

EVALUATION OF MODIFIED ALVARADO SCORING AND ULTRASONOGRAM IN THE DIAGNOSIS OF ACUTE APPENDICITIS

By

VENKATESH M

Dissertation submitted to the

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY



In partial fulfilment of the requirements for the degree of

M.S. GENERAL SURGERY – BRANCH I



DEPARTMENT OF GENERAL SURGERY

THANJAVUR MEDICAL COLLEGE AND HOSPITAL

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Under the guidance of

Prof. Dr. S. SRI HARI M.S.

**DEPARTMENT OF GENERAL SURGERY
THANJAVUR MEDICAL COLLEGE AND HOSPITAL
MAY, 2018**



Thanjavur Medical College

THANJAVUR, TAMILNADU, INDIA - 613001

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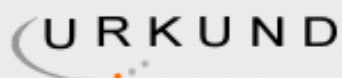
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This Dissertation is submitted to The TAMILNADU Dr. M.G.R Medical University, Chennai in partial fulfilment of University requirements for the award of M.S Degree (GENERAL SURGERY).

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Postgraduate Student
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CERTIFICATE BY THE GUIDE

This is to certify that this dissertation titled **“EVALUATION OF MODIFIED ALVARADO SCORING AND ULTRASONOGRAM IN THE DIAGNOSIS OF ACUTE APPENDICITIS”** is a bonafide research work done by **Dr. VENKATESH M,** in partial fulfilment of the requirement for the degree of **M.S. GENERAL SURGERY – BRANCH I.**

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Dr. VENKATESH M

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INTRODUCTION

Acute appendicitis is the commonest cause of acute surgical abdomen. Acute appendicitis and its complications continue to be a significant source of morbidity and mortality, so prompt recognition and proper treatment is essential.

Appendix usually referred as a vestigial organ with no known function is now considered as a specialised part of gastro intestinal tract with concentration of lymphoid tissue. It is an integral part of gut associated lymphoid tissue (GALT). Appendix is present only in humans, certain anthropoid apes and the wombats.

Appendix is useful in reconstructive biliary, tubal and urological surgery. Negative appendicectomy therefore robs the patient of a useful asset and also has a morbidity of 15%.

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.

Hence diagnosis of acute appendicitis remains crucial and the effectiveness of Modified Alvarado Scoring and USG in the diagnosis of acute appendicitis needs to be evaluated and their importance needs to be stressed

AIM OF THE STUDY

- To analyze the incidence of acute appendicitis in relation to the total number of surgical emergencies
- To correlate between Modified Alvarado Scoring System (MASS) and diagnosis of acute appendicitis
- To correlate between ultrasonogram findings in patients with acute abdomen and diagnosis of acute appendicitis
- To determine the single most important factor among MASS in relation to acute appendicitis

MATERIALS AND METHODS

- This is a prospective descriptive study among patients operated for acute appendicitis in Thanjavur Medical College Hospital during the period of September 2016 to August 2017
- About 380 patients who were operated for acute appendicitis on emergency basis were analyzed. Patient's history and clinical examination was done to arrive at a diagnosis and Modified Alvarado Score was calculated for all patients. USG was done in 308 patients
- Incidence, age distribution, sex distribution, most common variable among MASS were evaluated
- The sensitivity, specificity, positive predictive value(PPV), negative predictive value(NPV) were computed for MASS and USG using Microsoft Office
- Variables in USG findings like fecolith and appendicular lumen diameter were also evaluated

INCLUSION CRITERIA

- Persons more than twelve years of age who were operated for acute appendicitis
- This includes
 - persons with an Alvarado score of > 7
 - persons with an Alvarado score of < 7 but with ultrasonogram findings suggestive of acute appendicitis
 - persons not satisfying above criteria but clinical features favouring acute appendicitis

EXCLUSION CRITERIA

- Persons less than twelve years of age
- Patients who were managed conservatively
- Patients with appendicular mass

DATA COLLECTION

- Informed and written consent
- Thorough clinical examination
- Complete blood count
- Body temperature
- MASS score
- USG findings
- Intra operative details
- Post operative HPE

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PROFORMA

PATIENT NAME

AGE / SEX

IP NO.

DOA :

MODIFIED ALVARADO SCORING SYSTEM

S.NO	MODIFIED ALVARADO SCORE	YES	NO
1	MIGRATORY RIF PAIN		
2	ANOREXIA		
3	NAUSEA AND VOMITING		
4	TENDERNESS (RIF)		
5	REBOUND TENDERNESS		
6	ELEVATED TEMPERATURE		
7	LEUKOCYTOSIS		

TOTAL SCORE -- / 9

USG FINDINGS :

1. DIAMETER OF APPENDICULAR LUMEN -

2. PRESENCE OF FECOLITH - YES / NO

PER OPERATIVE FINDING

- 1). ACUTE INFLAMMED APPENDICITIS
- 2). ACUTE PERFORATED APPENDICITIS
- 3). APPENDICULAR ABSCESS
- 4). NORMAL APPENDIX

HPE REPORT : NORMAL / ACUTE APPENDICITIS

OBSERVATIONS

380 patients who were operated for acute appendicitis on an emergency basis were included in the study. The observations were

Incidence

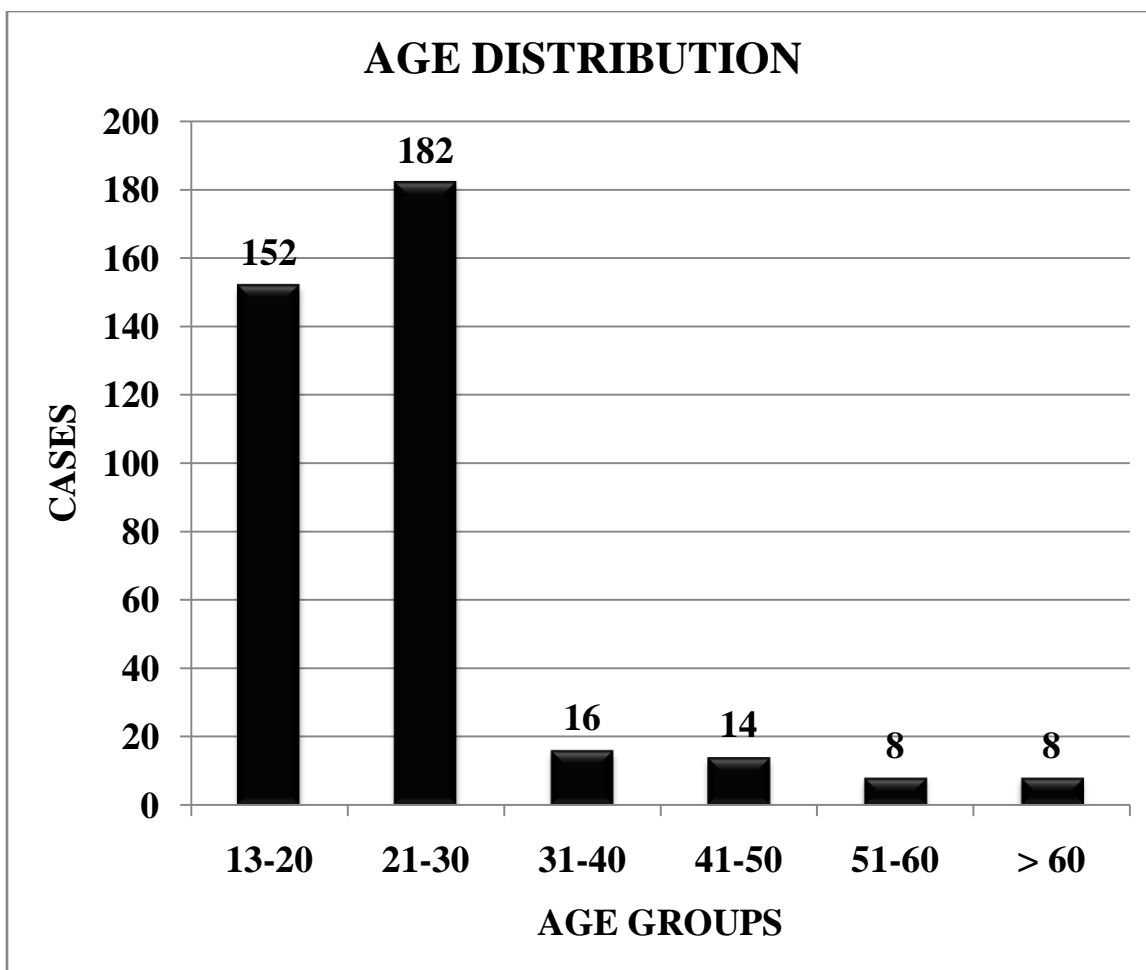
Of the total emergencies of 1488 patients, the total number of appendicectomies done was 380; which accounted for **25.54 % of emergency surgeries** in TMCH

Age distribution

The age of patients varied from 13-70 yrs with majority of patients in 21-30 yrs age group

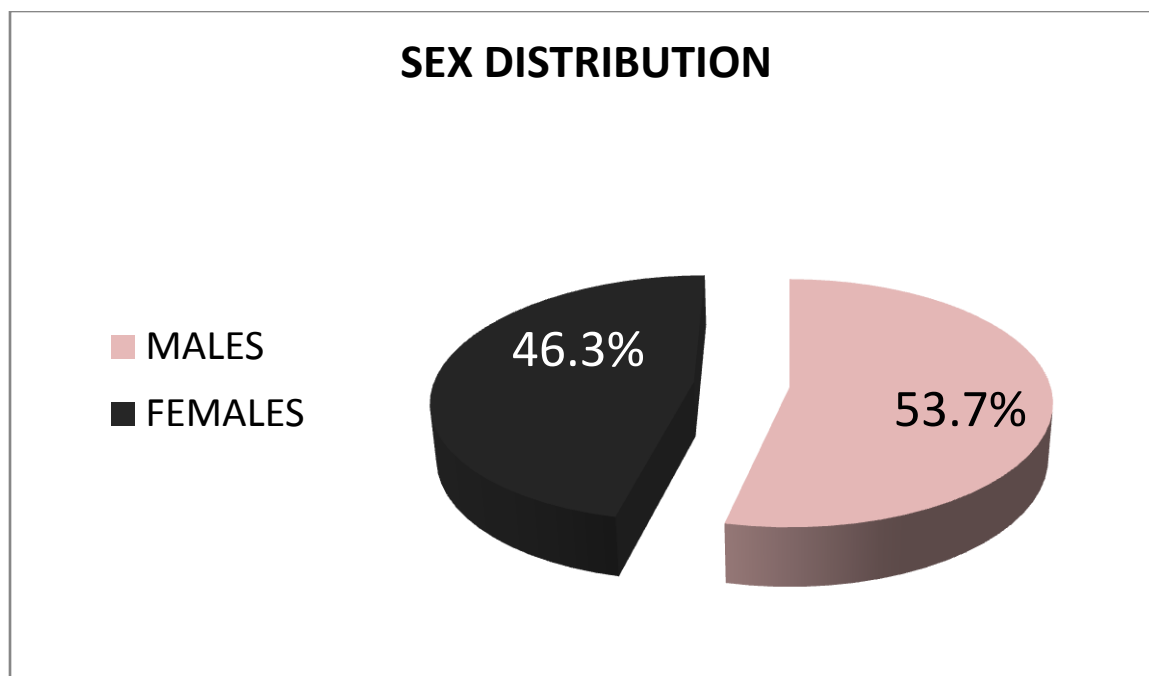
About 47.9 % cases are in age group 21-30years. 40% were in age group 13-20years. 4.2% cases were in age group of 31-40 and 3.7% were in age group of 41-50. 2.1% cases were in age group 51-60 and another 2.1% cases were in age group >60 yrs.

AGE GROUP (yrs)	MALE	FEMALE	TOTAL
13-20	84	68	152
21-30	98	84	182
31-40	8	8	16
41-50	6	8	14
51-60	4	4	8
>60	4	4	8



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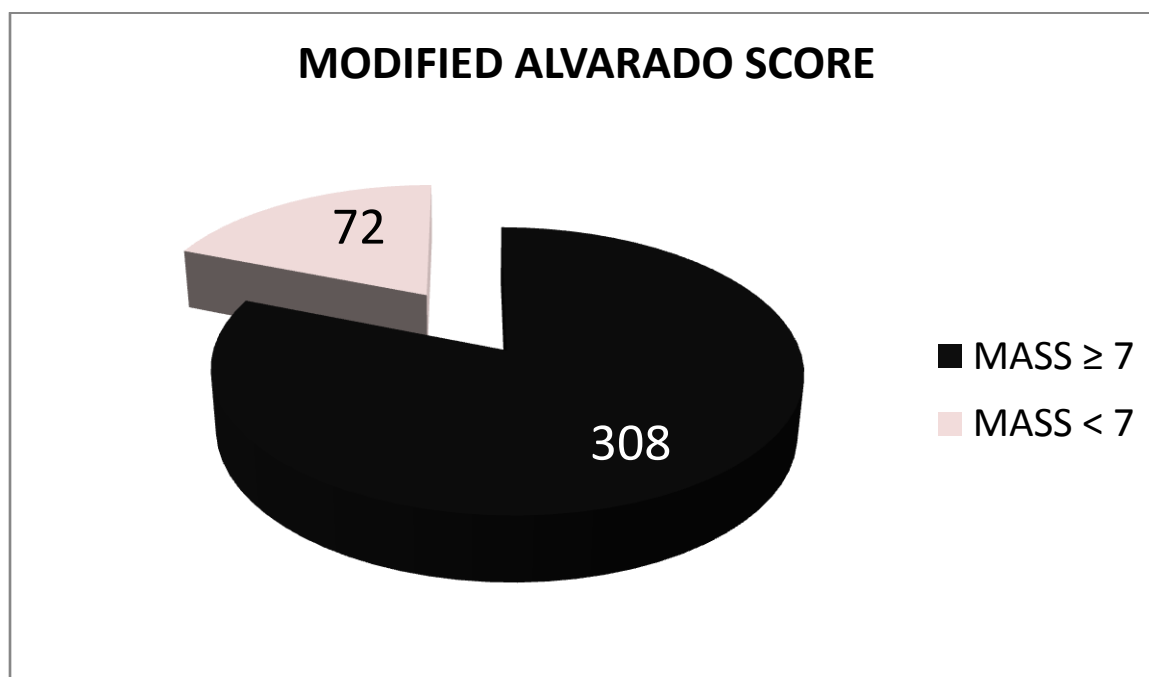
Of the total 380 patients, 204 patients were males which accounted for 53.7% and 176 patients were females which accounted for 46.3%



MODIFIED ALVARADO SCORING SYSTEM

FACTOR	NO. OF PATIENTS	PERCENTAGE %
Migratory RIF pain	372	97.9
Anorexia	196	57.6
Nausea and vomiting	288	75.8
Tenderness	380	92.1
Rebound Tenderness	224	58.9
Elevated temperature	320	84.2
Leucocyte count	312	82.1

Migratory RIF pain is the most common symptom being present in 97.9% of patients



MASS ≥ 7 in about 308 patients which accounted for 81.1 % of patients

MODIFIED ALVARADO SCORE AND POST OPERATIVE HPE REPORT

MASS	HPE POSITIVE	HPE NEGATIVE
≥ 7	306	2
< 7	68	4

Sensitivity	81.8 %
Specificity	66.6 %
Positive predictive value	99.4 %
Negative predictive value	5.6 %
Negative appendicectomy rate	1.6 %

ULTRASOUND AND POST OPERATIVE HPE REPORT

Ultrasound is done in 308 patients out of the total 380 patients. Remaining patients were taken up for surgery based on clinical grounds without USG evidence

USG	HPE POSITIVE	HPE NEGATIVE
SUGGESTIVE	288	2
NOT FAVOURABLE	16	2

SENSITIVITY 94.7 %

SPECIFICITY 50 %

POSITIVE PREDICTIVE VALUE 99.3 %

NEGATIVE PREDICTIVE VALUE 11.1 %

IN PATIENTS WITH MASS < 7, the USG findings and post operative HPE report were compared

USG FINDINGS	HPE POSITIVE	HPE NEGATIVE
SUGGESTIVE	52	2
NOT FAVOURABLE	16	2

INCIDENCE OF FECOLITH

USG FINDING	HPE POSITIVE	HPE NEGATIVE
FECOLITH +	124	NIL
FECOLITH -	180	4

Fecolith is present in 40.25 % of patients who were undergone USG

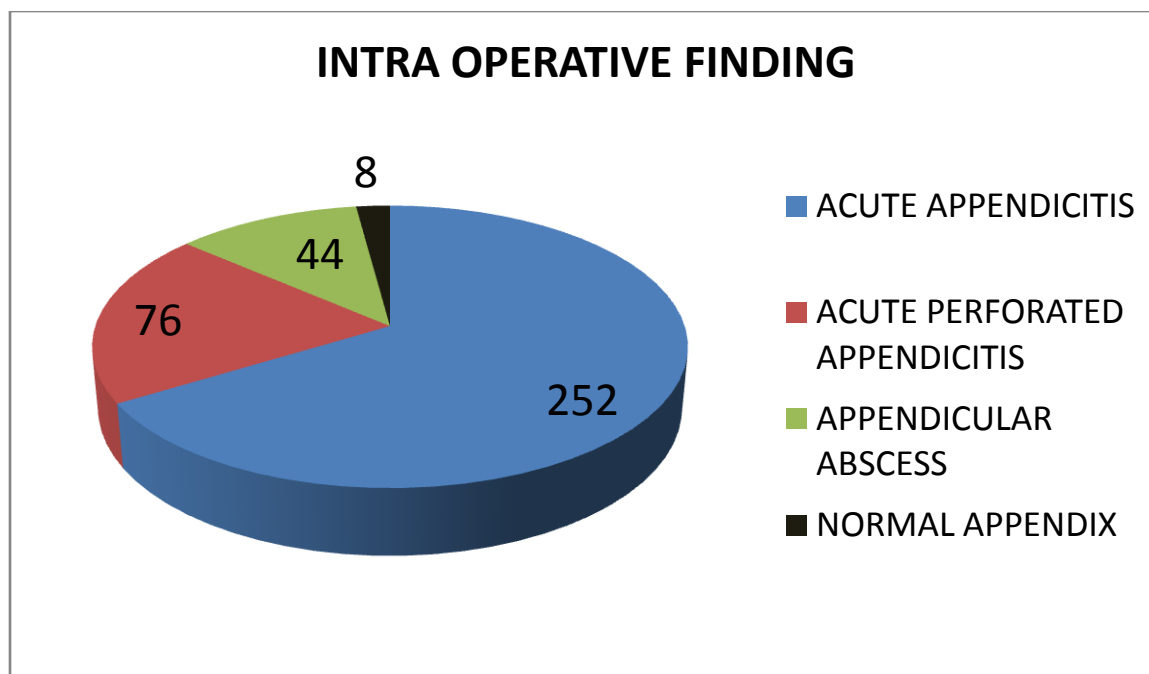
APPENDICULAR LUMEN DIAMETER

USG FINDING	HPE POSITIVE	HPE NEGATIVE
Appendicular lumen > 6mm	290	0
Appendicular lumen < 6mm	14	4

Appendicular lumen > 6mm in 94.15% of patients who undergone USG

INTRA OPERATIVE FINDING

Acute appendicitis	252
Acute perforated appendicitis	76
Appendicular abscess	44
Normal appendix	8



Two of the eight cases which looked as normal appendix intra operatively were reported as acute appendicitis in post operative HPE report

RESULTS

The following are the results of my study on the Evaluation of Modified Alvarado Scoring and USG in the diagnosis of acute appendicitis

- 1) Appendicectomies are the most common emergency surgery done accounting for 25.54% of the total emergencies
- 2) The most common age group affected is 21-30 yrs which accounts for 47.9% of patients
- 3) Males have a slightly increased incidence (53.7%) of acute appendicitis when compared to females
- 4) The most common variable among the Modified Alvarado Score is Migratory RIF pain which is present in 97.9% of patients
- 5) The MASS score is more than or equal to 7 in about 81.1% of patients and has sensitivity of 81.8% and positive predictive value of 99.4%
- 6) The overall negative appendicectomy rate is 1.6 %
- 7) USG is more sensitive (94.7%) than MASS in the diagnosis of Acute Appendicitis but it lacks specificity
- 8) Fecolith is present in 40.25% of patients who were undergone USG and it has a PPV of 100% and is mostly associated with acute perforated appendicitis or appendicular abscess

DISCUSSION

HISTORICAL DATA

1736 - First appendectomy was performed by Claudius Amyand, Surgeon to west minister and St.George's hospital.

1755 – Heister described appendix as the primary site of inflammation in a criminal.

1830 – Goldbeck introduced the term perityphilitis

1839 – Bright and Addison first published a textbook on symptoms that accompanied inflammation and perforation of the appendix.

1886 – Fitz coined the term appendicitis. Gave a lucid and logical description of clinical features of disease and pathological changes.

1848 – Hancock successfully drained appendix abscess in a 30 yr female in 8th month of pregnancy.

1867 - Parker advocated earlier incision of appendicular abscess.

1880 – Shepherd successfully removed a gangrenous appendix.

1886 – Kronlein first to publish an account of gangrenous appendix

1887 – Morton successfully removed inflammed appendix within an abscess cavity.

1889 – McBurney pioneered early diagnosis and early operative intervention in acute appendicitis. Introduced muscle splitting incision. Ochsner and Sherren advocated conservative treatment in late cases.

1983 – First laparoscopic appendectomy done by Semm.

REVIEW OF LITERATURE

Anatomy and embryology

Appendix is a worm shaped blind tube of varying length (2-25)cm opening into the posteromedial wall of the caecum 2cm below the ileocaecal valve. It is the only organ in the body that has no constant position. Its only constant feature is it arises from the site at which the three taenia coli coalesce.

Embryology:

It develops as a protuberance from the terminal portion of caecum at the 8th week of intrauterine life. During both antenatal and postnatal development, the growth rate of the caecum exceeds that of the appendix, displacing the appendix medially toward the ileocaecal valve.

Anomalies

Position - found in left iliac fossa in transposition of viscerae
 - found in right hypochondrium / epigastrium in case of malrotation of gut with failure of descend of caecum.

Number: Absence – rare

Duplication

Wallbridge classification

Type A – partial duplication of appendix on single caecum

Type B - single caecum with two completely separate appendices.

B1 - Birdlike appendix, two appendices symmetrically placed on either side of the ileocaecal valve

B2 - one appendix arises from the usual site

Another rudimentary appendix along one of the taenia coli

Type C – two caecum each with an appendix

Position : Its tip lies in the following positions

POSITION	INCIDENCE
Retrocaecal *	65.28 %
Pelvic	31.01%
Subcaecal	2.26%
Retroileal #	1.00%
Paracolic	0.40%
Postileal	0.40%

* - commonest position found at operation

- commonest position in the absence of disease.

It has its own mesentery, a prolongation of the inferior layer of the mesentery of the terminal ileum.

Blood supply:

Appendicular artery, a branch of the posterior caecal artery.

Appendicular vein drains into ileocolic vein and then into superior mesenteric vein.

Lymph drainage:

Into nodes associated with the ileocolic artery.

Acute appendicitis:

It is the acute inflammation of the appendix. Most common cause of “Acute surgical abdomen”

Incidence: Incidence of acute appendicitis parallels that of lymphoid development with peak incidence in early adulthood. It is rare before the age of two. Before puberty the incidence of acute appendicitis is equal in both sexes. But after puberty there is a slight male preponderance

Male: female = 1.3: 1

It is more common in people with western dietary habit.

Pathology: Cases of appendicitis are best classified as

1. acute appendicitis without perforation, and

2. acute appendicitis with perforation

This includes acute appendicitis with peritonitis, acute appendicitis with local abscess and appendicular mass.

Causative organism: Not associated with any single bacterial, viral or protozoal invader.

Following organisms have been isolated

- Bacteroides & E.coli - almost all cases
- Peptostreptococcus - 80%
- Pseudomonas - 40%
- Bacteroides splanchnicus - 40%
- Lactobacillus - 37%
- CMV associated appendicitis is common in immuno compromised individuals.

Two types of inflammation are noted

1. catarrhal appendicitis
2. obstructive appendicitis

Catarrhal appendicitis:**Figure 1 : Acute catarrhal appendicitis**

It is initially a mucosal and submucosal inflammation and later may involve the serosa. It has a normal or hyperaemic external appearance and cut open specimen shows oedematous, thickened and reddened mucosa with or without ulceration. Bacterial invasion of the lymphoid follicles is the cause. Gangrene is relatively rare. This is the type in which the acute inflammatory process may resolve spontaneously.

Obstructive appendicitis:

It is the dangerous type, since the appendix becomes a closed loop of bowel containing decomposing faecal matter. The process of events begin with the accumulation of normal mucus secretion, proceeds to proliferation of the contained bacteria and pressure atrophy of the mucosa, which allows bacterial access to deeper tissue planes, and continues with inflammation of the walls of the appendix with vessel thrombosis and eventual gangrene.



Figure 2 : Acute gangrenous appendicitis with fecolith

The cause of obstruction may be

1. faecolith – present in two thirds of gangrenous appendixes.
2. lymphoid hyperplasia
3. kinks, adhesions
4. food debris
5. parasites particularly pinworm, ascaris
6. gall stone
7. Strangulation of appendix within a hernial sac.

Appendicular perforation



Figure 3 : A case of appendicular tip perforation

Pathophysiology of Appendicular perforation:

Bacterial and chemical contamination of the peritoneal cavity following the perforation of appendix leads to peritonitis, which is referred as secondary peritonitis (infection arising from an intra abdominal source). The pathophysiology of secondary peritonitis are discussed under local response and systemic response.

1) Local response to peritoneal infection:

- An increase in local blood flow and influx of fluid into the infective foci in peritoneal cavity. Histamine and bradykinin are the main mediators of this response. Depending on the extent of peritoneal insult, fluid volumes of 10 L or more may

accumulate into peritoneal cavity leading to massive third-space fluid loss which may result in hypovolaemic shock. Initially the inflammatory fluid is transudate, which later becomes exudate due to increased vascular permeability resulting in leaking of Igs, complement factors, coagulation factors, autocoids & cytokines.

- Bacterial phagocytosis – The recruitment and accumulation of large number of leucocytes (mainly neutrophils and macrophages) to the site of inflammation is accomplished by changes in local blood flow as well as increased margination and adherence of WBCs to endothelial and mesothelial cells. These are mediated by bradykinin, anaphylatoxins C3a & C5a, platelet activating factor, TNF, IL-1. By 4 to 6 hours following peritoneal insult, significant neutrophil influx had occurred and is peaked at 8 hrs. These inflammatory mediators also stimulate the recruited WBCs to phagocytose and kill the bacteria by release of lysosomal enzymes.

- Fibrin deposition – under normal circumstances, intact mesothelial cells maintain fibrinolytic activity within peritoneal cavity by secretion of tPA. In the setting of mesothelial injury and active inflammation, local fibrinolytic activity is suppressed due to loss of tPA. Moreover, with high fibrinogen concentrations in these situations, fibrin deposition is increased through intrinsic pathway. Fibrin deposition is further enhanced by release of tissue thromboplastin (Factor III) from mesothelial cells which stimulates extrinsic pathway. The objective of fibrin deposition is to isolate and contain the peritoneal contamination and prevent widespread dissemination. These fibrinous adhesions cause the adherence of loops of intestine and omentum to one another and with

parietal peritoneum thus creating a physical barrier against widespread peritoneal contamination.

- Abscess formation: is the culmination of the sequestration process described above. Within the adherent mass of viscera, fibrin and bacterial exudate, liquefaction develops due to release of proteolytic enzymes from WBCs and the action of bacterial exoenzymes. The abscess capsule is formed with organized fibrin and adherent adjacent viscera.

- Peritoneal healing: peritoneum heals rapidly after insult/injury. Rate of healing is independent of size of the peritoneal wound. Within 3 days after injury, the wound is covered by connective tissue cells and by day 5, these new cells resemble mesothelial cells. Following resolution of the inflammation, normal fibrinolytic activity returns as mesothelial cell regeneration occurs and fibrinous adhesions are degraded and removed. However in setting of severe peritoneal injury or persistent infection, filmy fibrinous adhesions are transformed to fibrous adhesions by the in growth of fibroblasts, capillaries and collagen deposition.

2) Systemic response to peritoneal infection

- Hypovolaemia – due to third space fluid loss.
- Hypovolaemia leads to decreased cardiac output and compensatory tachycardia.

Systemic

Hypotension may also be mediated by potent vasodilators like TNF, IL-I, PAF, Nitric Oxide, leading to decreased peripheral vascular resistance.

- Precapillary shunting occurs in pulmonary and splanchnic circulation leading to peripheral hypoxia.
- Decreased urine output occurs due to hypovolaemia and decreased renal blood flow with compensatory RAAS activation.
- ‘Warm shock’ sets in with tachycardia, fever, oliguria, hypotension and warm extremities.
- Abdominal distension creates mechanical restriction to diaphragmatic mobility and decreases ventilation, creating atelectasis. Increased pulmonary vascular permeability also leads to pulmonary oedema, increased work of breathing and hyperventilation with worsening of pulmonary oedema and alveolar collapse, severe hypoxaemia resulting in ARDS.
- Tissue metabolism is increased due to high peripheral catecholamines and cortisol. But peripheral hypoxia leads to increased anaerobic glycolysis leading to lactic acid accumulation and metabolic acidosis.
- Following early depletion of glycogen storage, protein catabolism is augmented in skeletal muscles to release branched chain aminoacids for use by myocytes for energy. Other aminoacids are released into circulation for hepatic gluconeogenesis and for production of acute phase proteins in SIRS. Utilisation of free fatty acids as an energy source is not efficient in early septic period. Thus severe loss in lean body mass occurs rapidly in sepsis. The most frequent site of appendicular perforation is the antimesenteric border of appendix.

Appendicular perforation can lead onto

- localised abscess formation,
- diffuse peritonitis or
- appendicular mass formation

After perforation, a localized abscess may form in the right iliac fossa or the pelvis, or diffuse peritonitis may ensue depending on

- age of the patient
- virulence of the invading bacteria,
- rate at which inflammation has progressed
- Position of appendix – retrocaecal and pelvic locations are more likely to form a localised abscess.

In 2 – 6% of patients, an ill defined mass will be palpable on physical examination.

Phlegmon - it consists of matted loops of bowel adherent to adjacent inflamed appendix.

Periappendiceal abscess – it contains pus in-between the bowel loops in addition to the above findings.

Poorer localisation of infection occurs in infants because the omentum is filmy and is less able to form a protective sheath around the inflamed appendix.

CLINICAL MANIFESTATIONS

Migratory RIF pain

Initially the pain of acute appendicitis is poorly localized & colicky in nature. This is due to midgut visceral discomfort in response to appendiceal inflammation and obstruction. The pain is frequently first noticed in the periumbilical region and is similar to, but less intense than the colic of small bowel obstruction.

With progressive inflammation of the appendix, the parietal peritoneum in the right iliac fossa becomes irritated, producing more intense, constant and localized somatic pain that begins to predominate. Patients often report this as migratory pain. In children and elderly this visceral-somatic pain sequence is often absent. An inflamed appendix in the pelvis may never produce somatic pain involving the anterior abdominal wall but may instead cause suprapubic discomfort and tenesmus.

Anorexia, nausea and vomiting

Central abdominal pain is associated with anorexia, nausea and usually one or two episodes of vomiting which follow the onset of pain (Murphy). Anorexia is a constant clinical feature, particularly in children.

Right iliac fossa tenderness

This is due to the irritation of parietal peritoneum.

Rebound tenderness (Blumberg's sign or release sign)

With each inspiration the examiner gradually presses his hand down in RIF and withdraws his hand suddenly and completely. The patient will immediately cry or wince with pain due to the springing back of parietal peritoneum along with the abdominal muscles.

Elevated temperature

A low grade pyrexia $< 38.7^{\circ}\text{C}$ is usually present in 80% of the patients. Temperature $> 39^{\circ}\text{C}$ is strongly suspicious of appendicular perforation.

Other signs include

Rovsing's sign – pressure over left iliac fossa produces pain in right iliac fossa. This is because the coils of ileum shift slightly to the right and press on the inflamed appendix.

Baldwing test – this test is useful in cases of retrocaecal appendix. A hand is placed over the flank of the patient. The patient is now asked to raise the right lower limb off the bed keeping the knee extended. The patient will immediately complain of pain in case of retrocaecal appendicitis. Retrocaecal appendix remains in close contact with the psoas major muscle which becomes contracted during flexion of the hip joint.

Psoas sign - patient lies with his right hip flexed. HyperExtension of right hip with the patient turned to the left produces pain, due to stretching of psoas major muscle.

Zachary Cope (obturator test): An inflamed pelvic appendix lies in contact with

the obturator internus. Flexion and internal rotation of right hip stretches this muscle produces pain in the hypogastrium.

INVESTIGATIONS

Leucocytosis

The total WBC count of over 10,000/cu.mm is taken as positive in Alvarado score. It is present in 80 -85% of patients with acute appendicitis. WBC count is also raised in 25% of patients with other causes of RIF pain. Leucocytosis bound to increase with progress of inflammation.

Shift to Left

Arneth pointed out that the number of lobes in neutrophils is related to their age. The senile one has the maximum number of lobes and the youngest one has no lobe but a single nucleus showing a sign of indentation. Arneth index is calculated by counting the number of nuclear lobes in 100 neutrophils.

STAGES				
I	II	III	IV	V
1-5%	30%	45%	18%	2%

When the number of cells belonging to stages I & II are greater denoting a shift to left, it suggests infective conditions that stimulate the bone marrow to produce new cells to combat infection.

Imaging

Plain films of the abdomen

According to Brook and Killen the following signs are suggestive of acute appendicitis:

1. Fluid levels close to the caecum and terminal ileum
2. Localised ileus – gas in caecum, ascending colon, terminal ileum.
3. Increased soft tissue density in right lower quadrant
4. Blurring of right flank stripe
5. Fecolith in right iliac fossa
6. Blurring of right psoas shadow
7. Gas filled appendix
8. Free intraperitoneal gas
9. Deformity of caecal gas shadow



Figure 4 : Plain X-ray abdomen showing appendicolith

The presence of a fecolith is rarely noted on plain films, but if present, is highly suggestive of the diagnosis.

Barium enema

Smith and associates enumerated the radiologic signs of appendicitis after barium enema as

1. persistent non visualisation of the appendix
2. partial visualisation of the appendix
3. pressure defect of the caecum, and
4. irritability of the caecum and terminal ileum on screening.

Ultrasonography:

Ultrasonography is useful in the differentiation of gynaecological causes of acute abdominal pain, such as detection of ovarian mass, ectopic pregnancy. With graded compression technique the appendix itself can be visualised.

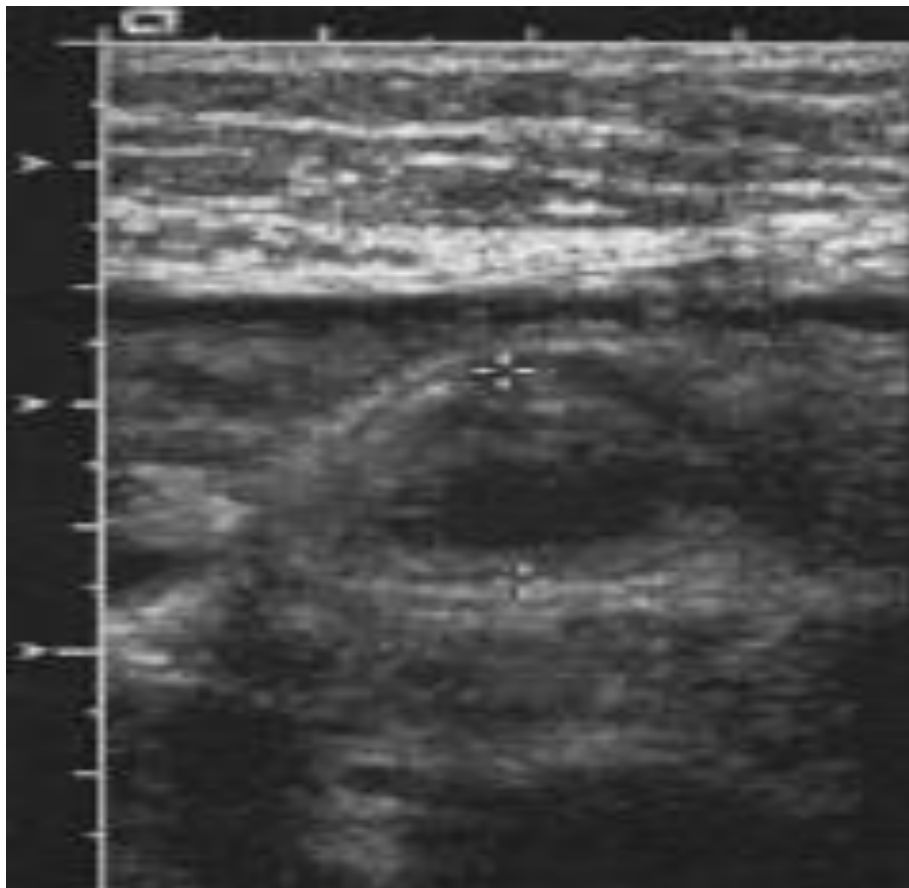


Figure 5 : Ultrasonogram showing acute appendicitis

Advantages

1. relatively inexpensive
2. doesn't require contrast
3. no radiation – can be used even in pregnant patients
4. helps to identify gynaecologic pathology
5. can be used to drain appendicular abscess

Disadvantages

1. operator dependent

The ultrasonographic signs of acute appendicitis are –

Blind ending tubular structure in right iliac fossa originating from cecum

1. that is aperistaltic
2. noncompressible
3. with anteroposterior diameter > 6mm
4. presence of faecolith
5. thickening of wall – serosa to mucosa thickness > 2mm highly suggestive
6. presence of periappendiceal fluid collection

False – positive scans

1. in the presence of periappendicitis from surrounding inflammation
2. a dilated fallopian tube can be mistaken for an inflamed appendix

3. in obese patients, the appendix may not be compressible because of overlying fat.

False - negative scans

1. inflammation is confined to tip of appendix
2. retrocecal appendix
3. appendix is markedly enlarged and is mistaken for small bowel
4. appendix is perforated and therefore compressible.

CT Signs of acute appendicitis:

1. Appendix measuring $> 6\text{mm}$ diameter
2. Failure of appendix to fill with oral contrast / air up to its tip.
3. An appendicolith
4. Enhancement of appendiceal wall with i.v. contrast.
5. Surrounding inflammatory changes include increased fat attenuation, fluid, inflammatory phlegmon, caecal thickening, abscess, extraluminal gas and lymphadenopathy.
6. Arrow head sign: Luminal contrast / air in caecum pointing towards the obstructed origin of the appendix (present in 30% cases of appendicitis).



Figure 6 : CT abdomen showing acute appendicitis with appendicolith

Laparoscopy

Laparoscopy is useful in equivocal cases of appendicitis. According to the study by Paterson-Brown and his associates only 3 out of 40 patients (7.5%) had an unnecessary appendectomy compared with 11 of 60 patients (22%) operated on without laparoscopy. This is particularly useful in female patients.

Diagnosis of acute appendicitis

The diagnosis of acute appendicitis is essentially clinical. A number of clinical and laboratory based scoring systems have been devised to assist the diagnosis. The most widely used is the Alvarado score.

ALVARADO SCORING / MANTRELS SCORE

Symptoms score

- migratory RIF pain 1
- anorexia 1
- nausea and vomiting 1

Signs

- tenderness (RIF) 2
- rebound tenderness 1
- elevated temperature 1

Laboratory

- leucocytosis 2
- shift to left 1

Total 10

A score of more than 7 is strongly predictive of acute appendicitis. A score of 5 or 6 is equivocal and a score of less than 5 is less likely to be a case of acute appendicitis

Shift to left is not included in MODIFIED ALVARADO SCORING SYSTEM (MASS) and hence maximum score obtained is 9. A score of 7 or more is strongly suggestive of acute appendicitis

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of acute appendicitis depends upon four major factors:

1. the anatomic location of the inflammed appendix
2. the stage of the process
3. the patient's age and
4. the patient's sex

Acute mesenteric adenitis – is the disease most often confused with acute appendicitis in children. Almost invariably an upper respiratory infection is present or has recently subsided. Voluntary guarding may be present but true rigidity is rare. Generalised lymphadenopathy may be present. A relative lymphocytosis, when present is diagnostic of acute mesenteric adenitis.

Acute gastroenteritis – is common in children. Viral gastroenteritis is an acute self limited disease with profuse watery stools, nausea and vomiting. The abdomen is relaxed between cramps and there are no localizing signs. Salmonella gastroenteritis results from consumption of contaminated food and there will be a point source.

Intestinal perforation in typhoid usually mimics acute appendicitis.

Diseases of the Male urogenital system - in males the following diseases are often confused with acute appendicitis.

Torsion testis, epididymitis and seminal vesiculitis.

Meckel's diverticulitis - is extremely difficult to diagnose preoperatively. Both have the same complications and require prompt surgical treatment.

Intussusception - Nearly all idiopathic intussusception occur under the age of 2. it mostly occurs in well nourished infants and in between the episodes the child is normal. After several hours the patient passes bloody mucoid stool. A sausage shaped mass is palpable in the right lower quadrant but later on, the quadrant becomes empty as the intussusception progresses distally. Treatment is hydrostatic reduction, if seen before peritonitis.

Regional Enteritis - It mostly mimics acute appendicitis. The presence of diarrhea and infrequency of anorexia, nausea, vomiting clinches the diagnosis. Acute ileitis must be differentiated from Crohn's. When distal ileum is acutely inflamed with no caecal involvement and a normal appendix, appendicectomy is indicated.

Perforated peptic ulcer - The spilled gastro duodenal contents gravitating to the right paracolic gutter closely mimics acute appendicitis (St.Valentino's appendicitis).

Other lesions:

Diverticulitis, perforating carcinoma of the caecum or the portion of sigmoid lying on the right side.

Epiploic appendagitis - It usually presents secondary to torsion. The symptoms correspond to the contour of the colon, and the pain may last several days.

Urinary tract infection - Acute pyelonephritis right side mimics retroileal appendicitis. But here they have chills, right costovertebral angle tenderness and bacteria in urine.

Ureteral stone - If a calculus is present near the appendix, it may simulate the condition, provided here the pain is referred to scrotum labia, penis. Hematuria and presence of fever, leucocytosis suggests it's a stone.

Primary peritonitis - It rarely mimics the condition. We might have nothing but cocci in the aspirate. It can be treated medically.

Henoch-Schonlein purpura - It occurs 2 to 3 weeks following a streptococcal infection. Joint pain, purpura and nephritis are nearly present.

Yersiniosis - *Y.enterocolitica* and *Y.pseudotuberculosis* gets transmitted through faecal and urinary contamination and infects humans causing mesenteric adenitis, ileitis, colitis, acute appendicitis of which many are self limited. If left untreated there is a risk of high fatality. These organisms are mostly sensitive to tetracycline, ampicillin, and kanamycin.

6% of the cases are of mesenteric adenitis, and 5% are of appendicitis. *Campylobacter jejuni* causes diarrhoea and pain mimicking acute appendicitis.

Gynaecologic disorders

In the decreasing order of frequency,

- PID
- Ruptured Graffian follicle
- Twisted ovarian cyst/ tumour
- Endometriosis
- Ruptured ectopic pregnancy.

P.I.D. - Nausea and vomiting are mostly absent here. pain and tenderness are usually lower. Motion of cervix is exquisitely painful. The purulent vaginal discharge shows intracellular diplococci. The ratio of appendicitis : PID is low in early menstrual phase and none in leuteal phase.

Ruptured Graffian follicle: The ovulation causing spilling of blood and follicular fluid. It is unusually copious and from right ovary mostly. Leukocytosis and fever are absent. Pain occurring in the midpoint of menstrual cycle, it is called as Mittelschmerz.

Other diseases:

- Foreign body perforation of the bowel
- Closed loop obstruction
- Mesenteric vascular occlusion.
- Pleuritis of right lower chest.
- Acute cholecystitis, pancreatitis
- Abdominal wall hematoma / abscess

TREATMENT

Because of the risk of progression to rupture, its attendant morbidity and mortality, immediate appendectomy is recommended in acute appendicitis. The sooner it is done, the better. There are four exceptions to this rule are

1. the patient is moribund with advanced peritonitis: here the only hope is to improve the condition by intravenous fluids, nasogastric suction, antibiotics, and blood transfusion in an attempt to get the patient fit for operation
2. the attack has already resolved; in such a case, appendicectomy can be advised as an elective procedure to prevent recurrence, but there is no immediate emergency,
3. circumstances make operation difficult or impossible. Here conservative treatment is given hoping that resolution will occur, or local appendix mass forms.
4. an appendix mass has formed without evidence of general peritonitis.

Preoperative preparation

In a straight forward case of acute appendicitis no special steps are required apart from those for other abdominal operation. Broad spectrum antibiotic therapy to cover gram negative and anaerobic organisms, preferably cefuroxime and metronidazole.

If generalised peritonitis is established, resuscitation is very important.

Resuscitation

It is an axiom that in all cases of generalised peritonitis, some degree of hypovolaemia is present. This is due to the “Third spacing” of extracellular fluid within the peritoneal cavity. The rapidity at which resuscitation is accomplished is dependent upon the degree of hypovolaemia and the physiologic status of the patient and also the acuity of the situation. The effectiveness of fluid replacement efforts can be judged by the normalisation of pulse rate, blood pressure and mental status. Placement of a urinary drainage catheter is essential since restoration of urine output is a reliable indicator of adequate fluid resuscitation. Invasive peripheral arterial and central venous pressure monitoring catheters should be placed in patients with frank septic shock, advanced age, or in patients with cardiac, pulmonary, renal insufficiency to provide more précised determinations of intravascular volume and cardiac output. Supplemental oxygen may be necessary and in more extreme circumstances endotracheal intubation and mechanical ventilation may be needed to preserve oxygenation.

Appendicectomy can be conventional / laparoscopic.

APPENDICEAL PERFORATION AND ITS MANAGEMENT

The overall rate of perforated appendicitis is 25.8% and hence immediate appendectomy has long been the recommended treatment of acute appendicitis for the known risk of progression to perforation. Children younger than 5 years of age and patients older than 65 years of age have the highest rate of perforation (45 & 51% respectively). It has been suggested that delays in presentation are responsible for the majority of perforated appendices. There is no accurate way of determining when an appendix will rupture prior to resolution of the inflammatory process.

Appendiceal rupture occurs most frequently distal to the point of luminal obstruction along the antimesenteric border of the appendix. Rupture should be suspected in the presence of fever greater than 39°C (102°F) and a WBC count > 18000/mm³. In the majority of cases, rupture is contained and patients display localised rebound tenderness. Generalised peritonitis will be present if the walling off process is ineffective in containing the rupture.

In 2 to 6% cases, an ill-defined mass will be detected on physical examination. This could represent a Phlegmon (matted loops of small bowel adherent to adjacent inflamed appendix) or a periappendiceal abscess.

The ability to distinguish acute, uncomplicated appendicitis from acute appendicitis with perforation on the basis of clinical findings is often difficult but it is important to make the distinction because their treatment differs. CT scan is beneficial in this setting.

Management

Phlegmon and small abscesses can be treated conservatively, with intravenous antibiotics. Well localised abscesses can be managed with percutaneous drainage with USG / CT guidance. Complex abscesses should be considered for surgical drainage. If operative drainage is required, it should be performed by an extraperitoneal approach with appendicectomy reserved only for cases in which appendix is easily accessible. Otherwise interval appendicectomy after 6 weeks following the acute event is the classical recommendation, for those patient treated non operatively or with simple abscess drainage.

Generalised peritonitis needs a laparotomy with drainage of abscess cavities and appendicectomy with peritoneal lavage and drainage.

MANAGEMENT OF APPENDICULAR MASS

Occasionally, a walled off perforated appendix will form an inflammatory mass. Usually there is a history of 4 or 5 days of pain. The clinical features are a shifting temperature with an increased pulse rate. There is a tender mass in the right iliac fossa that can often also be palpated on rectal examination. However, there is no evidence of a generalised peritonitis, in that the rest of the abdomen is soft and bowel sounds are present. The WBC count is raised considerably.

If an appendix mass is present and the condition of the patient is satisfactory, the standard treatment is the conservative Ochsner-Sherren regimen. This is based on the premise that the inflammatory process is already localised and that inadvertent surgery is difficult and may be dangerous. It may be impossible to find the appendix and,

occasionally, a faecal fistula may form. For these reasons it is wise to observe a nonoperative programme, but to be prepared to operate should clinical deterioration occur.

Careful record of the patient's condition and the extent of the mass should be made, and the abdomen regularly reexamined. It is helpful to mark the limits of mass on the abdominal wall using a skin pencil. A nasogastric tube should be passed and intravenous fluid and antibiotic therapy instigated. Temperature and pulse rate should be recorded 4 hourly and a fluid balance record maintained. Clinical deterioration or evidence of peritonitis is indication for early laparotomy. Clinical improvement is usually evident within 24-48 hours at which time the nasogastric tube can be removed and oral fluids introduced. Failure of the mass to resolve should raise the suspicion of a ileocaecal tuberculosis, carcinoma or Crohn's disease. Using this regime approximately 90% of cases resolve without incident. It is advisable to remove the appendix usually after an interval of 6-8weeks.

Criteria for stopping conservative treatment

1. a rising pulse rate
2. increasing or spreading abdominal pain
3. increasing size of the mass
4. Vomiting or copious gastric aspirate.

COMPLICATIONS

Preoperative

1. perforation of appendix
2. generalised peritonitis
3. appendicular abscess

Postoperative

Early complications

1. paralytic ileus
2. wound infection – most common postoperative complication
 - residual abscess
 - paracaecal abscess
 - pelvic abscess
 - subphrenic abscess
3. hemorrhage
4. faecal fistula –external and internal type caused by
 - necrosis of caput caecae
 - erosion of caecal / ileal wall by drain
 - release of appendicular stump
 - retained foreign body

- regional enteritis
- ileocaecal tuberculosis
- iatrogenic

5. intestinal fistula

- appendiculo-vesical
- appendiculo-rectal
- appendiculo-vaginal

6. chest complications

- bronchogenic pneumonia
- atelectasis
- empyema

Late complications

1. adhesions causing bowel obstruction
2. ventral hernia
3. inguinal hernia

Histopathologic features

Macroscopic appearance

1. Grossly, an appendix with well-developed acute inflammation shows a fibrinous or purulent coating of the serosa, with engorgement of the vessels.
2. The mucosa shows areas of ulceration against a markedly hyperemic background.
3. Obstruction of the lumen by a fecalith or some other agent is found in about one fourth to one third of the cases

Microscopic appearance

1. The changes range from minimal focal inflammation to total necrosis of the appendiceal wall, the degree of abnormalities being partially dependent on the interval between the onset of symptoms and the operation.
2. In early lesions, neutrophils appear at the base of the crypt adjacent to a small defect in the epithelium.
3. In late lesions the inflammatory process reaches the submucosa and spreads quickly to the remaining appendix.
4. In advanced stages, the mucosa is absent, and the wall is necrotic.
5. Thrombosed vessels are seen in one fourth of the cases.

Periappendicitis

- It refers to acute or chronic inflammation of the appendiceal serosa.
- It is invariably present in the advanced stages of appendicitis.
- It can be seen in the absence of a primary inflammation of this organ, as a result of spread of an inflammatory process from another site, such as the female adnexae.
- In the presence of periappendicitis, evidence of mucosal involvement should be thoroughly sought; if none is found, the diagnosis given should be that of periappendicitis rather than appendicitis, the implication being that the primary site of the inflammation is probably located elsewhere. There is close correlation between the gross and microscopic findings in acute appendicitis. Therkelsen reviewed 154 organs with microscopic evidence of acute appendicitis; grossly, evidence of inflammation was evident in 125, equivocal in 25, and absent in 4.

OPEN APPENDICECTOMY

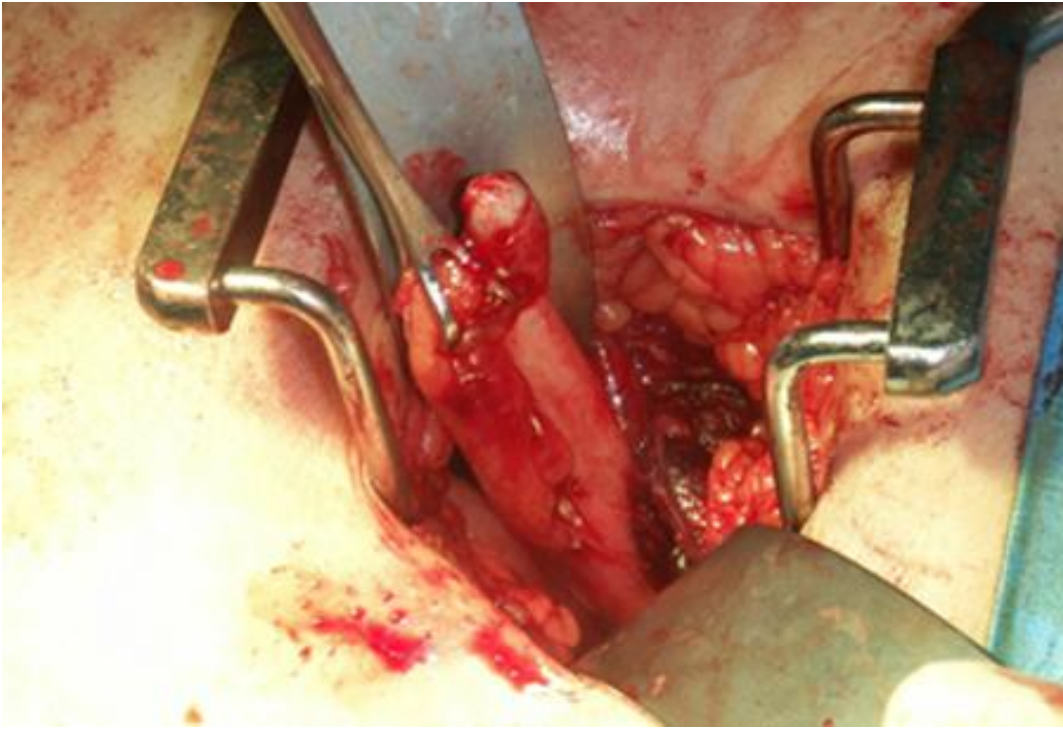


Figure 7 : Open appendicectomy for a case of acute appendicitis

If open appendectomy is chosen, the surgeon must then decide on the location and type of incision. Prior to incision, a single dose of antibiotics should be administered, typically a second-generation cephalosporin. The patient should be reexamined after the induction of general anesthesia, which enables deep palpation of the abdomen. If a mass representing the inflamed appendix can be palpated, the incision can be centered at that location. If no appendiceal mass is detected, the incision should be centered over McBurney's point, one-third of the distance from the anterior superior iliac spine to the

umbilicus. A curvilinear incision, now known as *McBurney's incision*, is made in a natural skin fold. It is important not to make the incision too medial or too lateral. An incision placed too medial opens onto the anterior rectus sheath, rather than the desired oblique muscles, while an incision placed too lateral may be lateral to the abdominal cavity.

The operation proceeds much as McBurney first described it in 1894. The incision extends through the subcutaneous tissue, exposing the aponeurosis of the external oblique muscle, which is divided, either sharply or with electrocautery, in the direction of its fibers. A muscle splitting technique is typically used, in which the external oblique, internal oblique, and transverses abdominis muscles are separated along the orientation of their muscle fibers. The peritoneum is thus exposed, grasped with forceps, and opened sharply along the orientation of the incision, taking care not to injure the underlying abdominal contents. Hemostats can be placed on the peritoneum to facilitate its identification at the time of wound closure. Cloudy fluid may be encountered on entering the peritoneum. Although some advocate bacterial culture of the peritoneal fluid, studies show that this neither helps direct the antibiotic regimen nor reduces infectious complications.

With a correctly placed incision, the cecum will be visible at the base of the wound. The incision should be explored with a finger in an attempt to locate the appendix. If the appendix is palpable and free from surrounding structures, it can be

delivered into the incision. Frequently, the appendix is palpable, but it adheres to surrounding structures. Filmy adhesions can be divided using blunt dissection, but thicker adhesions should be divided under direct vision. To facilitate this, the cecum can be partially delivered into the incision to provide better exposure of the appendix. If necessary to improve exposure, the incision can be extended medially by partially dividing the rectus muscle or laterally by further dividing the oblique and transversus abdominis muscles. If the appendix cannot be visualized, it can be located by following the teniae coli of the cecum to the cecal base, from which the appendix invariably originates. Once located, the appendix is delivered through the incision. Grasping the mesentery with a Babcock clamp can sometimes facilitate this maneuver. Care should be taken to avoid perforation of the appendix, with spillage of pus or enteric contents into the abdomen. The arterial supply to the appendix, which runs in the mesoappendix, is now divided between clamps and tied with 3-0 polyglactin or silk suture. This is usually performed in an antegrade fashion, from the appendiceal tip toward the base. Division of the artery to the appendiceal base is necessary to ensure that the entire appendix can be removed without leaving an excessively long appendiceal stump.



Figure 8 : Open appendicectomy - Ligation of appendicular base

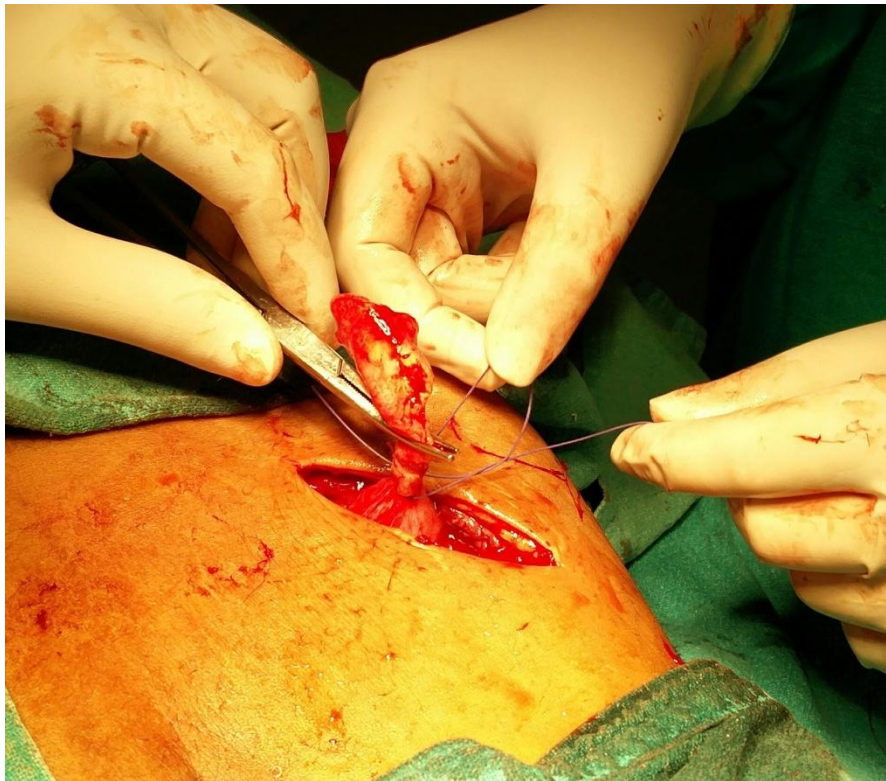


Figure 9 : Transfixation of appendicular base and crushing of base of appendix

In excising the appendix, the surgeon must decide whether or not to invert the appendiceal stump. Traditionally, the appendix was ligated and divided, and its stump was inverted with a purse-string suture for the theoretical purpose of avoiding bacterial contamination of the peritoneum and subsequent adhesion formation. However, recent prospective studies show no advantages to appendiceal stump inversion. In one such study, 735 appendectomy patients were randomly assigned to ligation plus inversion or simple ligation of the appendiceal stump.

There was no difference between the two groups in the incidence of wound infection or adhesion formation, and operating time was shorter in the simple ligation group. Inversion may also have the deleterious effect of deforming the cecal wall, which could be misinterpreted as a cecal mass on future contrast radiographs. Furthermore, the long-standing notion that stump inversion reduces postoperative adhesions was discredited by Street and colleagues. In their analysis, postoperative adhesions requiring operation were significantly increased in the inversion group.

To divide the appendix, the surgeon can use either suture ligation or a gastrointestinal stapler. For ligation, two hemostat clamps are placed at the base of the appendix. The clamp closest to the cecum is removed, having crushed the appendix at that site. Two heavy, absorbable sutures such as chromic gut is used to doubly ligate the appendix, and the appendix is subsequently divided proximal to the second clamp. The exposed mucosa of the appendiceal stump can be cauterized to minimize the theoretical

risk of postoperative mucocele, although no data exist to support this. If appendiceal stump inversion is chosen, a seromuscular purse-string 3-0 silk suture is placed in the cecum around the appendiceal base after ligation but prior to division of the appendix. The purse-string suture should be placed approximately 1 cm from the base of the appendix, as placing it too close to the appendix makes stump inversion difficult. After the appendix is divided, the purse-string suture is tightened and tied while the assistant uses forceps to invaginate the appendiceal stump. Alternatively, the appendix can be divided at its base using a TA-30 stapler. Again, the stump need not be inverted, but can be if desired, using interrupted Lembert sutures with 3-0 silk suture. No matter how the appendix is divided, the residual appendiceal stump should be no longer than 3 mm to minimize the possibility of stump appendicitis in the future. Occasionally, inflammation at the tip of the appendix makes antegrade removal of the appendix difficult. In such cases, the appendix can be removed in a retrograde fashion. In so doing, the appendix is divided at its base using one of the methods described previously. The mesoappendix is then divided between clamps, starting at the appendiceal base and progressing toward the tip. In certain cases, the appendiceal inflammation extends to the base of the appendix or beyond to the cecum. Division of the appendix through inflamed, infected tissue leaves the potential for leakage of cecal contents with a resultant abscess or fistula. Ensuring that the resection margin is grossly free of active inflammation can minimize this risk. If the base of the cecum is also inflamed but there is sufficient uninflamed cecum between the appendix and the ileocecal valve, an appendectomy with partial cecectomy can be performed using a stapling device. Care should be taken to avoid narrowing the cecum at

the ileo-cecal valve. If the inflammation extends to the ileocecal junction, an ileocecectomy with primary anastomosis may be necessary. After the appendix is removed, hemostasis is achieved and the right lower quadrant and pelvis are irrigated with warm saline. The peritoneum is closed with a continuous 0 absorbable suture; this layer provides no strength but helps to contain the abdominal contents during abdominal wall closure. The internal and external oblique muscles are then closed in succession using continuous 0 absorbable suture. To decrease postoperative narcotic requirements, the external oblique fascia can be infused with local anesthetic. Interrupted absorbable sutures are typically placed in Scarpa's fascia, and the skin can be closed with a subcuticular absorbable suture. With a preoperative dose of intravenous antibiotics and primary closure of the skin, fewer than 5% of patients with nonperforated appendicitis can be expected to develop a wound infection.

LAPAROSCOPIC APPENDECTOMY

Multiple port placements for laparoscopic appendectomy exist. The authors utilize a three-port technique, with one umbilical and one suprapubic port. Although the third port can be placed in either the left or right lower quadrant, we prefer the left lower quadrant. This follows the laparoscopic principle of triangulation, such that the port locations direct the camera and instruments toward the right lower quadrant for optimal visualization of the appendix. The patient is positioned supine on the operating room table with the left arm tucked. The video monitor is placed at the patient's right side,

because once pneumoperitoneum is performed, the surgeon and assistant both stand on the patient's left. A single dose of a second-generation cephalosporin is administered prophylactically. Prior to incision, a nasogastric tube and a Foley catheter are placed to decompress the stomach and urinary bladder. A Foley catheter can be avoided if a reliable patient urinates immediately prior to entering the operating room. A 1- to 2-cm vertical or transverse incision is made just inferior to the umbilicus and carried down to the midline fascia. A 12-mm trocar is placed using either Hassan or Veress technique, depending on surgeon preference. After insufflation of the abdomen and inspection through the umbilical port, a 5-mm suprapubic port is placed in the mid-line, taking care to avoid injury to the bladder, and another 5-mm port is placed in the left lower quadrant. These port sites typically provide excellent cosmesis postoperatively due to their small size and peripheral location on the abdomen. A 5-mm, 30-degree laparoscope is inserted through the left lower quadrant trocar. Placing the laparoscope in the left lower quadrant allows triangulation of the appendix in the right lower quadrant by instruments placed through the two midline trocars. The surgeon operates the two dissecting instruments and the assistant operates the laparoscope. The appendix is identified at the base of the cecum, and any adhesions to surrounding structures can be lysed with a combination of blunt and sharp dissection supplemented with electrocautery. If a retrocecal appendix is encountered, division of the lateral peritoneal attachments of the cecum to the abdominal wall often improves visualization. Care must be taken to avoid underlying retroperitoneal structures, specifically the right ureter and iliac vessels. The appendix or mesoappendix can be gently grasped with a Babcock clamp placed through the suprapubic port and

retracted anteriorly. A dissecting forceps placed through the umbilical port creates a window in the mesoappendix at the appendiceal base. Caution should be taken not to injure the appendiceal artery during this maneuver. As in the open procedure, the base of the appendix should be adequately dissected so that it can be divided without leaving a significant stump. The appendix should be divided at the confluence of the appendix and cecum, or just onto the cecal wall, to avoid the possibility of stump appendicitis or mucocoele. The appendix can be removed in a retrograde fashion, first dividing the appendix, followed by division of the mesoappendix. A laparoscopic gastrointestinal anastomosis (GIA) stapler is placed through the umbilical port and fired across the appendiceal base. After reloading, the stapler is again inserted through the umbilical port and placed across the mesoappendix, which is divided with firing of the stapler. Alternatively, the appendix can be secured using an Endoloop (Ethicon, Endo-Surgery, Cincinnati, Ohio) and the mesoappendix with an Endoloop or cautery device. If desired, the appendix can be removed antegrade, by first dividing the mesoappendix prior to directing attention to the base. The appendix should be placed in a retrieval bag and removed through the umbilical port site to minimize the risk of wound infection. The operative field is inspected for hemostasis and can be irrigated with saline. Finally, the fascial defect at the umbilicus is closed with interrupted absorbable suture, and all skin incisions are closed with fine subcuticular absorbable suture.

Postoperative Care

Patients with nonperforated appendicitis typically require a 24- to 48-hour hospital stay. Postoperative care for both the laparoscopic and open approaches is similar. Patients can be started on a clear liquid diet immediately, and their diet can be advanced as tolerated. No postoperative doses of antibiotics are required. Patients can be discharged when they tolerate a regular diet and oral analgesics.

Perforated Appendicitis

When appendicitis progresses to perforation, management depends on the nature of the perforation. If the perforation is contained, a solid or semisolid periappendiceal mass of inflammatory tissue can form, referred to as a *phlegmon*. In other cases, contained perforation may result in a pus-filled abscess cavity. Finally, free perforation can occur, causing intraperitoneal dissemination of pus and fecal material. In the case of free perforation, the patient is typically quite ill and perhaps septic. Urgent laparotomy is necessary for appendectomy and irrigation and drainage of the peritoneal cavity. If the diagnosis of perforated appendicitis is known, the appendectomy can be performed through an RLQ incision, and the technique follows that previously described for open appendectomy.

Sometimes patients with free perforation present with an acute abdomen and generalized peritonitis, and the decision to perform a laparotomy is made without a definitive diagnosis. In such instances, a midline incision is prudent. Once perforated appendicitis is discovered, appendectomy again proceeds as described previously. Peritoneal drains are not necessary, as they do not reduce the incidence of wound infection or abscess after appendectomy for perforated appendicitis. The final operative decision is whether or not to close the incision. Because of wound infection rates ranging from 30 to 50% with primary closure of grossly contaminated wounds, many advocate delayed primary or secondary closure. However, a cost-utility analysis of contaminated appendectomy wounds showed primary closure to be the most cost-effective method of wound management. Our technique of skin closure is interrupted permanent sutures or staples every 2 cm with loose wound packing in between. Removal of the packing in 48 hours often leaves an excellent cosmetic result with an acceptable incidence of wound infection. Patients are often continued on broad-spectrum antibiotics for 5–7 days and should remain in the hospital until afebrile and tolerating a regular diet. If the patient does not have signs of generalized peritonitis but an abscess or phlegmon is suspected by history and physical exam, a CT scan can be particularly helpful to confirm the diagnosis. A solid, inflammatory mass in the RLQ without evidence of a fluid-filled abscess cavity suggests a phlegmon. In such instances, appendectomy can be difficult due to dense adhesions and inflammation. Ileocectomy may be necessary if the inflammation extends to the wall of the cecum.

Complications such as inadvertent enterotomy, postoperative abscess, or enterocutaneous fistula may ensue. Because of these potential complications, many support an initially nonoperative approach. Such an approach is only advisable if the patient is not ill appearing. Nonoperative management includes intravenous antibiotics and fluids as well as bowel rest. Patients should be closely monitored in the hospital during this time. Treatment failure, as evidenced by bowel obstruction, sepsis, or persistent pain, fever, or leukocytosis, requires immediate appendectomy. If fever, tenderness, and leukocytosis improve, diet can be slowly advanced, usually within 3–5 days.

Patients are discharged home when clinical parameters have normalized. Using this approach, more than 80% of patients can be spared an appendectomy at the time of initial presentation. If imaging studies demonstrate an abscess cavity, CT- or ultrasound-guided drainage can often be performed per-cutaneously or transrectally. Studies suggest that this approach to appendiceal abscesses results in fewer complications and shorter overall length of stay. Again, following drainage the patient is closely monitored in the hospital and is placed on bowel rest with intravenous antibiotics and fluids. Advancement of diet and hospital discharge progress as clinically indicated.

Interval Appendectomy

Treatment following initial nonoperative management of an appendiceal phlegmon or abscess is controversial. Some recommend interval appendectomy (appendectomy performed approximately 6 weeks after inflammation has subsided), while others consider subsequent appendectomy unnecessary. Factors to be considered when advising patients on interval appendectomy include a relatively low incidence of future appendicitis (8–10% and often associated with an appendicolith) and a morbidity associated with an interval appendectomy of approximately 11%. These factors must be weighed against the higher morbidity associated with an immediate appendectomy in the setting of acute recurrent appendicitis in the future (as high as 36% when appendicitis is associated with a phlegmon or abscess) as well as the possibility of an ongoing appendiceal pathology, including inflammatory bowel disease and cancer. Because it can now be performed laparoscopically on an outpatient basis with low morbidity, interval appendectomy should be considered for patients who were initially treated with nonoperative management, but there is not convincing evidence to recommend this approach.

Normal Appendix

Because of the difficulty in diagnosing appendicitis, it is not uncommon for a normal appendix to be found at appendectomy. Sometimes referred to as misdiagnosis, this can occur more than 15% of the time, with considerably higher percentages in infants, the elderly, and young women. Negative appendectomy is to be avoided when possible, because of the risk of surgical complications and the cost associated with unnecessary surgery. Nonetheless, in certain instances, the diagnosis is in doubt, and a noninflamed appendix is found at laparotomy or laparoscopy. The surgeon must then decide whether or not to remove the appendix. For multiple reasons, it is advisable to remove the grossly normal appendix. First, if the pain recurs and the appendix has been removed, appendicitis will no longer be a possibility and can be removed from the differential diagnosis. If the patient suffers RLQ pain in the future and the appendix has not been removed, but the patient has a classic RLQ scar, a surgeon evaluating the patient may assume a history of appendectomy and erroneously remove appendicitis from consideration. As laparoscopic appendectomy becomes more popular, this may even be true for patients with port site scars suggestive of appendectomy. Finally, there is strong evidence that a surgeon's gross assessment of the appendix can be inaccurate. In one study, 11 (26%) out of 43 appendectomy specimens described as normal by the surgeon showed acute appendicitis on pathological examination. As a result, removal of a grossly normal appendix at the time of appendectomy is recommended. When a normal appendix is discovered at appendectomy, it is important to search for other possible causes of the

patient's symptoms. The terminal ileum can be inspected for evidence of terminal ileitis, which could be from infectious causes (*Yersinia* or tuberculosis) or Crohn's disease.

In the absence of perforation, resection should not be performed for Crohn's disease and appropriate medical therapy should be initiated postoperatively. The ileum should also be evaluated for an inflamed or perforated Meckel's diverticulum, which should be excised. In females, the ovaries, fallopian tubes, and uterus should be examined for pathology as well. Evaluation of the left adnexa can be difficult through an RLQ incision, highlighting the utility of laparoscopy in female patients.

Chronic Appendicitis

Although rare, chronic appendicitis can explain persistent abdominal pain in some patients. Patients do not present with the typical symptoms of acute appendicitis. Instead, they complain of weeks to years of RLQ pain and may have had multiple medical evaluations in the past. When queried, they may describe an initial episode with more classic symptoms of acute appendicitis, for which no treatment was delivered. Diagnosis can be difficult, as laboratory and radiological studies are typically normal. Pathology evaluation revealing chronic inflammation confirms the diagnosis. Because the diagnosis is often uncertain preoperatively, laparoscopy can be a useful tool to allow exploration of the abdomen.

Asymptomatic Appendicolith

As CT scans become more widely utilized, it is likely that an increasing number of asymptomatic appendicoliths will be discovered. As discussed previously, appendicoliths are not pathognomonic for appendicitis but should only be considered in conjunction with the clinical presentation and other diagnostic studies. Lowe and associates studied CT scans of children with suspected appendicitis and compared them to CT scans of children with abdominal trauma. Six (14%) of 44 patients with suspected appendicitis had an appendicolith but proved not to have appendicitis. In addition, 2 (3%) of the 74 trauma patients had an appendicolith on CT. These children were not followed to see if appendicitis developed later in life, but the considerable number of asymptomatic appendicoliths seen on adult abdominal radiographs suggests that many patients with an appendicolith will never develop appendicitis. Based on this, appendectomy for asymptomatic appendicolith cannot be recommended.

NEOPLASMS OF THE APPENDIX

Neoplasms of the appendix are rare, affecting less than 1% of appendectomies. Signs and symptoms of appendicitis prompt appendectomy in up to 50% of patients, and it is not uncommon for the patients with an appendiceal neoplasm to have acute appendicitis as well. Patients may also present with a palpable mass, intussusception, urologic symptoms, or an incidentally discovered mass on abdominal imaging or at laparotomy for another purpose. Typically, the diagnosis is not known until laparotomy or pathologic evaluation of the appendectomy specimen, but preoperative diagnosis may

become more common as imaging techniques become more widely used. Because of their common embryologic origin, the appendix and colon are susceptible to many of the same neoplastic growths. The most common appendiceal tumors include cystic neoplasms, carcinoid tumors, adenocarcinoma, and metastases. Other tumors have been reported but are extremely rare, such as lymphoma, stromal tumors (leiomyoma and leiomyosarcoma), and Kaposi's sarcoma.

Cystic Neoplasms and Pseudomyxoma Peritonei

Sometimes referred to as *mucocèles*, mucinous neoplasms of the appendix include a spectrum of diseases, including simple cyst, mucinous cystadenoma, mucinous cystadenocarcinoma, and pseudomyxoma peritonei. Mucocèle is not a true pathologic diagnosis and instead refers to the macroscopic appearance of an appendix distended with mucus. Any of the above conditions can form a mucocèle, but the more specific diagnostic term is preferable. A simple cyst results from nonneoplastic occlusion of the appendiceal lumen, is usually less than 2 cm in diameter, and is often an incidental finding at appendectomy. In contrast, mucinous cystadenomas, benign tumors that represent the majority of “mucocèles,” can grow to 8 cm or larger. They typically remain asymptomatic due to slow-growing distension of the appendix and instead present incidentally as a mass on physical examination or abdominal imaging. On plain radiograph or CT, wall calcification is characteristic. It is recommended that all mucinous appendiceal masses 2 cm or larger be surgically removed. For mucinous cystadenoma,

appendectomy is sufficient if the lesion does not involve the appendiceal base. Occasionally, the mass will rupture prior to or at the time of removal, but this rupture is typically contained to the right lower quadrant and is considered localized pseudomyxoma peritonei.

If the mass is benign, appendectomy and removal of any residual mucin is curative. Laparoscopic appendectomy is not currently recommended because of the possibility of malignancy and spillage of mucin-secreting cells throughout the abdomen. Because of an association with colon and rectal carcinoma, a screening colonoscopy is recommended postoperatively. Mucinous cystadenocarcinoma represents the malignant form of cystic neoplasms of the appendix.

In contrast to cystadenoma, patients are usually symptomatic with abdominal pain, weight loss, an abdominal mass, or signs of acute appendicitis. Increasing abdominal girth may also be present and suggests development of pseudomyxoma peritonei from perforation and peritoneal dissemination of mucin-secreting cells. Diffuse pseudomyxoma peritonei is highly predictive of malignancy; in one series, 95% of patients with pseudomyxoma had an associated mucinous cystadenocarcinoma. The recommended treatment consists of right hemicolectomy with debulking of any gross spread of disease and removal of all mucin. It is not uncommon, however, for the diagnosis to be unknown until the time of pathologic evaluation of the appendectomy specimen. In such cases, reoperation with right hemicolectomy is recommended, as 5-year survival for mucinous cystadenocarcinoma is 75% after hemicolectomy and less

than 50% after appendectomy alone. Some referral centers advocate extensive initial resections including omentectomy, as well as repeated debulking procedures for recurrent disease.

Adenocarcinoma

Primary adenocarcinoma of the appendix is classified into two types: mucinous (discussed previously) and colonic. The colonic type is less common, less likely to secrete mucus, and more likely to present with acute appendicitis due to obstruction of the appendiceal lumen.

Because of similarities with colon carcinoma, appendiceal adenocarcinomas are classified as Dukes stage A, B, C, and D, with 5-year survival rates of 100, 67, 50, and 6%, respectively. The colonic type has a less favorable prognosis, with only 41% 5-year survival after treatment, compared to 71% for the mucinous type. The optimal treatment is right hemicolectomy, and reoperation should be recommended if the diagnosis is made on pathologic evaluation of an appendectomy specimen

Carcinoid Tumors

The most common neoplasm of the appendix, carcinoid tumors comprise more than 50% of all appendiceal tumors. Among malignant tumors of the appendix, carcinoids are less aggressive and carry a much more favorable prognosis than adenocarcinomas, with 5-year survival approaching 90%. Most appendiceal carcinoids

are found incidentally at the time of appendectomy for appendicitis. However, because the majority of appendiceal carcinoids are located at the tip of the appendix, the carcinoid mass is the cause of appendicitis only 25% of the time. Tumor size is the primary determinant of malignant potential. About 75% of carcinoids are less than 1 cm in size and 5–10% are over 2 cm. Lymph node invasion and distant metastases are exceedingly rare except in tumors over 2 cm. Histologically, carcinoids of the appendix are categorized as goblet cell and classic carcinoid. Mortality is higher for goblet cell but is still lower than that of adenocarcinoma.

Treatment of appendiceal carcinoids is dictated primarily by tumor size. Simple appendectomy is sufficient for tumors less than 1 cm because of the low likelihood of lymph node involvement. For masses larger than 2 cm, right hemicolectomy is recommended. Because of a concern for increased metastatic potential, some authors also advocate right hemi-colectomy in young patients; in carcinoids at the appendiceal base; and when there is evidence of lymphatic invasion, lymph node involvement, spread to the mesoappendix, tumor-positive resection margins, or cellular pleomorphism with a high mitotic index.

CONCLUSION

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 Modified 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% to 14%. Fenyo, 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.

Our study demonstrates that modified Alvarado score applied to all adult patients is substantially superior in the diagnosis of acute appendicitis with a sensitivity of 81.8 % and a specificity of 66.6 %.

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 JUNIUR RESIDENT in clinical routine in a peripheral hospital.**

Negative appendicectomy rate in this study is 1.6 % . 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 94.7% and a specificity of 50% in the hands of experienced Person.

According to our study, USG seems to be a more sensitive investigation but it lacks specificity. USG is more useful in deciding for surgery in patients with Modified Alvarado Score < 7. Hence Modified Alvarado Score along with Ultrasonogram proves to be evident in the diagnosis of acute appendicitis thereby reducing the rates of negative appendicectomy as well as missed appendicitis both of which are equally harmful to the society.

Hence we recommend the routine use of Modified Alvarado Scoring along with USG (in cases with MASS < 7) in all cases of suspected appendicitis for the earliest diagnosis and better management of patients.

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MASTER CHART

S.No	NAME	AGE / SEX	IP NO	MASS	USG FINDING	FECOLITH	APPENDICULAR LUMEN > 6MM	INTRA OP FINDING	POST OP HPE
				max. 9					
1	Muthusami	13/M	45162	7	Suggestive	absent	yes	Inflamed	positive
2	Rajendran	14/M	45367	7	Suggestive	absent	yes	Inflamed	positive
3	Parthipan	64/M	45572	7	Suggestive	absent	yes	Inflamed	positive
4	Kumar	13/M	45777	7	Not done	-	-	Inflamed	positive
5	Sundharavadivel	14/M	45982	6	not favourable	absent	no	Inflamed	positive
6	Dhanavel	62/M	46187	7	Suggestive	absent	yes	Inflamed	positive
7	Raj	13/M	46392	7	Suggestive	absent	yes	Inflamed	positive
8	Ganeshan	14/M	46597	7	Not done	-	-	Inflamed	positive
9	Anthonisami	13/M	46802	7	Suggestive	absent	yes	Inflamed	positive
10	Nadeshan	14/M	47007	6	not favourable	absent	no	Inflamed	positive
11	Baskar	68/M	47212	7	Not done	-	-	Normal	negative
12	Ayyadurai	13/M	47417	7	Not done	-	-	Inflamed	positive
13	Saminadhan	14/M	47622	7	Suggestive	absent	yes	Inflamed	positive
14	Ilangovan	13/M	47827	7	Suggestive	absent	yes	Abscess	positive
15	Murugan	13/M	48032	7	Suggestive	absent	yes	Inflamed	positive
16	Palaniswami	14/M	48237	7	Not done	-	-	Inflamed	positive
17	Raman	13/M	48442	7	Suggestive	absent	yes	Inflamed	positive
18	Govindharaj	14/M	48647	7	Suggestive	absent	yes	Inflamed	positive
19	Shekalavudeen	13/M	48852	7	Suggestive	absent	yes	Inflamed	positive
20	Chinnayi	26/F	49057	7	Not done	-	-	Inflamed	positive
21	Ramalingam	13/M	49262	7	Suggestive	absent	yes	Inflamed	positive

22	Kalayamani	26/F	49467	7	Suggestive	absent	yes	Inflamed	positive
23	Mahalingham	14/M	49672	7	Suggestive	absent	yes	Inflamed	positive
24	Ramasami	14/M	49877	7	Not done	-	-	Inflamed	positive
25	Velamkanni	26/F	50082	7	Suggestive	absent	yes	Inflamed	positive
26	Selvam	14/M	50287	7	Suggestive	absent	yes	Inflamed	positive
27	Iyyakannu	26/F	50492	7	Suggestive	absent	yes	Inflamed	positive
28	Nachimuthu	15/M	50697	7	Not done	-	-	Inflamed	positive
29	Kaviselvan	15/M	50902	7	Suggestive	absent	yes	Inflamed	positive
30	Gobibagya	26/F	51107	7	Suggestive	absent	yes	Abscess	positive
31	Rajapan	15/M	51312	7	Suggestive	absent	yes	Inflamed	positive
32	Manikandan	15/M	51517	7	Not done	-	-	Inflamed	positive
33	Gobi	16/M	51722	7	Not done	-	-	Normal	negative
34	Palanivel	15/M	51927	7	Suggestive	absent	yes	Inflamed	positive
35	Marimuthu	16/M	52132	6	not favourable			Inflamed	positive
36	Suganthan	15/M	52337	7	Not done	-	-	Inflamed	positive
37	Sivakumar	62/M	52542	7	Suggestive	absent	yes	Inflamed	positive
38	Thangamani	26/F	52747	7	Suggestive	absent	yes	Inflamed	positive
39	Nagarajan	15/M	52952	7	Suggestive	absent	yes	Inflamed	positive
40	Vivekanandhan	16/M	53157	7	Not done	-	-	Inflamed	positive
41	Dhamodharan	15/M	53362	7	Suggestive	absent	yes	Inflamed	positive
42	Kodiyarani	26/F	53567	7	Suggestive	absent	yes	Inflamed	positive
43	Vasuki	26/F	53772	7	Suggestive	absent	yes	Inflamed	positive
44	Vengadesh	15/M	53977	7	Not done	-	-	Inflamed	positive
45	Bharathiraja	15/M	54182	7	Suggestive	absent	yes	Inflamed	positive

46	Maheshwari	26/F	54387	7	Suggestive	absent	yes	Perforated	positive
47	Thamarai selvan	16/M	54592	7	Suggestive	absent	yes	Inflamed	positive
48	Prathik	16/M	54797	7	Not done	-	-	Inflamed	positive
49	Ruban	16/M	55002	5	not favourale	absent	no	Inflamed	positive
50	Vetriselvan	16/M	55207	6	not favourale	absent	no	Inflamed	positive
51	Ajish	16/M	55412	5	not favourale	absent	no	Inflamed	positive
52	manivannan	16/M	55617	7	Not done	-	-	Inflamed	positive
53	lokesh	16/M	55822	7	Suggestive	absent	yes	Inflamed	positive
54	elakkiya	26/F	56027	7	Suggestive	absent	yes	Inflamed	positive
55	krishnamoorthy	17/M	56232	7	Suggestive	absent	yes	Inflamed	positive
56	sara	26/F	56437	7	Not done	-	-	Inflamed	positive
57	mathiyalagi	26/F	56642	7	Suggestive	absent	yes	Inflamed	positive
58	aravindh	17/M	56847	7	Suggestive	absent	yes	Inflamed	positive
59	rajendran	17/M	57052	7	Suggestive	absent	yes	Inflamed	positive
60	vinodha	26/F	57257	7	Not done	-	-	Inflamed	positive
61	vasanth	17/M	57462	7	Suggestive	absent	yes	Perforated	positive
62	lakshmi	26/F	57667	7	Suggestive	absent	yes	Inflamed	positive
63	Ibrahim	17/M	57872	7	Suggestive	absent	yes	Inflamed	positive
64	dharshini	26/F	58077	7	Not done	-	-	Inflamed	positive
65	dhanush	17/M	58282	7	Suggestive	absent	yes	Inflamed	positive
66	santhosh	17/M	58487	7	Suggestive	absent	yes	Inflamed	positive
67	sabapathi	17/M	58692	7	Suggestive	absent	yes	Inflamed	positive
68	guna	17/M	58897	7	Not done	-	-	Inflamed	positive

69	nandhini	26/F	59102	6	Suggestive	absent	yes	normal	negative
70	banumathi	26/F	59307	6	not favourale	absent	no	Inflamed	positive
71	renganathan	17/M	59512	5	not favourale	absent	no	Inflamed	positive
72	sowmiya	26/F	59717	7	Not done	-	-	Inflamed	positive
73	gandhimathi	26/F	59922	7	Suggestive	absent	yes	Inflamed	positive
74	ahishek	18/M	60127	7	Suggestive	absent	yes	Inflamed	positive
75	amirthavalli	26/F	60332	7	Suggestive	absent	yes	Inflamed	positive
76	shanthi	26/F	60537	6	Not done	-	-	Inflamed	positive
77	sundari	26/F	60742	7	Suggestive	absent	yes	Inflamed	positive
78	pothi	26/F	60947	7	Suggestive	absent	yes	Inflamed	positive
79	nathiyasan	18/M	61152	7	Suggestive	absent	yes	Inflamed	positive
80	chandran	18/M	61357	6	Not done	-	-	Inflamed	positive
81	poongodi	26/F	61562	7	Suggestive	absent	yes	Inflamed	positive
82	anbalagan	18/M	61767	7	Suggestive	absent	yes	Inflamed	positive
83	vignesh	18/M	61972	7	Suggestive	absent	yes	Perforated	positive
84	kamala	26/F	62177	5	Not done	-	-	Inflamed	positive
85	vijay	18/M	62382	6	not favourale	absent	no	Inflamed	positive
86	sabariammal	24/F	62587	5	not favourale	absent	no	Inflamed	positive
87	usha	24/F	62792	6	not favourale	absent	no	Inflamed	positive
88	vijayakumari	24/F	62997	6	Not done	-	-	Inflamed	positive
89	karthiga	24/F	63202	7	Suggestive	absent	yes	Inflamed	positive
90	sasikala	24/F	63407	7	Suggestive	absent	yes	Inflamed	positive
91	ramamoorthy	18/M	63612	7	Suggestive	absent	yes	Inflamed	positive

92	jayalakshmi	24/F	63817	6	Not done	-	-	Inflamed	positive
93	jayaseelan	18/M	64022	7	Suggestive	absent	yes	Inflamed	positive
94	jaiganesh	18/M	64227	7	Suggestive	absent	yes	Inflamed	positive
95	logammal	24/F	64432	7	Suggestive	absent	yes	Inflamed	positive
96	karthik	18/M	64637	6	Not done	-	-	Inflamed	positive
97	arulmurugan	19/M	64842	7	Suggestive	absent	yes	Inflamed	positive
98	vanaja	24/F	65047	7	Suggestive	absent	yes	Inflamed	positive
99	thangaraj	19/M	65252	7	Suggestive	absent	yes	Inflamed	positive
100	umamaheshwari	24/F	65457	6	Not done	-	-	Inflamed	positive
101	anjammal	24/F	65662	7	Suggestive	absent	yes	Inflamed	positive
102	ponnambal	24/F	65867	7	Suggestive	absent	yes	Inflamed	positive
103	parthipan	19/M	66072	7	Suggestive	absent	yes	Inflamed	positive
104	karthick	19/M	66277	5	Not done	-	-	Inflamed	positive
105	devika	24/F	66482	7	Suggestive	absent	yes	Inflamed	positive
106	hajaniyamudeen	19/M	66687	7	Suggestive	absent	yes	Inflamed	positive
107	saranya	24/F	66892	7	Suggestive	absent	yes	Inflamed	positive
108	veeramani	19/M	67097	6	Not done	-	-	Inflamed	positive
109	kavitha	24/F	67302	6	not favourable	absent	no	Inflamed	positive
110	subathra	24/F	67507	5	not favourable	absent	no	Inflamed	positive
111	vignesh	19/M	67712	6	not favourable	absent	no	Inflamed	positive
112	snegan	19/M	67917	6	Not done	-	-	Inflamed	positive
113	vignesh	19/M	68122	7	Suggestive	absent	yes	Inflamed	positive
114	devakumar	19/M	68327	7	Suggestive	absent	yes	Inflamed	positive

115	rajkumar	20/M	68532	7	Suggestive	absent	yes	Inflamed	positive
116	kaviya	24/F	68737	6	Not done	-	-	Inflamed	positive
117	santhosh	20/M	68942	7	Suggestive	absent	yes	Inflamed	positive
118	kajammal	24/F	69147	7	Suggestive	absent	yes	Inflamed	positive
119	nadhiya	24/F	69352	7	Suggestive	absent	yes	Inflamed	positive
120	muniyandi	20/M	69557	6	Not done	-	-	Inflamed	positive
121	kanimozhi	24/F	69762	7	Suggestive	absent	yes	Inflamed	positive
122	vignesh kumar	20/M	69967	7	Suggestive	absent	yes	Inflamed	positive
123	muthu	20/M	70172	7	Suggestive	absent	yes	Inflamed	positive
124	nagavalli	24/F	70377	6	Not done	-	-	Inflamed	positive
125	arjun	20/M	70582	7	Suggestive	absent	yes	Inflamed	positive
126	janaki	24/F	70787	7	Suggestive	absent	yes	Inflamed	positive
127	senthil kumar	20/M	70992	7	Suggestive	absent	yes	Inflamed	positive
128	nithya	24/F	71197	6	Not done	-	-	Inflamed	positive
129	nathim	20/M	71402	7	Suggestive	absent	yes	Inflamed	positive
130	ayyammal	24/F	71607	8	Suggestive	absent	yes	Inflamed	positive
131	nivetha	24/F	71812	8	Suggestive	absent	yes	Inflamed	positive
132	kumaran	20/M	72017	6	Not done	-	-	Inflamed	positive
133	iyappan	20/M	72222	8	Suggestive	absent	yes	Inflamed	positive
134	saranya	24/F	72427	8	Suggestive	absent	yes	Inflamed	positive
135	thiyagarajan	20/M	72632	8	Suggestive	absent	yes	Perforated	positive
136	mahalakshmi	24/F	72837	6	Not done	-	-	Inflamed	positive
137	prakash	20/M	73042	8	Suggestive	absent	yes	Inflamed	positive
138	kalaiselvi	24/F	73247	8	Suggestive	absent	yes	Inflamed	positive
139	kamalakannan	20/M	73452	8	Suggestive	absent	yes	Inflamed	positive

140	sumathi	18/F	73657	5	Not done	-	-	Inflamed	positive
141	laya	18/F	73862	8	Suggestive	absent	yes	Inflamed	positive
142	jamuna	24/F	74067	8	Suggestive	absent	yes	Inflamed	positive
143	shanthi	18/F	74272	6	not favourable	absent	no	normal	negative
144	swathi	18/F	74477	6	Not done	-	-	Inflamed	positive
145	swetha	18/F	74682	8	Suggestive	absent	yes	Inflamed	positive
146	shanthi	18/F	74887	8	Suggestive	absent	yes	Inflamed	positive
147	thangamani	24/F	75092	8	Suggestive	absent	yes	Inflamed	positive
148	muniyammal	18/F	75297	6	Not done	-	-	Inflamed	positive
149	thangammal	18/F	75502	8	Suggestive	absent	yes	Inflamed	positive
150	muthayee	18/F	75707	8	Suggestive	absent	yes	Inflamed	positive
151	kodiyarasi	24/F	75912	8	Suggestive	absent	yes	Inflamed	positive
152	vasuki	24/F	76117	6	Not done	-	-	Inflamed	positive
153	vengatesh	20/M	76322	8	Suggestive	absent	yes	Inflamed	positive
154	bharathiraja	20/M	76527	8	Suggestive	absent	yes	Inflamed	positive
155	maheswari	24/F	76732	8	Suggestive	absent	yes	Inflamed	positive
156	mutharasi	18/F	76937	5	Not done	-	-	Inflamed	positive
157	prathika	66/F	77142	8	Suggestive	absent	yes	Inflamed	positive
158	pothumponnu	18/F	77347	8	Suggestive	absent	yes	Inflamed	positive
159	vemu	24/F	77552	8	Suggestive	absent	yes	Inflamed	positive
160	vembu	18/F	77757	6	Not done	-	-	Inflamed	positive
161	valli	18/F	77962	8	Suggestive	absent	yes	Inflamed	positive
162	revathy	68/F	78167	8	Suggestive	absent	yes	Inflamed	positive
163	swathi	24/F	78372	8	Suggestive	absent	yes	Inflamed	positive

164	valliammal	17/F	78577	6	Not done	-	-	Inflamed	positive
165	ponnammal	17/F	78782	8	Suggestive	absent	yes	Inflamed	positive
166	kanimozhi	24/F	78987	8	Suggestive	absent	yes	Inflamed	positive
167	ajithi	24/F	79192	8	Suggestive	absent	yes	Inflamed	positive
168	bakiyam	17/F	79397	6	Not done	-	-	Inflamed	positive
169	elanjiyam	64/F	79602	8	Suggestive	absent	yes	Inflamed	positive
170	mangai	17/F	79807	8	Suggestive	absent	yes	Inflamed	positive
171	nandhini	17/F	80012	8	Suggestive	absent	yes	Inflamed	positive
172	jeevitha	69/F	80217	5	Not done	-	-	Inflamed	positive
173	suseela	24/F	80422	8	Suggestive	absent	yes	Inflamed	positive
174	kamali	24/F	80627	8	Suggestive	absent	yes	Inflamed	positive
175	kanaga	24/F	80832	8	Suggestive	absent	yes	Perforated	positive
176	revathy	24/F	81037	6	Not done	-	-	Inflamed	positive
177	siva	52/M	81242	8	Suggestive	absent	yes	Inflamed	positive
178	sathyamoorthy	56/M	81447	8	Suggestive	absent	yes	Inflamed	positive
179	papathi	24/F	81652	8	Suggestive	absent	yes	Inflamed	positive
180	jansi deepika	24/F	81857	6	Not done	-	-	Inflamed	positive
181	vanitha	24/F	82062	8	Suggestive	absent	yes	Inflamed	positive
182	kanmani	24/F	82267	8	Suggestive	absent	yes	Inflamed	positive
183	amutha	24/F	82472	8	Suggestive	absent	yes	Inflamed	positive
184	banumathi	24/F	82677	5	Not done	-	-	Inflamed	positive
185	suresh kumar	53/M	82882	8	Suggestive	absent	yes	Inflamed	positive
186	kaviyarasan	54/M	83087	8	Suggestive	absent	yes	Inflamed	positive
187	navayee	24/F	83292	8	Suggestive	absent	yes	Inflamed	positive
188	vijitha	52/F	83497	6	Not done	-	-	Inflamed	positive

189	sumathi	17/F	83702	8	Suggestive	absent	yes	Inflamed	positive
190	sangeetha	17/F	83907	8	Suggestive	absent	yes	Inflamed	positive
191	arokiya princiya	51/F	84112	8	Suggestive	absent	yes	Inflamed	positive
192	iswarya	24/F	84317	5	Not done	-	-	Inflamed	positive
193	priya	17/F	84522	8	Suggestive	absent	yes	Inflamed	positive
194	mohana	17/F	84727	8	Suggestive	absent	yes	Inflamed	positive
195	shanmugapriya	17/F	84932	8	Suggestive	absent	yes	Inflamed	positive
196	mohaanaapriya	17/F	85137	6	Not done	-	-	Inflamed	positive
197	sumithra	17/F	85342	8	Suggestive	absent	yes	Inflamed	positive
198	lavanya	17/F	85547	8	Suggestive	absent	yes	Inflamed	positive
199	sumathi	17/F	85752	8	Suggestive	absent	yes	Inflamed	positive
200	selvam	30/M	85957	6	Not done	-	-	Inflamed	positive
201	mariyammal	53/F	86162	8	Suggestive	absent	yes	Inflamed	positive
202	vijay	30/M	86367	5	Suggestive	absent	yes	normal	negative
203	malathi	54/F	86572	8	Suggestive	absent	yes	Inflamed	positive
204	vinoth	30/M	86777	6	Not done	-	-	Inflamed	positive
205	vengadesan	41/M	86982	8	Suggestive	absent	yes	Inflamed	positive
206	vijayakumar	42/M	87187	8	Suggestive	absent	yes	Inflamed	positive
207	anuradha	15/F	87392	8	Suggestive	absent	yes	Inflamed	positive
208	arul prito	43/M	87597	6	Not done	-	-	Inflamed	positive
209	sakthivel	44/M	87802	8	Suggestive	absent	yes	Inflamed	positive
210	nandhini	15/F	88007	8	Suggestive	absent	yes	Inflamed	positive
211	noor mohammad	45/M	88212	8	Suggestive	absent	yes	Inflamed	positive
212	venkatesh	46/M	88417	6	Not done	-	-	Inflamed	positive

213	anbazhagan	30/M	88622	8	Suggestive	absent	yes	Inflamed	positive
214	nagammal	41/F	156	8	Suggestive	absent	yes	Inflamed	positive
215	kumarasamy	30/M	390	8	Suggestive	absent	yes	Inflamed	positive
216	kaliyan	30/M	624	6	Not done	-	-	Inflamed	positive
217	varadarajan	30/M	858	8	Suggestive	absent	yes	Inflamed	positive
218	durairaj	30/M	1092	8	Suggestive	absent	yes	Inflamed	positive
219	saradambal	42/F	1326	8	Suggestive	absent	yes	Inflamed	positive
220	deenadayalan	29/M	1560	6	Not done	-	-	Inflamed	positive
221	muthulakshmi	43/F	1794	8	Suggestive	absent	yes	Inflamed	positive
222	aiyyavu	29/M	2028	8	Suggestive	absent	yes	Inflamed	positive
223	azhagesan	29/M	2262	8	Suggestive	absent	yes	Inflamed	positive
224	mohandoss	29/M	2496	6	Not done	-	-	Inflamed	positive
225	dharmalingam	29/M	2730	8	Suggestive	absent	yes	Inflamed	positive
226	shanthamary	44/F	2964	8	Suggestive	absent	yes	Inflamed	positive
227	sundaramoorthy	29/M	3198	8	Suggestive	absent	yes	Inflamed	positive
228	murugaiyan	29/M	3432	6	Not done	-	-	Inflamed	positive
229	rajamanickam	29/M	3666	8	Suggestive	absent	yes	Inflamed	positive
230	raj	29/M	3900	8	Suggestive	absent	yes	Inflamed	positive
231	nayagan	29/M	4134	8	Suggestive	absent	yes	Inflamed	positive
232	sathya	45/F	4368	6	Not done	-	-	Inflamed	positive
233	karuppaiya	28/M	4602	8	Suggestive	absent	yes	Inflamed	positive
234	sivanesan	28/M	4836	8	Suggestive	absent	yes	Inflamed	positive
235	kaliyaperumal	28/M	5070	8	Suggestive	absent	yes	Inflamed	positive
236	manickam	28/M	5304	6	Not done	-	-	Inflamed	positive
237	logeshwari	46/F	5538	8	Suggestive	absent	yes	Inflamed	positive

238	perumal	28/M	5772	8	Suggestive	absent	yes	Abscess	positive
239	dakshinamoorthy	28/M	6006	8	Suggestive	absent	yes	Inflamed	positive
240	jaffar hussain	28/M	6240	6	Not done	-	-	Inflamed	positive
241	rakkappan	28/M	6474	8	Suggestive	absent	yes	Inflamed	positive
242	paramasivam	28/M	6708	8	Suggestive	absent	yes	Inflamed	positive
243	manickam	28/M	6942	8	Suggestive	absent	yes	Inflamed	positive
244	manjula	47/F	7176	5	Not done	-	-	Inflamed	positive
245	thangaraj	27/M	7410	8	Suggestive	absent	yes	Inflamed	positive
246	rajammal	48/F	7644	8	Suggestive	absent	yes	Inflamed	positive
247	arul	31/M	7878	8	Suggestive	absent	yes	Abscess	positive
248	ramaiya	32/M	8112	6	Not done	-	-	Inflamed	positive
249	vaduvambal	26/F	8346	9	Suggestive	present	yes	Inflamed	positive
250	manikandan	33/M	8580	9	Suggestive	present	yes	Perforated	positive
251	ravi	34/M	8814	9	Suggestive	present	yes	Abscess	positive
252	pandiyar	35/M	9048	6	Not done	-	-	Inflamed	positive
253	meeyanathan	36/M	9282	9	Suggestive	present	yes	Perforated	positive
254	amar singh	37/M	9516	9	Suggestive	present	yes	Perforated	positive
255	elakky	26/F	9750	9	Suggestive	present	yes	Abscess	positive
256	lakshmi	26/F	9984	6	Not done	-	-	Inflamed	positive
257	alamelu	26/F	10218	9	Suggestive	present	yes	Perforated	positive
258	kaviarasan	38/M	10452	9	Suggestive	present	yes	Perforated	positive
259	govindaraj	27/M	10686	9	Suggestive	present	yes	Abscess	positive
260	periyatchi	31/F	10920	6	Not done	-	-	Inflamed	positive
261	singaravelu	27/M	11154	9	Suggestive	present	yes	Perforated	positive
262	vargeesh	15/F	11388	9	Suggestive	present	yes	Perforated	positive

263	nagalakshmi	32/F	11622	9	Suggestive	present	yes	Abscess	positive
264	rajendran	27/M	11856	6	Not done	-	-	Inflamed	positive
265	panchali	33/F	12090	9	Suggestive	present	yes	Perforated	positive
266	selvi	34/F	12324	9	Suggestive	present	yes	Perforated	positive
267	ramaiya	27/M	12558	9	Suggestive	present	yes	Abscess	positive
268	perumal	27/M	12792	6	Not done	-	-	Inflamed	positive
269	mani	27/M	13026	9	Suggestive	present	yes	Perforated	positive
270	samiya	27/M	13260	5	not favourable	absent	no	normal	negative
271	kuppusamy	27/M	13494	9	Suggestive	present	yes	Inflamed	positive
272	thangamani	27/M	13728	5	Not done	-	-	Inflamed	positive
273	palanisamy	26/M	13962	9	Suggestive	present	yes	Abscess	positive
274	perumal	26/M	14196	5	not favourable	absent	no	Inflamed	positive
275	krishnan	26/M	14430	6	not favourable	absent	no	Inflamed	positive
276	saraswathy	35/F	14664	6	Not done	-	-	Inflamed	positive
277	chandrasekar	26/M	14898	9	Suggestive	present	yes	Perforated	positive
278	chandra	36/F	15132	9	Suggestive	present	yes	Perforated	positive
279	shankar	26/M	15366	9	Suggestive	present	yes	Abscess	positive
280	ponnaiyan	26/M	15600	6	Not done	-	-	Inflamed	positive
281	selvi	37/F	15834	9	Suggestive	present	yes	Perforated	positive
282	vadivel	26/M	16068	9	Suggestive	present	yes	Inflamed	positive
283	murugan	26/M	16302	9	Suggestive	present	yes	Abscess	positive
284	kumaravel	26/M	16536	9	Suggestive	present	yes	Abscess	positive
285	chellapa	26/M	16770	9	Suggestive	present	yes	normal	positive

286	pushpam	38/F	17004	9	Suggestive	present	yes	Perforated	positive
287	anandham	25/M	17238	9	Suggestive	present	yes	Perforated	positive
288	murugesan	25/M	17472	9	Suggestive	present	yes	Abscess	positive
289	ameer	25/M	17706	9	Suggestive	present	yes	Perforated	positive
290	pitchaimuthu	25/M	17940	9	Suggestive	present	yes	Perforated	positive
291	gowri	26/F	18174	9	Suggestive	present	yes	Abscess	positive
292	amsavalli	26/F	18408	9	Suggestive	present	yes	Perforated	positive
293	vijayarani	26/F	18642	9	Suggestive	present	yes	Inflamed	positive
294	sathya	25/M	18876	9	Suggestive	present	yes	Abscess	positive
295	tamil sevi	26/F	19110	9	Suggestive	present	yes	Perforated	positive
296	saroja	26/F	19344	9	Suggestive	present	yes	Perforated	positive
297	chellaiyan	25/M	19578	9	Suggestive	present	yes	Abscess	positive
298	chinnaiyan	25/M	19812	9	Suggestive	present	yes	Perforated	positive
299	kavitha	26/F	20046	9	Suggestive	present	yes	Perforated	positive
300	rasu udayar	25/M	20280	9	Suggestive	present	yes	Abscess	positive
301	arumugam	25/M	20514	9	Suggestive	present	yes	Perforated	positive
302	venkadachalam	25/M	20748	9	Suggestive	present	yes	Perforated	positive
303	kannan	24/M	20982	9	Suggestive	present	yes	Abscess	positive
304	murugesan	24/M	21216	9	Suggestive	present	yes	Perforated	positive
305	ramaiya	24/M	21450	9	Suggestive	present	yes	Perforated	positive
306	panchavarnam	26/F	21684	9	Suggestive	present	yes	Abscess	positive
307	mahalingam	24/M	21918	9	Suggestive	present	yes	Abscess	positive
308	jayaraman	24/M	22152	9	Suggestive	present	yes	normal	positive
309	mangalambal	26/F	22386	9	Suggestive	present	yes	Perforated	positive

310	marimuthu	24/M	22620	9	Suggestive	present	yes	Perforated	positive
311	chinnaiyan	24/M	22854	9	Suggestive	present	yes	Abscess	positive
312	kaliya perumal	24/M	23088	9	Suggestive	present	yes	Perforated	positive
313	raja mohmmad	24/M	23322	9	Suggestive	present	yes	Perforated	positive
314	muthu krishnan	24/M	23556	9	Suggestive	present	yes	Abscess	positive
315	pitchai pillai	23/M	23790	9	Suggestive	present	yes	Perforated	positive
316	andiappan	23/M	24024	9	Suggestive	present	yes	Perforated	positive
317	duraisamy	23/M	24258	9	Suggestive	present	yes	Abscess	positive
318	victoria	26/F	24492	9	Suggestive	present	yes	Perforated	positive
319	mariappan	23/M	24726	9	Suggestive	present	yes	Perforated	positive
320	backiyam	26/F	24960	9	Suggestive	present	yes	Abscess	positive
321	vinodh	23/M	25194	9	Suggestive	present	yes	Perforated	positive
322	natesan	23/M	25428	9	Suggestive	present	yes	Perforated	positive
323	nagaraj	23/M	25662	9	Suggestive	present	yes	Abscess	positive
324	amirtham	26/F	25896	9	Suggestive	present	yes	Perforated	positive
325	kunjammal	26/F	26130	9	Suggestive	present	yes	Perforated	positive
326	ravi	23/M	26364	9	Suggestive	present	yes	Abscess	positive
327	rajendran	23/M	26598	9	Suggestive	present	yes	Inflamed	positive
328	babu	23/M	26832	9	Suggestive	present	yes	Perforated	positive
329	sitha lakshmi	26/F	27066	9	Suggestive	present	yes	Abscess	positive
330	malika	15/F	27300	9	Suggestive	present	yes	Perforated	positive
331	marudhaiyan	22/M	27534	9	Suggestive	present	yes	Perforated	positive
332	subramaniyam	22/M	27768	9	Suggestive	present	yes	Abscess	positive
333	natarajan	22/M	28002	9	Suggestive	present	yes	Perforated	positive

334	srinivasan	22/M	28236	9	Suggestive	present	yes	Perforated	positive
335	murugaiyan	22/M	28470	9	Suggestive	present	yes	Abscess	positive
336	muralidaran	22/M	28704	9	Suggestive	present	yes	Perforated	positive
337	angamuthu	22/M	28938	9	Suggestive	present	yes	Perforated	positive
338	chinnathambi	22/M	29172	9	Suggestive	present	yes	Abscess	positive
339	mundiyayee	15/F	29406	9	Suggestive	present	yes	Perforated	positive
340	dhanalakshmi	15/F	29640	9	Suggestive	present	yes	Perforated	positive
341	vasantha	15/F	29874	9	Suggestive	present	yes	Abscess	positive
342	abdul rahman	22/M	30108	9	Suggestive	present	yes	Perforated	positive
343	pushpavalli	15/F	30342	9	Suggestive	present	yes	Perforated	positive
344	thangama	15/F	30576	9	Suggestive	present	yes	Abscess	positive
345	natarajan	22/M	30810	9	Suggestive	present	yes	Perforated	positive
346	sumathi	17/F	31044	9	Suggestive	present	yes	Perforated	positive
347	tamil selvi	15/F	31278	9	Suggestive	present	yes	Abscess	positive
348	selvi	15/F	31512	9	Suggestive	present	yes	Perforated	positive
349	rajadurai	21/M	31746	9	Suggestive	present	yes	Perforated	positive
350	veera kumari	15/F	31980	9	Suggestive	present	yes	Abscess	positive
351	gunasekar	21/M	32214	9	Suggestive	present	yes	Perforated	positive
352	suganthi	15/F	32448	9	Suggestive	present	yes	Perforated	positive
353	dakshinamoorthy	21/M	32682	9	Suggestive	present	yes	Abscess	positive
354	perumal	21/M	32916	9	Suggestive	present	yes	Perforated	positive
355	thangaiyan	21/M	33150	9	Suggestive	present	yes	Perforated	positive
356	marimuthu	21/M	33384	9	Suggestive	present	yes	Abscess	positive
357	chandra mohan	21/M	33618	9	Suggestive	present	yes	Perforated	positive

358	sambath kumar	21/M	33852	9	Suggestive	present	yes	Perforated	positive
359	ariya muthu	21/M	34086	9	Suggestive	present	yes	Abscess	positive
360	nagaraj	21/M	34320	9	Suggestive	present	yes	Perforated	positive
361	ponnammal	14/F	34554	9	Suggestive	present	yes	Perforated	positive
362	vasuki	14/F	34788	9	Suggestive	present	yes	Abscess	positive
363	latha	14/F	35022	9	Suggestive	present	yes	Perforated	positive
364	suganya	14/F	35256	9	Suggestive	present	yes	Perforated	positive
365	shanmugavalli	14/F	35490	9	Suggestive	present	yes	Abscess	positive
366	nithya	14/F	35724	9	Suggestive	present	yes	Perforated	positive
367	swathi	14/F	35958	9	Suggestive	present	yes	Perforated	positive
368	swetha	14/F	36192	9	Suggestive	present	yes	Abscess	positive
369	vidhu prabha	14/F	36426	9	Suggestive	present	yes	Perforated	positive
370	yazhini	14/F	36660	9	Suggestive	present	yes	Perforated	positive
371	seethe	14/F	36894	9	Suggestive	present	yes	Abscess	positive
372	sangeetha	14/F	37128	9	Suggestive	present	yes	Perforated	positive
373	supriya	14/F	37362	9	Suggestive	present	yes	Perforated	positive
374	suleka	14/F	37596	9	Suggestive	present	yes	Abscess	positive
375	saranya	14/F	37830	9	Suggestive	present	yes	Perforated	positive
376	sumathi	14/F	38064	9	Suggestive	present	yes	Perforated	positive
377	shanthi	14/F	38298	9	Suggestive	present	yes	Abscess	positive
378	devi	14/F	38532	9	Suggestive	present	yes	Perforated	positive
379	lakshmi	14/F	38766	9	Suggestive	present	yes	Perforated	positive
380	jagatheeshwari	14/F	39000	9	Suggestive	present	yes	Abscess	positive