Dissertation on

EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS

Submitted in partial fulfillment of the requirement for the award of the degree of

M.S. BRANCH – I
(GENERAL SURGERY)

DEPARTMENT OF GENERAL SURGERY
GOVT. STANLEY MEDICAL COLLEGE & HOSPITALS

THE TAMILNADU Dr.M.G.R.MEDICAL UNIVERSITY,
CHENNAI – TAMILNADU.

SEPTEMBER – 2006

CERTIFICATE

This is to certify that this dissertation on **"EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS"** presented herein by **Dr.S.GANESH PRASAD** , is the original work done in the Department of General Surgery, Government Stanley Medical College and Hospitals, Chennai in partial fulfillment of requirements of M.S. Branch-I (General Surgery) examination of The Tamilnadu DR.M.G.R. Medical University to be held in September 2006 under guidance and supervision during the academic period of 2003 – 2006.

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DECLARATION

I, **DR.S.GANESH PRASAD** , solemnly declare that this dissertation, titled **"EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS"** is a bonafide record of work done by me in the Department of General Surgery, Government Stanley Medical College and Hospitals, Chennai under the guidance of my unit chief

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ACKNOWLEDGEMENT

I thank **Dr.VASANTHA,M.D.,**Dean , for permitting me to conduct this study in Government Stanley Medical College and Hospitals, Chennai-1.

I , owe my sincere thanks to **Prof**. **DR.D.R.GUNASEKARAN, M.S.,FICS.,** prof. & head of surgery department, Government Stanley Medical College and Hospitals, for his valuable guidance , constant encouragement and suggestion during my study.

I have great pleasure in expressing my gratitude and humbleness towards my teacher and guide **Prof. DR.MUSTHAQ AHMED KHAN, M.S.,** under whom I Had the great privilege of working as a post graduate student receiving his constant advice and valuable guidance. He encouraged in preparing the dissertation and inculcated the principles of surgery in me.

I am extremely thankful to the Assistant professors of my unit **Dr.Govardhan.M.S., Dr. D.Jayakumar . M.S., Dr. A.Rajendran.M.S., Dr.Muniappan.M.S.,** for their valuable suggestion and help. I also thank my Collegues, CRRIs , and hospital workers for helping me

Last , but not the least , I thank all my patients with gratitude for their co-operation in this study.

CONTENTS

INTRODUCTION

Acute appendicitis remains one of the most common surgical diseases encountered . When appendicitis manifests in its classic form, it is easily diagnosed and treated. Unfortunately, these classic symptoms occur in just over half of patients with acute appendicitis. Accurate and timely diagnosis of atypical appendicitis therefore remains clinically challenging and one of the most commonly missed problems in the emergency department. Furthermore, the consequence of missing appendicitis, thus leading to perforation, significantly increases morbidity and prolongs hospitalization .

AIM OF STUDY

The aim of this study is to evaluate the value of MODIFIED ALVARADO SCORING SYSTEM (MASS) as a diagnostic tool to aid the early and accurate diagnosis of acute appendicitis.

HISTORICAL REVIEW

The appendix was probably first noted as early as the Egyptian civilization (3000 BC). During the mummification process, abdominal parts were removed and placed in Coptic jars with inscriptions describing the contents. When these jars were uncovered, inscriptions referring to the "worm of the intestine" were discovered .

Aristotle and Galen did not identify the appendix because they both dissected lower animals, which do not have appendices. Celsus, however, probably discovered the appendix because he was allowed to dissect criminals executed by Caesar.

Leonardo da Vinci first depicted the appendix in anatomic drawings in 1492 . In 1521, Jacopo Beregari da Capri, a professor of anatomy in Bologna, identified the appendix as an anatomic structure. In the 1500s, Vesalius (1543) and Pare (1582) referred to the appendix as the caecum. Laurentine compared the appendix to a twisted worm in 1600, and Phillipe Verheyen coined the term appendix vermiformis in 1710.

In 1886, Reginald H. Fitz, a Harvard pathologist, first described the clinical condition of acute appendicitis . He correctly pointed out the importance of its early diagnosis and timely treatment, based on his analysis of 257 cases of perforating inflammation of the appendix and 209 cases of typhlitis or perityphlitis (Fitz, 1886). A few years later, Charles McBurney described the clinical findings prior to rupture and advocated early surgical intervention. Despite aggressive intervention, mortality and morbidity rates remained high through the rest of the 19th century and the first half of the 20th century. The mortality rate associated with appendicitis declined with the introduction of antibiotics and with the development of anesthesia and better perioperative care

1492 Leonardo da Vinci clearly depicted the organ in his anatomical drawings.

1521 Berengario DaCarpi first described the organ.

1530 Vido Vidius first named the worm-like organ as the vermiform appendix.

1543 Andreas Vesalius had it well illustrated in ‘De Humani Corporis Fabrica.’

1711 Lorenz Heister gave the first good description of a case of acute appendicitis—a post mortem on an executed criminal
.

1735 Claudius Amyand performed the first recorded successful appendicectomy -the appendix, perforated by a pin, and surrounding omentum were removed through a scrotal wound while dealing with a faecal fistula in a chronic hernia in an 11-year-old boy.

1767 John Hunter described a gangrenous appendix at post mortem.

1812 John Parkinson first described a faecolith in a perforated appendix at post mortem.

1827 Francois Melier suggested the possibility of appendicectomy as an

operation. Dupuytren opposed this view.

1839 Bright and Addison published a medical textbook clearly outlining the symptomatology of acute appendicitis. Hodgkin agreed.

1850s onwards—anaesthesia took off, perityphlitis abscesses drained — Hancock (1848), Willard Parker (1867) and others (1870s)

1867 Joseph Lister gave his first paper on ‘Antisepsis’.

1880 Lawson Tait operated with the express intent of performing appendicectomy having made a pre-operative diagnosis of disease of the organ.

1883 Abraham Groves of Ontario did likewise.

1884 Mikulicz in Krakow recommended and performed surgery for appendicitis. Kronlein in Germany did likewise.

1885 Charter Symonds, an Englishman, performed the first interval operation for appendicitis but did not remove the appendix.

1886 Hall of New York in May performed appendicectomy but had not commenced the operation with such an intent.

1887 Sir Frederick Treves of London unkinked an appendix in February of that year. Morton, seven years after Tait in England and four years after Groves in Canada, in April of that year performed the first

deliberated appendicectomy for appendicitis in the United States.

Treves recommended interval appendicectomy

1888 onwards for a decade brought improvement of technique -Treves, Senn, McBurney, Weir, Worcester, Fowler, Deaver, Marcy and Richardson.

1886 Reginald Heber Fitz who was Shattuck Professor of Pathological Anatomy at Harvard University.

R.H. Fitz read a paper entitled 'Perforating Inflammation on the Vermiform Appendix with Special Reference to its Early Diagnosis and Treatment'. He had been a pupil of Virchow, and being a pathologist gave a detailed description of the pathology of the condition.

1894 July -McBurney outlined the grid-iron incision and named his 'point'.

1902 Oschner and Sherren suggested a conservative regime to prevent infection spreading making subsequent surgery safer.

1904 Murphy reported 2.000 appendicectomies between 1880 and 1903 mostly being what we call interval appendicectomies and named his triad (pain, vomiting and R.I.F. tenderness).

1905 Rockey described a transverse skin incision which Elliot had done in 1896.

1906 Davis, Harrington, Weir and Fowler all wrote on appendicectomy

HISTORY ABOUT

LAPROSCOPIC APPENDECTOMY

In 1977, Dekok used a scope to assist in removing an appendix through mini – laparotomy site. Semm first performed true nonacute laparoscopic appendicectomy in 1983 , employed a Roeder loop and electrocautery to Remove an appendix incidentally during a gynaec procedure. In 1987, first Lap appendectomy for acute appendicitis was done by Schreiber. Laproscopy has decreased the number of negative appendicectomies to 75% In all cases of right lower quadrant pain. It helps to rule out other intra abdominal pathology.

EMBRYOLOGY OF VERMIFORM APPENDIX

Only A Few Diverse Mammals Possess An Appendix

In a study of the alimentary tracts of animals we find the appendix is not present in any invertebrate. Among the vertebrates, it is absent in fish, amphibians, reptiles, birds and most mammals. In fact, the vermiform appendix, recognised as a worm-like, narrow extension beginning abruptly at the caecal apex 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.

Caecum and appendix develop from the caecal bud as a diverticulum that arises from the post arterial segment of mid gut loop. The proximal part of the bud grows to form the caecum.It's distal part remains narrow and forms the appendix.

During the greater part of fetal life the appendix arises from the apex of caecum. Subsequently the later wall of 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.

Rarely the caecum does not migrate during development to it's normal position in the right lower quadrant of abdomen. In such cases we come across a sub-hepatic appendix or in situs inversus totalis , the appendix is in the left iliac fossa, causing diagnostic difficulty if appendicitis develops.

ANATOMY

The appendix averages 10 cm in length but can range from 2-20 cm. The wall of the appendix consists of 2 layers of muscle, an inner circular and outer longitudinal. The longitudinal layer is a continuation of the taeniae coli. The appendix is lined by colonic epithelium.

Few submucosal lymphoid follicles are noted at birth. These follicles enlarge, peak from 12-20 years, and then decrease. This correlates with the incidence of appendicitis.

Blood supply to the appendix is mainly from the **appendicular artery**, a branch of **the ileocolic artery**.

This artery courses through the mesoappendix posterior to the terminal ileum. An **accessory appendicular artery** can branch from the posterior cecal artery. This artery can lead to significant intraoperative and postoperative hemorrhage and should be searched for carefully and ligated once the main appendicular artery is controlled .

The base of the appendix is fairly constant and is located at the posteromedial wall of the cecum about 2.5 cm below the ileocecal valve. This is also where the taeniae converge .

The base is at a constant location, whereas the position of the tip of the appendix varies. In **65%** of patients, the tip is located in **a retrocecal** position; in **30%,** it is located at the brim or in **the true pelvis**; and, in **5%**, it is extraperitoneal, situated **behind the cecum**, ascending colon, or distal ileum. The location of the tip of the appendix determines early signs and symptoms.

AETIOPATHOGENESIS

Appendicitis results from obstruction of the lumen of the appendix. Obstruction may be from **lymphoid hyperplasia (60%), fecolith or fecal stasis (35%), foreign body (4%), and tumors (1%) .**

The basic pathophysiology of appendicitis is obstruction of the lumen of the appendix followed by infection. In 60% of patients, obstruction is caused by hyperplasia of the submucosal follicles. This form of obstruction is mostly observed in children and is known as **catarrhal appendicitis**.

A fecolith or fecal stasis causes luminal obstruction 35% of the time and is usually observed in adults. Obstruction may also be caused by foreign bodies (4%) and tumors (1%).

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 distention 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, diarrhea, constipation), or intermittent low-grade fever. If the perforation is not successfully walled off, then diffuse peritonitis will develop.

CLINICAL PRESENTATION

SYMPTOMS:

Abdominal pain is the most common symptom of appendicitis. In multiple studies, specific characteristics of the abdominal pain and other associated symptoms have proved to be reliable indicators of acute appendicitis (Table 1). A thorough review of the history of the abdominal pain and of the patient's recent genitourinary, gynecologic and pulmonary history should be obtained.

Anorexia, nausea and vomiting are symptoms that are commonly associated with acute appendicitis. The classic history of pain beginning in the periumbilical region and migrating to the right lower quadrant occurs in only 50 percent of patients.[1] Duration of symptoms exceeding 24 to 36 hours is uncommon in nonperforated appendicitis.[1]

TABLE 1
Common Symptoms of Appendicitis

Common symptoms*	Frequency (%)
Abdominal pain	~100
Anorexia	~100
Nausea	90
Vomiting	75
Pain migration	50
Classic symptom sequence (vague periumbilical pain to anorexia/nausea/unsustained vomiting to migration of pain right lower quadrant to low-grade fever)	50

*--Onset of symptoms typically within past 24 to 36 hours.

SIGNS :

Right lower quadrant tenderness to palpation is the most important physical examination finding, other signs may help confirm the diagnosis (Table 2).

The rebound tenderness that is associated with peritoneal irritation has been shown to be more accurately identified bypercussion of the abdomen than by palpation with quick release.

As previously noted, the location of the appendix varies. When the appendix is hidden from the anterior peritoneum, the usual symptoms and signs of

acute appendicitis may not be present. Pain and tenderness can occur in a location other than the right lower quadrant.

A **retrocecal appendix** in a retroperitoneal location may cause flank pain. In this case, stretching the iliopsoas muscle can elicit pain. **The psoas sign is** elicited in this manner: the patient lies on the left side while the examiner extends the patient's right thigh . In contrast, a patient with a **pelvic appendix** may show no abdominal signs, but the rectal examination may elicit tenderness in the **cul-de-sac**.

In addition, an **obturator sign** (pain on passive internal rotation of the flexed right thigh) may be present in a patient with a pelvic appendix

.

TABLE 2
Common Signs of Appendicitis

- Right lower quadrant pain on palpation (the single most important sign)
- Low-grade fever (38°C [or 100.4°F])--absence of fever or high fever can occur
- Peritoneal signs
- Localized tenderness to percussion
- Guarding
- Other confirmatory peritoneal signs (absence of these signs does not exclude appendicitis)
- Psoas sign--pain on extension of right thigh (retroperitoneal retrocecal appendix)
- Obturator sign--pain on internal rotation of right thigh (pelvic appendix)
- Rovsing's sign--pain in right lower quadrant with palpation of left lower quadrant
- Dunphy's sign--increased pain with coughing
- Flank tenderness in right lower quadrant (retroperitoneal retrocecal appendix)
- Patient maintains hip flexion with knees drawn up for comfort

DIFFERENTIAL DIAGNOSIS :

Differential Diagnosis of Acute Appendicitis

Gastrointestinal	Gynecologic	Pulmonary
Abdominal pain, cause unknown	Ectopic pregnancy	Pleuritis
Cholecystitis	Endometriosis	Pneumonia (basilar)
Crohn's disease	Ovarian torsion	Pulmonary infarction
Diverticulitis	Pelvic inflammatory disease	Genitourinary
Duodenal ulcer	Ruptured ovarian cyst (follicular, corpus luteum)	Kidney stone
Gastroenteritis	Tubo-ovarian abscess	Prostatitis
Intestinal obstruction	Systemic	Pyelonephritis
Intussusception	Diabetic ketoacidosis	Testicular torsion
Meckel's diverticulitis	Porphyria	Urinary tract infection
Mesenteric lymphadenitis	Sickle cell disease	Wilms' tumor
Necrotizing enterocolitis	Henoch-Schönlein purpura	Other
Neoplasm (carcinoid, carcinoma, lymphoma)		Parasitic infection
Omental torsion		Psoas abscess
Pancreatitis		Rectus sheath hematoma
Perforated viscus		
Volvulus		

LABORATORY AND RADIOLOGIC EVALUATION :

If the patient's history and the physical examination do not clarify the diagnosis, laboratory and radiologic evaluations may be helpful. A clear diagnosis of appendicitis obviates the need for further testing and should prompt immediate surgical referral.

LABORATORY TESTS:

The white blood cell (WBC) count is elevated (greater than 10,000 per mm^3) in 80 percent of all cases of acute appendicitis.

Unfortunately, the WBC is elevated in up to 70 percent of patients with other causes of right lower quadrant pain.Thus, an elevated WBC has a low predictive value. Serial WBC measurements (over 4 to 8 hours) in suspected cases may increase the specificity, as the WBC count often increases in acute appendicitis (except in cases of perforation, in which it may initially fall).

In addition, 95 percent of patients have neutrophilia and, in the elderly, an elevated band count greater than 6 percent has been shown to have a high predictive value for appendicitis. In general, however, the WBC count and differential are only moderately helpful in confirming the diagnosis of appendicitis because of their low specificities.

VALUE OF C-REACTIVE PROTEIN:

A more recently suggested laboratory evaluation is determination of the C-reactive protein level. An elevated C-reactive protein level (greater than 0.8 mg per dL) is common in appendicitis, but studies disagree on its sensitivity and specificity. An elevated C-reactive protein level in combination with an elevated WBC count and neutrophilia are highly sensitive (97 to 100 percent). Therefore, if all three of these findings are absent, the chance of appendicitis is low.

In patients with appendicitis, a urinalysis may demonstrate changes such as mild pyuria, proteinuria and hematuria, but the test serves more to exclude urinary tract causes of abdominal pain than to diagnose appendicitis.

RADIOLOGIC EVALUATION:

Plain radiographs, while often revealing abnormalities in acute appendicitis, lack specificity and are more helpful in diagnosing other causes of abdominal pain.

Ultrasonography and computed tomographic (CT) scans are helpful in evaluating patients with suspected appendicitis. Ultrasonography is appropriate in patients in which the diagnosis is equivocal by history and physical examination. It is especially well suited in evaluating right lower quadrant or pelvic pain in pediatric and female patients. A normal appendix (6 mm or less in diameter) must be identified to rule out appendicitis. An inflamed appendix usually measures greater than 6 mm in diameter , is noncompressible and tender with focal compression. Other right lower quadrant conditions such as inflammatory bowel disease, cecal diverticulitis, Meckel's diverticulum, endometriosis and pelvic inflammatory disease can cause false-positive ultrasonography results.

CT, specifically the technique of appendiceal CT, is more accurate than ultrasonography . Appendiceal CT consists of a focused, helical, appendiceal CT after a Gastrografin-saline enema (with or without oral contrast) and can be performed and interpreted within one hour. Intravenous contrast is unnecessary. The accuracy of CT is due in part to its ability toidentify a normal appendix better than ultrasonography. An inflamed appendix is greater than 6 mm in diameter, but the CT also demonstrates periappendiceal inflammatory changes .

If appendiceal CT is not available standardabdominal/pelvic CT with contrast remains highly useful and may be more accurate than ultrasonography.

US CRITERIA FOR THE DIAGNOSIS OF ACUTE APPENDICITIS:

Rigorous adherence to the criteria for diagnosing appendicitis is recommended. The inflamed appendix is seen as a blind-ended, tubular structure with a laminated wall that arises from the base of the cecum It should be aperistaltic and noncompressible. A threshold diameter of 6 mm is invaluable for diagnosing acute appendicitis . Circumferential color in the wall of the inflamed appendix on color Doppler US images is strongly supportive evidence of active inflammation .

The course of the appendix is variable and includes both retrocecal and

pelvic locations. The appendix in the former location often is best appreciated on scans obtained with the transducer positioned adjacent to the cecum or to the ascending colon, with an oblique plane of insonation. The pelvic appendix, in comparison, often is best seen in women with endovaginal scanning . Different degrees of bladder filling also will influence the ability to see a pelvic appendix.

Appendicoliths appear as bright, echogenic foci with clean distal acoustic shadowing . Their identification within the appendix or in the adjacent perienteric soft tissue after perforation is highly associated with a positive

diagnosis. Failure to see an appendicolith, in contrast, is noncontributory. Appendicoliths without actual calcium content may show a similar appearance to calcified appendicoliths on US images, and their identification is most helpful in this clinical situation.

Prior to the actual perforation of the appendix, ischemic and gangrenous change in the appendiceal wall may lead to focal or generalized loss of definition of the wall layers . With gangrene, color Doppler US may show decreased or no perfusion.

With perforation of the appendix, the distended appendix may no longer be visualized at US examination. Although the criteria for the diagnosis of appendicitis are focused on the appendix itself, inflammatory changes in the perienteric fat are often the first and most obvious findings at US examination. Inflamed fat appears at US as an "echogenic mass effect."

CT CRITERIA FOR THE DIAGNOSIS OF ACUTE APPENDICITIS:

Visualization of the appendix is strongly dependent on the type and quality of the CT examination, although appendiceal size, the amount of periappendiceal fat, and the degree of ileocecal bowel opacification are important influencing factors . In complicated cases, dynamic cine review of images on the CT console may facilitate recognition of the appendix, terminal ileum, and cecum. The normal appendix is identified in 67%–100% of symptomatic adults who undergo thin-section helical CT of the right lower quadrant

Appendiceal visualization is technique dependent, with the highest detection rates reported in patients who have received rectal contrast material. When seen, the normal appendix appears as a tubular or ringlike pericecal structure that is either totally collapsed or partially filled with fluid, contrast material, or air. In our experience, the normal appendiceal wall measures less than 1–2 mm in thickness. The periappendiceal fat should appear homogeneous, although a thin mesoappendix may be present.

A definitive CT diagnosis of acute appendicitis can be made if an abnormal appendix is identified or if a calcified appendicolith is seen in association with pericecal inflammation . The appearance of the abnormal appendix varies with the stage and severity of the disease process. The CT findings are most subtle in patients with mild, nonperforating appendicitis who undergo scanning shortly after the onset of symptoms. In these patients, the appendix may appear as a minimally distended, fluid-filled, tubular structure 5–6 mm in diameter surrounded by the homogeneous fat attenuation of the normal mesentery. This appearance is seen in only the most incipient forms of acute appendicitis and, in our experience, occurs in fewer than 5% of patients who undergo scanning.

Most patients who undergo CT demonstrate greater degrees of luminal distention and evidence of transmural inflammation . The inflamed appendix usually measures 7–15 mm in diameter. Circumferential and symmetric wall thickening is nearly always present and is best demonstrated on images obtained with intravenous contrast material enhancement The thickened wall usually is homogeneously enhanced, although mural stratification in the form of a target sign may be noted.

TREATMENT

Indications for operation :

Any patient with suspected appendicitis who has

(1) persistent pain and becomes febrile,

(2) an increasing WBC count, or

(3) worsening clinical examination findings

should undergo appendectomy or at least diagnostic laparoscopy. In patients with an atypical presentation, the most important determination for appendectomy is serial physical examinations. The WBC count often does not increase after the patient is admitted and hydrated; therefore, any patient sent home from the emergency department should undergo a follow-up evaluation the next day .

SURGICAL THERAPY:

A total of 17 prospective randomized trials have compared laparoscopic versus open appendectomy. The two techniques are similar with respect to the negative appendectomy rate (lap = 14.4% vs open = 14.5%), length of hospital stay (lap = 3.0 d vs open = 3.7 d), and intra-abdominal abscess (lap = 1.9% vs open = 0.8%). Laparoscopic appendectomy appears to have a slightly lower wound infection rate (2.9%) compared to open appendectomy (7.4%) .

Preoperative details:

All patients diagnosed with appendicitis should be adequately hydrated with isotonic intravenous fluids. In addition, broad-spectrum intravenous antibiotics (ampicillin, gentamicin, and metronidazole or a third-generation cephalosporin and metronidazole) should be started prior to the operation. Newer single agent, broad-spectrum antibiotics may also be used. Antibiotics, analgesics, or antipyretics should not be administered to patients admitted for serial examination because these medications may mask the underlying disease process.

OPEN APPENDECTOMY :

Incision:

Most surgeons perform appendectomy through a RLQ incision over the McBurney point (two thirds of the distance between the umbilicus and the anterior superior iliac spine). The subcutaneous tissue and Scarpa fascia are dissected until the external oblique aponeurosis is identified. This aponeurosis is divided sharply along the direction of its fibers. A muscle-splitting technique is then used to gain access to the peritoneum. Once the peritoneum is entered, any purulent fluid should be cultured.

Delivering the appendix:

Small Richardson retractors are placed into the peritoneum, and the cecum is identified and partially exteriorized using a moist gauze pad or Babcock clamp. The taenia coli is followed to the point where it converges with the other taenia, leading to the base of the appendix. The rest of the appendix is then brought into the field of vision. Gentle manipulation may be required to bluntly dissect any inflammatory adhesions.

Division of the mesoappendix and ligation of the appendix:

Once the appendix is exteriorized, the mesoappendix is divided between clamps, divided, and ligated. The base of the appendix is clamped after milking potential fecaliths into the lumen of the appendix. The appendix is then tied off with a 0-polyglycolic (PG) acid suture. The appendix is

amputated and passed off the field as a specimen.

The mucosa of the appendiceal stump may be cauterized to avoid future mucus production. Inverting the appendiceal stump is not necessary. The cecum and appendiceal stump are then placed back into the abdomen. The pelvis and the right pericolic gutter are suctioned to remove any fluid.

A drain is not required unless an obvious cavity is present following drainage of a well-developed abscess.

Closure of the incision:

The peritoneum is identified, and hemostats are placed on the cut ends at both apices and the midpoint of the superior and inferior sides. The peritoneum is closed with a continuous 3-0 PG suture. The inferior oblique muscles are reapproximated with a figure-of-eight 3-0 PG suture, and the external oblique fascia is closed with a continuous 2-0 PG suture. The skin may be closed with staples or subcutaneous sutures.

Laparoscopic appendectomy :

A urinary bladder catheter is placed, and the surgeon typically stands on the left side of the patient. Video monitors are placed at the patient's feet.

A 6-mm infraumbilical incision is made, followed by placement of the Veress needle. After confirmation of intraperitoneal placement, a pneumoperitoneum (14 mm Hg) is established and maintained using a

carbon dioxide insufflator. The Veress needle is replaced with a 5-mm trocar, and a 5-mm, 30-degree laparoscope is used. Alternatively, the 5-mm trocar can be placed directly into the abdominal cavity using an open cutdown approach.

Under direct visualization, a 12-mm trocar is inserted into the left lower quadrant (LLQ) and another 5-mm trocar in the right periumbilical region. Through the right periumbilical trocar, a grasper is used to gain control of the appendix. A small hole in the mesoappendix is made using a dissector placed through the LLQ port at the base of the appendix.

An endo-gastrointestinal assistant stapler is then used to staple the base of the appendix, and a vascular reload is used to staple across the mesoappendix. Once the appendix is free, it is removed through the LLQ port. Appropriate peritoneal irrigation is then performed. The fascia of the LLQ and nfraumbilical port sites are closed with 0-PG suture, and the skin incisions are closed with subcuticular sutures.

Postoperative details:

If acute appendicitis is encountered, perioperative antibiotics covering skin flora should be continued for 24 hours. If suppurative appendicitis is encountered, intravenous antibiotics covering enteric flora should be

continued for 48-72 hours and can be safely discontinued once the patient remains afebrile for 24 hours. In both instances, clear liquids can be started once the patient is stable from anesthesia, and diet can be advanced as tolerated.

If gangrenous or perforated appendicitis is encountered, continue intravenous antibiotics until the patient is afebrile and has return of bowel function and a normal WBC count with a normal differential. Once bowel function returns, clear liquids can be started and the diet advanced as tolerated. In most patients, a nasogastric tube is not needed (Hoelzer, 1999).

Follow-up care:

The patient should return to the clinic 1-2 weeks following discharge for wound evaluation and discussion of the pathology.

Full activity may resume in 2 weeks following appendectomy if performed through an RLQ incision. If a midline incision was used, activity should be limited for 6 weeks.

COMPLICATIONS

The overall morbidity rate of appendicitis is approximately 10%.

Most perioperative morbidity is caused by infectious complications.

1. Wound infections occur in approximately 5% of all appendectomies; however, incidence of this complication is related to the stage of appendicitis. The wound infection rate is 1.4% for nonacute appendicitis, 3% for acute appendicitis, and 10-15% for perforated or gangrenous appendicitis.
2. Formation of intra-abdominal or pelvic abscess following appendectomy occurs in 2-5% of patients. The incidence is higher for gangrenous or perforated appendicitis (6-8%) compared to early or suppurative appendicitis (1-2%) .
3. Other complications include persistent ileus, small bowel obstruction, and pulmonary complications such as atelectasis and pneumonia.
4. Deep venous thrombosis, pulmonary embolism, and myocardial infarction have also occurred in the early postoperative period.

MATERIALS AND METHODS

A Prospective study was conducted from AUGUST 2004 to AUGUST 2005 in a single surgical unit.

Patients with suspected acute appendicitis were assessed by modified Alvarado scoring system.

Age group comprised of 10 yrs to 70 yrs. Both sexes were included.

Patients included in the study were haemodynamically stable without any concurrent illness.

Thorough clinical examination was done along

with total leucocyte count.

THE MODIFIED ALVARADO SCORE

SYMPTOMS:

1.Migrating right iliac fossa Pain	:	1
2. Anorexia	:	1
3. Nausea / vomiting	:	1

SIGNS:

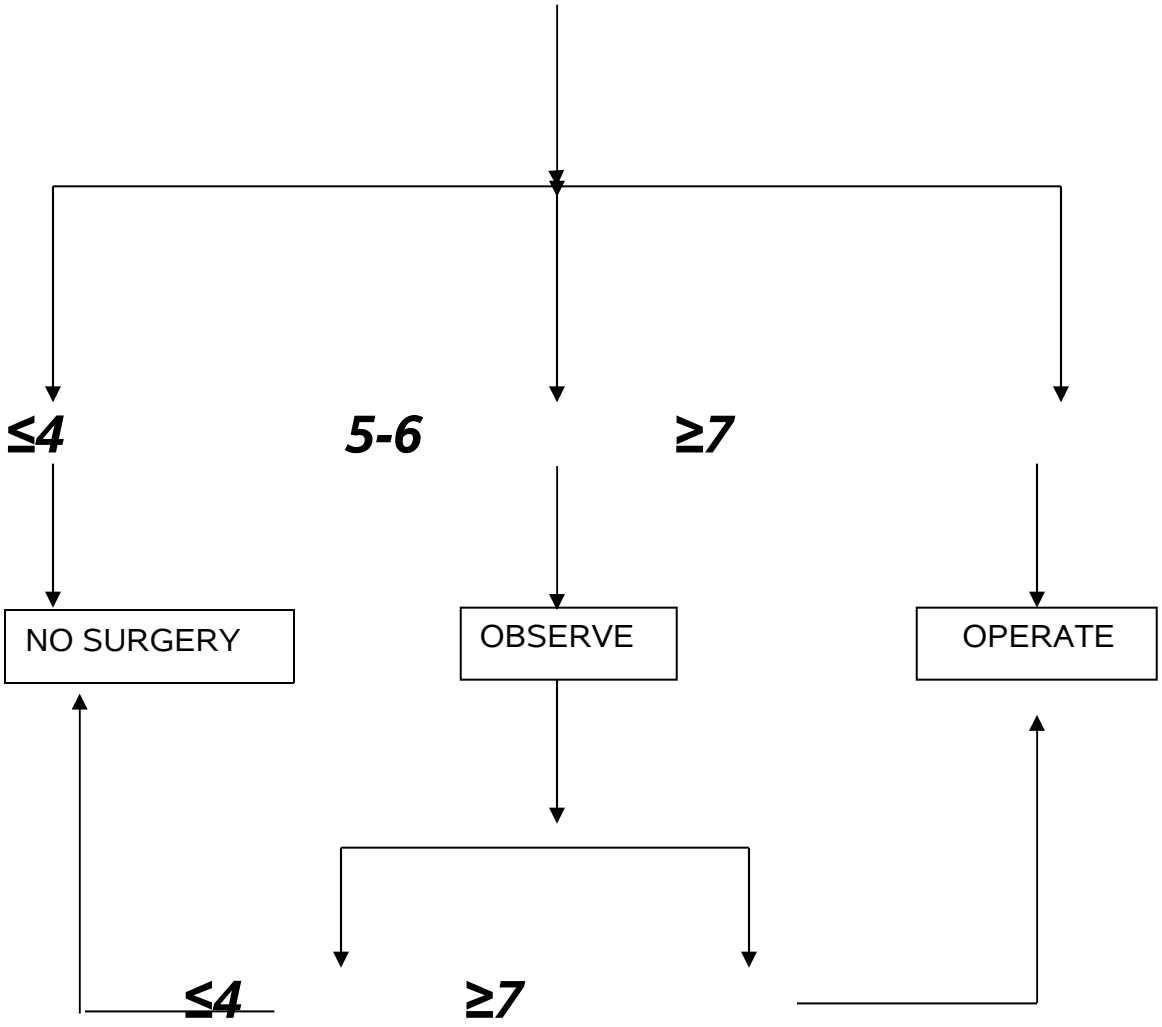
1.	Tenderness right iliac fossa	:	2
2.	Rebound tenderness	:	1
3.	Elevated temperature	:	1

LABORATORY TEST:

1. Leukocytosis	:	2

TOTAL SCORE : 9

MODIFIED ALVARADO SCORE



OBSERVATION & RESULTS

Total no. of patients with

Suspected appendicitis : 120

Patients with score ≥ 7 : 98

Patients with score 5-6 : 10

Patients with score ≤ 4 : 12

No. of patients whose score

Increased to ≥ 7 during period

Of observation : 6

No. of patients whose score

Decreased to ≤ 4 during period

Of observation : 4

No. of patients who underwent

Appendicectomy : 104

No. of patients who did not

Undergo appendicectomy : 16

Histo pathologically positive

Appendicitis : 101

No. of patients who had normal

Appendix : 3

Patients with score ≤ 4 but

Developed appendicitis : 3

ALVARADO SCORING RESULTS	APPENDICITIS (HPE +VE)	NORMAL APPENDIX	TOTAL
+ VE	101	3	104
- VE	3	13	16
TOTAL	104	16	120

Sensitivity of the test = $\frac{101 \times 100}{104}$

= 97.11 %

Specificity of the test = $\frac{13 \times 100}{16}$

= 81.25 %

positive predictive value = 97.11 %

Negative appendicectomy Histopathologically

$$\text{Rate} = \frac{\text{Negative cases}}{\text{Total number of Appendicectomies}}$$

$$= \frac{3}{104} \times 100$$

$$= 2.8\ \%$$

Missed appendicitis No. of missed cases

$$\text{Rate} = \frac{\text{Of appendicitis}}{\text{Total number of Suspected cases}}$$

$$= \frac{3}{120} \times 100$$

$$= 2.5\ \%$$

RESULTS FOR MALE PATIENTS

Total no. of patients with

Suspected appendicitis : 60

Patients with score ≥ 7 : 50

Patients with score 5-6 : 5

Patients with score ≤ 4 : 5

No. of patients whose score

Increased to ≥ 7 during period

Of observation : 3

No. of patients whose score

Decreased to ≤ 4 during period

Of observation : 2

No. of patients who underwent

Appendicectomy : 53

No. of patients who did not

Undergo appendicectomy	:	7
Histo pathologically positive Appendicitis	:	52
No. of patients who had normal Appendix	:	1
Patients with score ≤ 4 but Developed appendicitis	:	1

ALVARADO SCORING RESULTS	APPENDICITIS (HPE +VE)	NORMAL APPENDIX	TOTAL
+ VE	52	1	53
- VE	1	6	7
TOTAL	53	7	60

Sensitivity of the test = $\frac{52 \times 100}{53}$

= 98 %

Specificity of the test = $\frac{6 \times 100}{7}$

= 85.7 %

positive predictive value = 98.1 %

Negative appendicectomy Histopathologically

$$\text{Rate} = \frac{\text{Negative cases}}{\text{Total number of Appendicectomies}}$$

$$= \frac{1}{53} \times 100$$

$$= 1.88\ \%$$

Missed appendicitis No. of missed cases

$$\text{Rate} = \frac{\text{Of appendicitis}}{\text{Total number of Suspected cases}}$$

$$= \frac{1}{60} \times 100$$

$$= 1.66\ \%$$

RESULTS FOR FEMALE PATIENTS

Total no. of patients with		
Suspected appendicitis	:	60
Patients with score ≥ 7	:	48
Patients with score 5-6	:	5
Patients with score ≤ 4	:	7
No. of patients whose score		
Increased to ≥ 7 during period		
Of observation	:	3
No. of patients whose score		
Decreased to ≤ 4 during period		
Of observation	:	2
No. of patients who underwent		
Appendicectomy	:	51

No. of patients who did not

Undergo appendicectomy : 9

Histo pathologically positive

Appendicitis : 49

No. of patients who had normal

Appendix : 2

Patients with score ≤ 4 but

Developed appendicitis : 2

ALVARADO SCORING RESULTS	APPENDICITIS (HPE +VE)	NORMAL APPENDIX	TOTAL
+ VE	49	2	51
+ VE	2	7	9
TOTAL	51	9	60

Sensitivity of the test = $\frac{49 \times 100}{51}$

= 96 %

Specificity of the test = $\frac{7 \times 100}{9}$

= 77.7 %

positive predictive value = 96 %

Negative appendicectomy Histopathologically

$$\text{Rate} = \frac{\text{Negative cases}}{\text{Total number of Appendicectomies}}$$

$$= \frac{2 \times 100}{51}$$

$$= 3.9\ \%$$

Missed appendicitis

$$\text{Rate} = \frac{\text{No. of missed cases Of appendicitis}}{\text{Total number of Suspected cases}}$$

$$= \frac{2}{60} \times 100$$

$$= 3.3\ \%$$

DISCUSSION

The diagnosis of acute appendicitis continues to be difficult due to the variable presentation of the disease and the lack of reliable diagnostic test. Although there has been some improvement in the diagnosis of acute appendicitis over the past several decades, the percentage of normal appendices reported in various series varies from 8 to 33%.

Clinical scoring systems have proved useful in the management of number of surgical conditions. In the past few years various scores have been developed to aid the diagnosis of acute appendicitis.Although many diagnostic scores have been advocated, most are complex and difficult to implement in the clinical situation. The Modifed Alvarado score, is a simple scoring system that can be instituted easily.

In a prospective study of 215 adults and children in Cardiff, use of the Alvarado score decreased an unusually high false-positive appendicectomy rate of 44% to14%.18 Fenyo 11, reported in one study a sensitivity of 90.2% and specificity of 91.4% and others reported a sensitivity of 73%, specificity of 87% with negative laparotomy rate of 17.5%.

To be useful, a scoring system must be both sensitive and specific. The modified Alvarado score proved to be **effective in adult male patients** with acute appendicitis_ **but not useful to the same extent in females of reproductive age group.**

Our study demonstrates that modified Alvarado score applied to all adult paitients is substantially superior in diagnosis of acute appendicitis in adults with a sensitivity of 97.11 % and a specificity of 81.25 %.

The Alvarado score is both simple to remember and to use. Scoring system seems ideal for the diagnosis of acute appendicitis because it's noninvasive , requires no special equipment and **can be easily used by A JUNIOUR RESIDENT in clinical routine in a peripheral hospital.**

Negative appendicectomy rate in this study is 2.8 % . Whereas in general the negative appendicectomy rate reported in literature is 15 -30 % . Thus it grossly reduces the negative appendicectomy rates.

In comparision the abdominal ultrasound has shown results, with an average sensitivity of 86% and a specificity of 94% under the conditions of well-controlled clinical trials, namely in the hands of experienced Person.

CT scans have excellent sensitivity and specificity, ranging 87-100% and 91-97%, respectively

Leucocyte count has a sensitivity of 85% and abdominal radiography 40%.

BUT,

Abdominal ultrasound requires special equipment and it's operator dependant. Computerized tomography is expensive and not readily available everywhere. It's the same with radio isotope studies. Abdominal X-ray is of limited use and has the risk of radiation exposure.

In our study (98 / 120) 81.66 % presented with a score of ≥ 7 .
Of the remaining 10 observed 4 had a score of ≥ 7 within 6 hours
And 2 within 12 hours. The remaining 5 persons who were observed didn't have an increase in the score further. **So 85 % of appendicectomies can be clinically decided within first 6 hours.**

Of the 12 who had a score of ≤ 4 , 3 developed acute appendicitis at a later date. **Missed appendicectomy rate is 2.5 %. Better clinical experience and recent radiological investigations may reduce this value.**

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CONCLUSION

Modified Alvarado scoring system with a diagnostic accuracy of 97 % seems to be ideal for supporting the diagnosis of acute appendicitis because it's noninvasive , **doesn't require special equipments, and is simple to remember and use in a peripheral setup by a junior resident where radiological investigations are difficult to perform.**

.The sensitivity and specificity of the test is good for the male population in par with the females. This can be easily attributed to **the pelvic pathological conditions in females which requires a diagnostic ultrasound in addition.**

In conclusion Modified Alvarado scoring along with an abdominal and pelvic ultrasound may be the ideal tool to diagnose acute appendicitis in females,

Whereas Modified Alvarado score holds good in diagnosing acute appendicitis in males.

Acute appendicitis is a common cause of abdominal pain in patients attending emergency departments. Nevertheless, a correct diagnosis based on clinical and laboratory findings is not easy.

Promising results have been published for the use of ultrasonography and computed tomography to improve the diagnostic accuracy. However, these investigations are highly investigator dependent or they involve exposure to radiation, respectively.

History taking and physical examination on the other hand require no special equipment and are readily available.

It is also conceivable that imaging techniques will gain wider acceptance, but careful history taking and clinical diagnosis are important measures,

(i) determining which patients would benefit from these investigations, and

(ii) providing the clinical context that is necessary for correct interpretation of imaging findings.

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PROFORMA

Name: DOA:

Age : DOS:

Sex: DOD:

Clinical presentation:

Symptoms:

Migrating right iliac fossa pain

Anorexia

Nausea

Vomiting

Signs:

Fever

RIF Tenderness

Rebound tenderness

Investigations :

Hb	Blood Sugar
Total leucocyte count	Blood urea
Differential count	Serum creatinine
ESR	Serum electrolytes
Chest x ray	Abdominal X ray

Intra operative finding:

1. position of appendix
2. gangrene
3. abscess
4. perforation

Histopathological report:

Post operative follow up.

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