator. The appendix, free of its mesentery, can be ligated at its base with an absorbable loop ligature, divided, removed through one of the operating ports. A single absorbable suture is used to close the linea alba at the

umbilicus and the small skin incisions may be closed with a subcuticular or simple sutures.

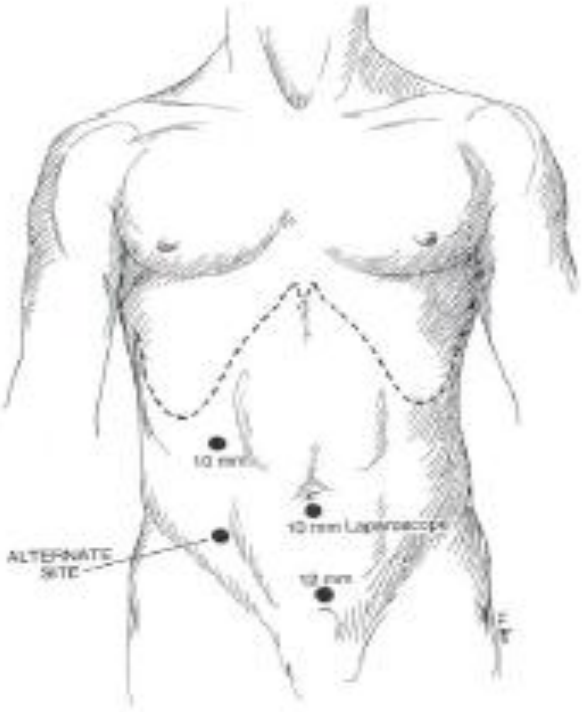
Advantages:

1. Less postoperative pain.

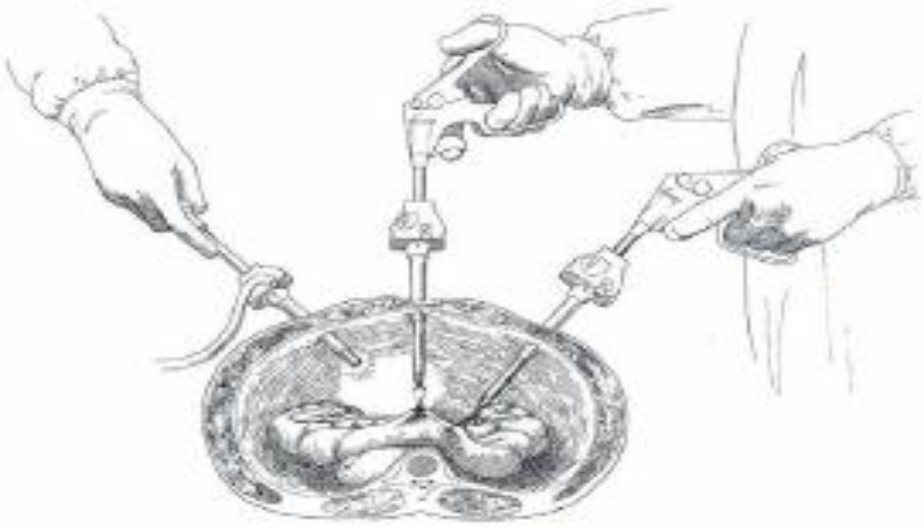
2. Return to daily activities sooner than those who have undergone open



Position of surgeon and assistants in laparoscopic appendicectomy



Port positions in laparoscopic appendicectomy



Laparoscopic appendicectomy in progress

FIGURE 9- PROCEDURE OF LAPAROSCOPIC APPENDICECTOMY

COMPLICATIONS OF APPENDICECTOMY:

Early complications:

1. Paralytic ileus

2. Sepsis – local wound abscess, pelvic abscess.

3. Rupture of the stump or caecal wall.

4. Haemorrhage: At any time during the first 72 hours after surgery means either leakage from the stump or a slipped arterial ligature.

Late complications:[71]

1. Intestinal obstruction due to local adhesive bands.

2. Incisional hernia

MATERIALS AND METHODS

Ninety patients suspected of suffering from acute appendicitis warranting emergency surgery for the same were evaluated from November 2012 to July 2014 at M.S.RAMAIAH MEDICAL COLLEGE.
The scoring system used by Alvarado and USG imaging was used

All the patients presenting with the right iliac fossa pain above 18 years were included in this study. Clinically patients with gynaecological and urological diseases were excluded from this study and patients with recurrent appendicitis were also excluded. A thorough elicitation of the history and physical examination were carried out including all the components of the Alvarado score.

All patients were evaluated by the Alvarado scoring system and USG of abdomen and pelvis was performed in all the patients and subjected to surgery. Appendix specimen sent for HPE for final confirmation of diagnosis.

All the results were analysed and tabulated according to age, sex, Alvarado components, pre operative score, USG imaging, Surgery done and HPE results.

OBSERVATION AND RESULTS

Study design: An observational clinical single group study

Table 1: Age distribution of patients studied

Age in years	No. of patients	%
≤20	6	6.7
21-30	46	51.1
31-40	28	31.1
41-50	7	7.8
51-60	3	3.3
Total	90	100.0

Mean ± SD: 30.57±7.97

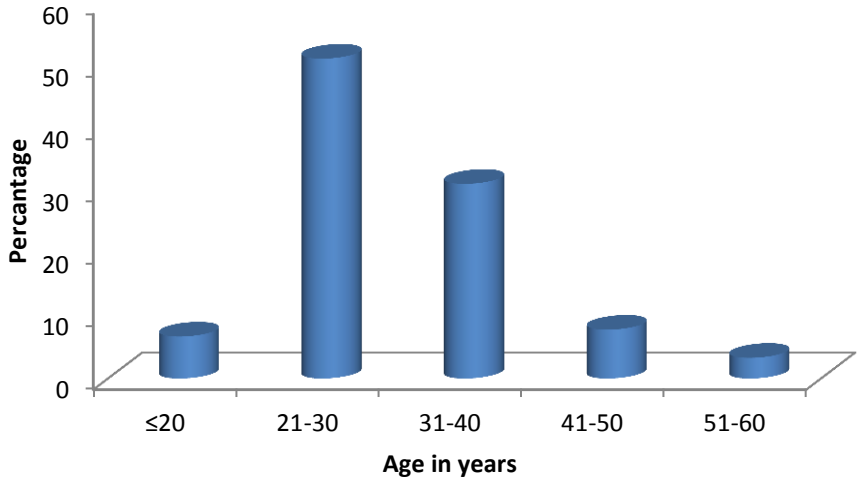


Table 2: Gender distribution of patients studied

Gender	No. of patients	%
Female	31	34.4
Male	59	65.6
Total	90	100.0

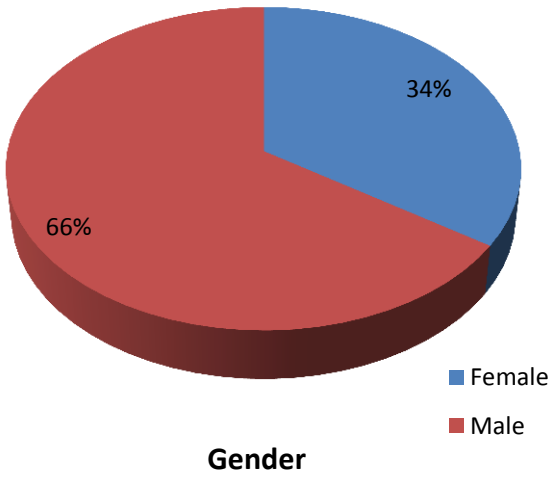


Table 3: Age distribution of patients studied according to gender

Age in years	Gender		Total
	Female	Male	
≤20	2(6.5%)	4(6.8%)	6(6.7%)
21-30	18(58.1%)	28(47.5%)	46(51.1%)
31-40	6(19.4%)	22(37.3%)	28(31.1%)
41-50	4(12.9%)	3(5.1%)	7(7.8%)
51-60	1(3.2%)	2(3.4%)	3(3.3%)
Total	31(100%)	59(100%)	90(100%)

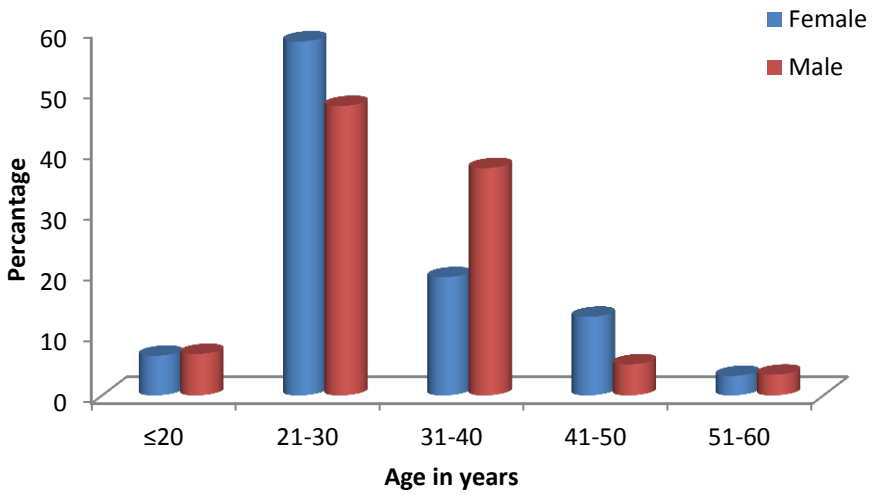


Table 4: Alvarado score of patients studied

Alvarado score	No. of patients	%
1-4	8	8.9
5-7	22	24.4
>7	60	66.7
Total	90	100.0

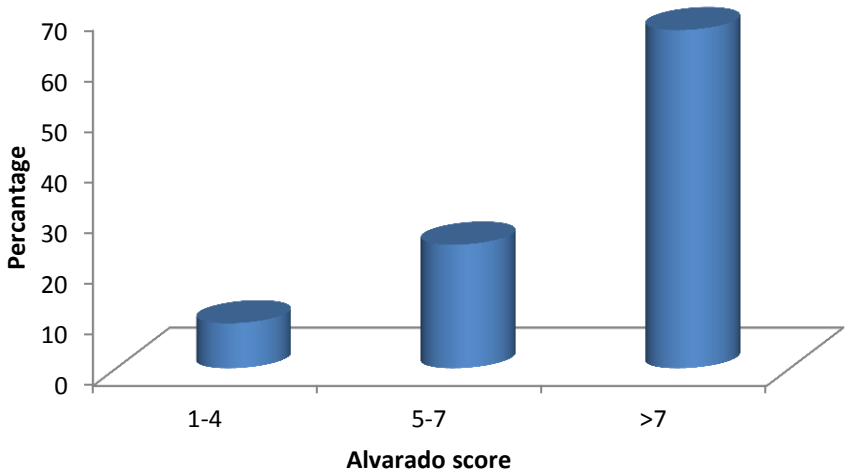


Table 5: USG Imaging of patients studied

USG Imaging	No. of patients	%
Acute appendicitis	64	71.1
Normal study	26	28.9
Total	90	100.0

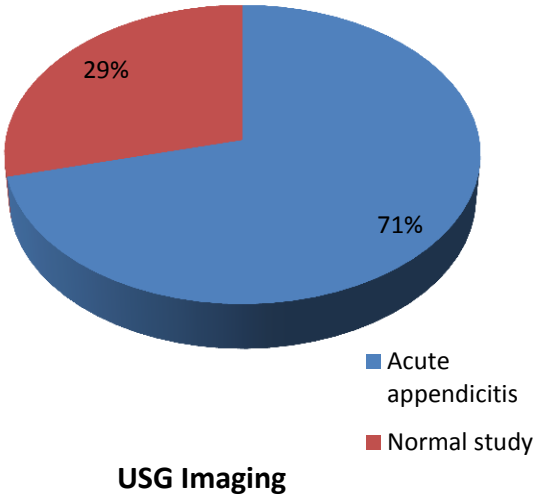


Table 6: Alvarado score according to gender

Alvarado score	Gender		Total
	Female	Male	
1-4	3(9.7%)	5(8.5%)	8(8.9%)
5-7	6(19.4%)	16(27.1%)	22(24.4%)
>7	22(71%)	38(64.4%)	60(66.7%)
Total	31(100%)	59(100%)	90(100%)

P=0.717, Not significant , Chi-Square test

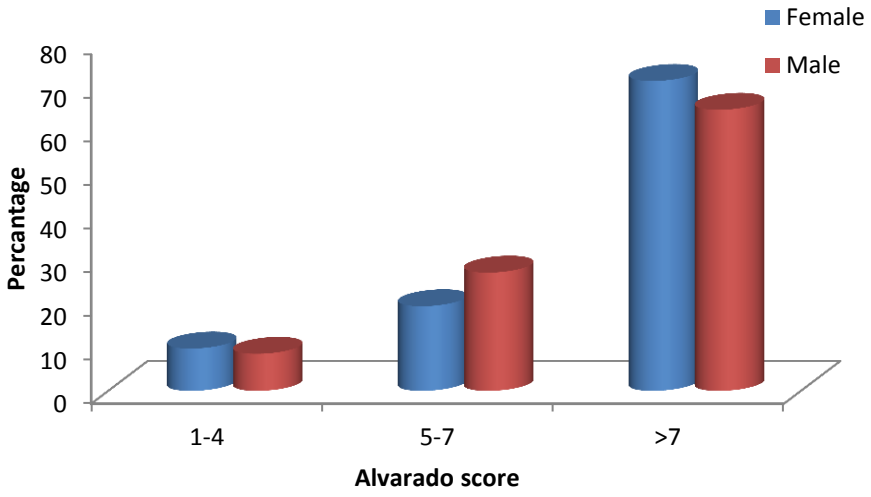


Table 7: USG Imaging according to gender

USG Imaging	Gender		Total
	Female	Male	
Acute appendicitis	24(77.4%)	40(67.8%)	64(71.1%)
Normal study	7(22.6%)	19(32.2%)	26(28.9%)
Total	31(100%)	59(100%)	90(100%)

P=0.339, Not significant , Chi-Square test

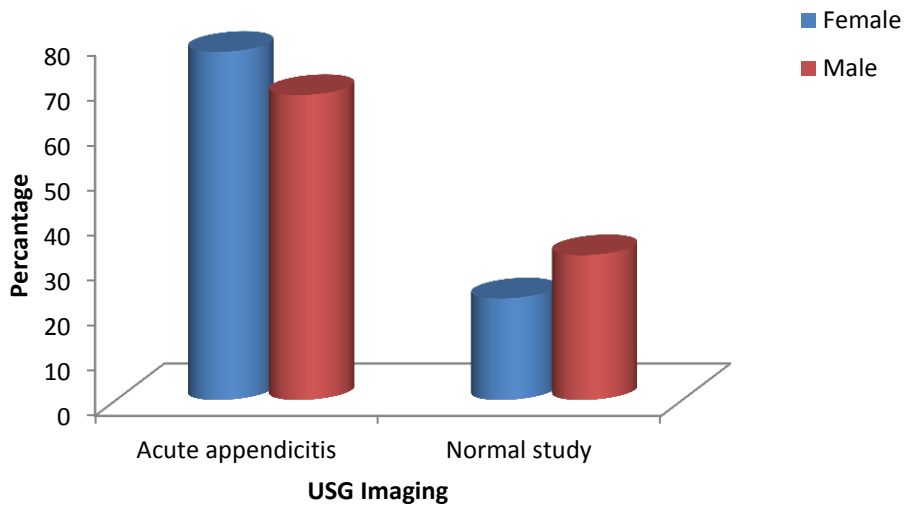


Table 8: Procedure of patients studied

Procedure	No. of patients	%
Laparoscopic appendectomy	8	8.9
Open appendectomy	82	91.1
Total	90	100.0

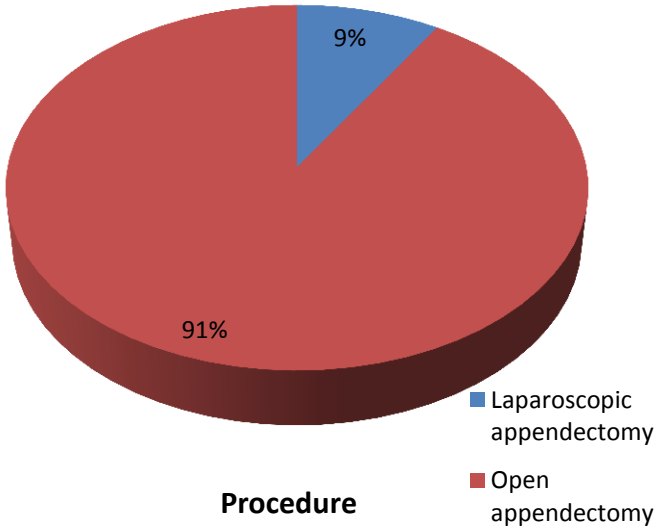


Table 9: HPE findings of patients studied

HPE	No. of patients	%
Acute appendicitis	86	95.6
Unremarkable	4	4.4
Total	90	100.0

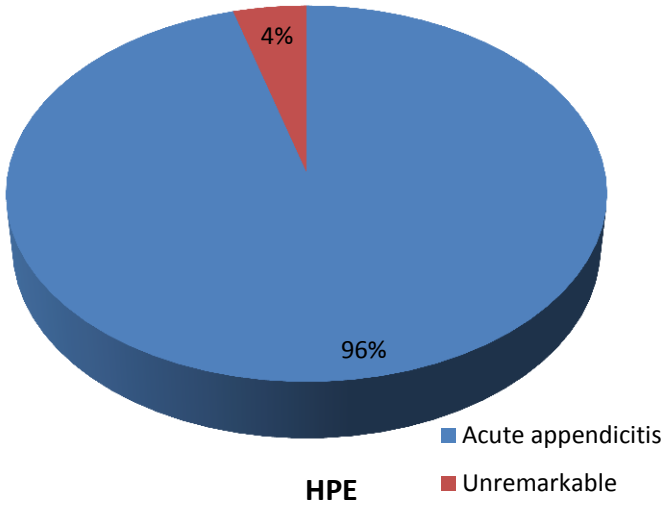
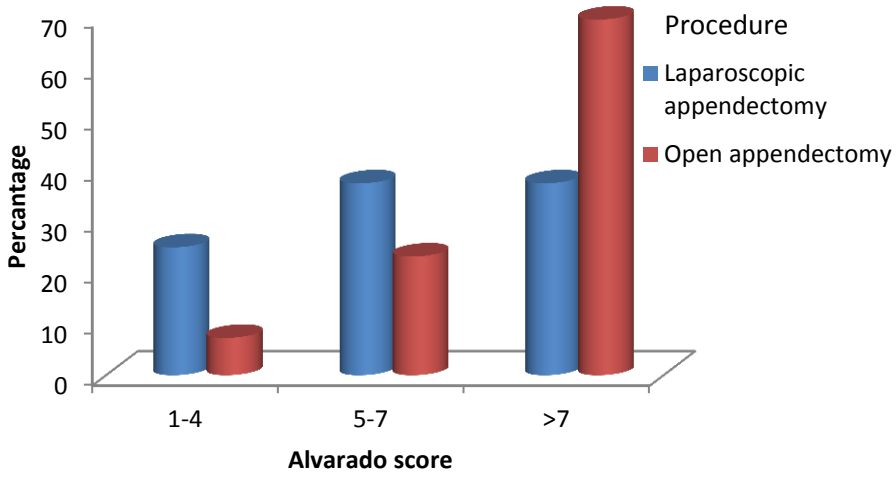


Table 10: Alvarado score according to Procedure

Alvarado score	Procedure		Total
	Laparoscopic appendectomy	Open appendectomy	
1-4	2(25%)	6(7.3%)	8(8.9%)
5-7	3(37.5%)	19(23.2%)	22(24.4%)
>7	3(37.5%)	57(69.5%)	60(66.7%)
Total	8(100%)	82(100%)	90(100%)

P=0.083+, Significant, Fisher Exact test



Statistical Methods: Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, **Assumptions: 1.**Dependent variables should be normally distributed, 2.Samples drawn from the population should be random, Cases of the samples should be independent

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

Significant figures

+ Suggestive significance (P value: $0.05<P<0.10$)

* Moderately significant (P value:$0.01<P \leq 0.05$)

** Strongly significant (P value : $P \leq 0.01$)

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 ,Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

DISCUSSION

Correlating the Alvarado score with USG in the diagnosis of Acute Appendicitis, the following observations were made (Table-11) and (Table-12)

In patients with score between 1-4, 6/8 (75%) showed histopathological evidence of Acute Appendicitis and USG showed features of Acute Appendicitis in 4/8 (50%), 0f 4 cases 2 patients were HPE positive for Acute Appendicitis and 2 patients were negative for Acute Appendicitis.

In patients with a score of 5-7, 21/22 (95.45%) showed histopathological evidence of Acute Appendicitis and USG showed features of Acute Appendicitis in 20/22 (90.9%) and 21/22 (95.45%) were positive for HPE.

Among the patients with a score of more than 7, 59/60(98.33%) had histopathological evidence of acute appendicitis and USG showed features of acute appendicitis in 40/60 patients, i.e 66.66%

Table 11: Alvarado score according to USG Imaging

Alvarado score	USG imaging		Total
	Acute appendicitis	Normal study	
1-4	4(6.3%)	4(15.4%)	8(8.9%)
5-7	20(31.3%)	2(7.7%)	22(24.4%)
>7	40(62.5%)	20(76.9%)	60(66.7%)
Total	64(100%)	26(100%)	90(100%)

P=0.039*, Significant, Chi-Square test

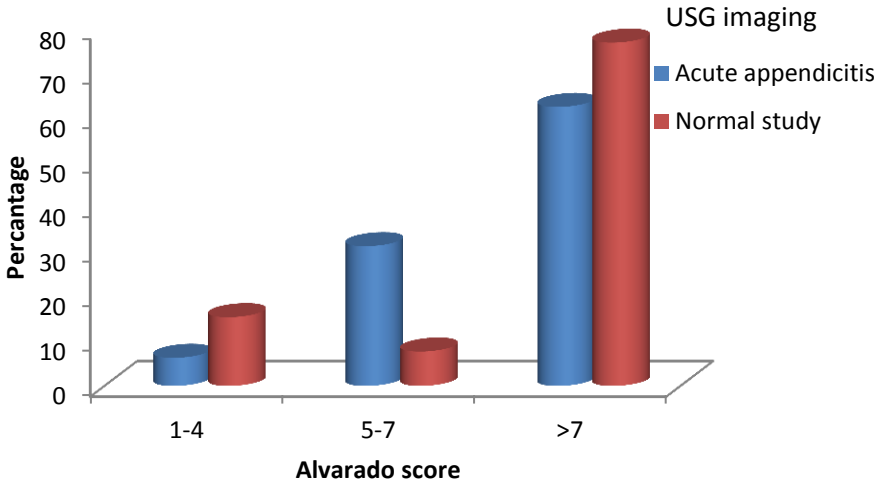
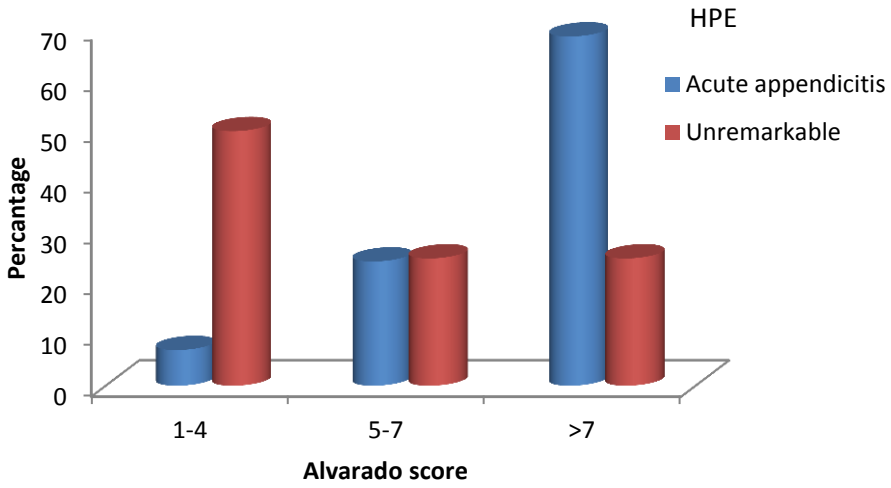


Table 12: Alvarado score according to Procedure

Alvarado score	HPE		Total
	Acute appendicitis	Unremarkable	
1-4	6(7%)	2(50%)	8(8.9%)
5-7	21(24.4%)	1(25%)	22(24.4%)
>7	59(68.6%)	1(25%)	60(66.7%)
Total	86(100%)	4(100%)	90(100%)

P=0.027*, Significant, Fisher Exact test



Usefulness of incorporating USG imaging in patients with low /equivocal Alvarado Score in improving the diagnostic accuracy in acute appendicitis.

Of the 90 patients,30 patients had score below 7 in which 22 patients had score between 5-7 and 8 patients had score between 1-4.

22 patients with Alvarado score of 5-7 showed HPE of acute appendicitis in 21/22 individuals i.e 95.45% of the patients were proved histopathologically to have Acute Appendicitis.

8 patients with Alvarado score of 1-4 showed HPE of acute appendicitis in 6/8 individuals i.e 75% of the patients were proved histopathologically to have Acute Appendicitis and remaining 25% were proved histopathologically to have normal Appendix.

Table 13: Correlation of USG and HPE in different range of Alvarado score

USG vs HPE for Acute appendicitis	Sensitivity	Specificity	PPV	NPV	Accuracy
1-4	50.00	50.00	75.00	25.00	50.00
5-7	95.24	100.00	100.00	50.00	95.45
>7	67.80	100.00	100.00	66.67	68.33
Total	73.28	75.00	98.44	11.54	73.33

USG showed 50% sensitivity, 50% specificity, 75% positive predictive value, 25% negative predictive value and 50% accuracy in Alvarado score of 1-4.

In the score range of 5-7, USG showed 95.24% sensitivity, 100% specificity, 100% positive predictive value, 50% negative predictive value and 95.45% accuracy

In the score of more than 7, USG showed 67.80% sensitivity, 100% specificity, 100% positive predictive value, 66.67% negative predictive value and 68.33% accuracy

The overall values of USG in our study was

- ✓ Sensitivity-73.28%
- ✓ Specificity-75%
- ✓ Positive Predictive Value-98.44%
- ✓ Negative Predictive Value-11.54% and
- ✓ Accuracy-73.33%

CONCLUSION

Alvarado score and USG imaging both are good diagnostic tool for predicting acute appendicitis in classical presentation of acute appendicitis.

In patients whose clinical scoring falls between 5 and 7,it is recommended to consider emergency appendectomy.

It is recommended to proceed with emergency appendectomy in all patients both men and women whose clinical score is more than 7.

Even though the literature (Alvarado A : A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 15:557, 1986) shows that Alvarado score is not very effective in predicting acute appendicitis in patients with a score of 5-7 but in our study 95.45% cases showed features of acute appendicitis in HPE.

With the score less than 4, Alvarado score and USG imaging is not a good clinical diagnostic system for exclusion or predicting acute appendicitis. Patients in this group needs further diagnostic tests to exclude acute appendicitis.

Hence we finally recommend applying the Alvarado's clinical scoring in all patients presenting with a clinical diagnosis of acute appendicitis.

Various diagnostic aids have been used to increase the diagnostic accuracy of acute appendicitis but still the clinical diagnosis is superior.

On correlation of Alvarado score with USG imaging, both were significantly associated.

In this study, ultrasonography was used to see whether the diagnosis of acute appendicitis could be improved.

For patients with typical clinical presentation, ultrasonography has no advantage over the Alvarado score.

Moreover, the additional information given by USG was not useful in cases of low Alvarado score.

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PROFORMA

Name :

Age & Sex :

Address :

Socio- economic status :

Date of Admission :

Date of Surgery :

Date of discharge :

IP No :

History,Location of Pain – RIF or generalized :

Nature of the pain :

Duration and onset

Associated with Anorexia/nausea/vomiting/constipation

Dysuria – present or absent

White discharge per vagina in females – present or absent

Similar history in the past and the treatments received then

History of medications (antibiotics)

History of intake of steroids or other immunosuppressive drugs

Personal history – appetite/ vegetarian or Non vegetarian / Bowel habits /micturition

Menstrual history in females

LMP Nature of the cycles – duration /flow / associated with pain

General Examination :

Temperature

Pallor

Pulse rate

Blood Pressure

Respiratory Rate

Tongue – Moist/Dry/Coated/Normal

Examination of the Abdomen :

Scaphoid or distended

Movements with respiration

Tenderness – RIF or generalized

Rebound tenderness – present or absent

Rectal examination

Percussion of the abdomen

Auscultation – Bowel sounds Normal/Sluggish/Absent

Examination of the Genitalia

Examination of the other systems

Gynaecological examination in females

Investigations:

CBC – Polymorphonuclear leukocytosis

Urine routine and deposits

Radiological – x ray abdomen

USG Abdomen

Histopathological examination of the removed appendix

Reactive lymphoid hyperplasia

Acute appendicitis

Presence of fecolith

Others

Other investigations:

Operative procedure:

Emergency / elective

Consultant / Assistant

Duration

Type of Anaesthesia GA/ RA

Type of incision

Lanz

Rutherford Morrison's

Right lower paramedian

Lower mid – line

Others

Findings

Free fluid in the RIF / general peritoneal cavity

Fluid sent for culture and sensitivity

Omentum in the RIF

Position of the appendix

Inflamed /Turgid/Gangrenous/Perforated/Appendicular

Abscess/Appendicular mass

Meckels diverticulum – Present /Inflammed/ Absent

Procedure done

Classical Appendectomy

Limited right Hemicolectomy

Appendicular abscess drainage

Drain/No drain

Post – operative Complications :

Uneventful

Others

MASTER CHART

SL NO.	NAME	AGE	SEX	IP NO.	ALVARADO SCORE	USG IMAGING	PROCEDURE	HPE	POST OP
1	PAVITHRA	18	F	419192	(1-4)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
2	SUNDAR	24	M	419945	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
3	SHYAM	30	M	419990	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
4	MONA	45	F	421004	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
5	MANJUNATH	32	M	422787	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
6	IMRAN KHAN	31	M	423545	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
7	SHAEEN TAJ	24	F	423898	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
8	VENKATESH	32	M	436676	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
9	VISHNU	35	M	435566	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
10	RAJLAXMI	27	F	439989	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
11	LUVI	34	M	439900	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
12	SHESHAPPA	32	M	439701	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
13	SANKARAPPA	18	M	439003	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
14	HASEENA BEGUM	24	F	441278	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
15	MD ISMAIL	29	M	441233	(1-4)	NORMAL STUDY	OPEN APPENDECTOMY	UNREMARKABLE	UNEVENTFULL
16	RANI	45	F	441379	>7	NORMAL STUDY	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
17	PARVEEN TAJ	35	F	441967	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
18	GAYATHRI	26	F	442087	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
19	MUNIYAPPA	38	M	442134	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
20	MAHENDRA	30	M	442245	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
21	SHEKHAR	26	M	442367	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
22	YASHODA	25	F	442354	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
23	LOKESH	27	M	442355	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
24	BHAGYA	30	F	442878	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
25	LAXMI	25	F	442787	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
26	SACHIN	29	M	446887	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
27	PRIYA	30	F	446766	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
28	SAEERA BANU	32	F	446980	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
29	VIDYA	40	F	449980	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
30	MANOJ BABU	52	M	449908	>7	NORMAL STUDY	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
31	JAYRAM REDDY	32	M	455151	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
32	SAROJAMMA	55	F	454243	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
33	PAVITHRAMMA	27	F	453677	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
34	KURSHID BANU	28	F	456877	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
35	ABHILASH	32	M	456678	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
36	KIRAN REDDY	29	M	453098	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
37	SONA	50	F	458097	(1-4)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	UNREMARKABLE	UNEVENTFULL
38	SHARADHA	18	F	451209	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
39	RAJANNA	28	M	452110	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
40	RAJESH KUMAR	29	M	467809	(1-4)	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
41	RAJITH K	43	M	461120	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
42	VENKATESH K M	27	M	465321	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
43	RAKESH D	48	M	461109	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
44	MAZAR AHMED	19	M	468767	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
45	ANTONY	32	M	468835	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
46	IQBAL	23	M	468970	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
47	TABASUM	32	F	468900	(5-7)	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
48	CHINAPPA	28	M	469565	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
49	SUMANTH RAJ	27	M	469757	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
50	SUMAYYA	25	F	469880	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
51	RATHOD VINOD	28	M	469560	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
52	RAJAPPA	32	M	469057	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
53	SAVITHRI	26	F	469005	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
54	RAMANNA	31	M	469779	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
55	BASVARAJ	36	M	465501	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
56	BHARATH RAJ	20	M	475309	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
57	AMEENA B	22	F	470098	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
58	PUNITH	29	M	471212	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
59	SRIDHAR	23	M	472433	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
60	LAKHSMI DEVI	29	F	471120	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
61	RAMU	32	M	471108	(5-7)	NORMAL STUDY	OPEN APPENDECTOMY	UNREMARKABLE	UNEVENTFULL
62	MANOBHIRAM	22	M	470039	(1-4)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
63	NEETU	28	F	471354	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
64	CHINABA	32	M	471399	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
65	NASEEM AHMED	29	M	475676	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
66	SAROJA	43	F	475660	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
67	PRITHVI	34	M	475562	>7	NORMAL STUDY	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
68	SIDHU	31	M	475322	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
69	PRASHANTH	54	M	475909	(5-7)	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
70	PREMA	28	F	476701	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
71	PREVEEN	27	M	476799	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
72	BAKSH UDDIN	28	M	476805	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
73	GIRISH RAJ	33	M	485251	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
74	SUNANDA	35	F	485299	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
75	VIJAY KUMAR	22	M	485498	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
76	GANESH REDDY	20	M	485377	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
77	SWARUP	34	M	485398	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
78	SUJATHA	21	F	486354	(1-4)	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
79	MD FAZAL	25	M	486309	(1-4)	NORMAL STUDY	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
80	MADHAVI	25	F	486112	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
81	MANJUNATH R	26	M	486230	>7	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
82	ALAWADDIN	32	M	486132	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
83	NARASIMHA	35	M	491912	(5-7)	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
84	NARAYANAMMA	38	F	498765	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
85	LOKESH PATIL	27	M	498076	>7	NORMAL STUDY	OPEN APPENDECTOMY	UNREMARKABLE	UNEVENTFULL
86	SHIVA KUMAR	28	M	490532	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
87	HARSHA	23	M	497623	(5-7)	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
88	MUJAHID	24	M	496671	(1-4)	NORMAL STUDY	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
89	DINESH	32	M	495661	(5-7)	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL
90	GOVINDRAJU	50	M	498771	>7	ACUTE APPENDICITIS	OPEN APPENDECTOMY	ACUTE APPENDICITIS	UNEVENTFULL