

Dissertation

**“PROSPECTIVE STUDY ON THE
DIAGNOSTIC VALUE OF
HYPERBILIRUBINEMIA AS A PREDICTIVE
FACTOR FOR APPENDICULAR
PERFORATION IN ACUTE APPENDICITIS”**

**M.S. BRANCH - I
GENERAL SURGERY**



**MADRAS MEDICAL COLLEGE
THE TAMILNADU
Dr.MGR MEDICAL UNIVERSITY
CHENNAI – TAMILNADU**

APRIL 2013

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This is to certify that, the dissertation entitled “**PROSPECTIVE STUDY ON THE DIAGNOSTIC VALUE OF HYPERBILIRUBINEMIA AS A PREDICTIVE FACTOR FOR APPENDICULAR PERFORATION IN ACUTE APPENDICITIS**” is the bonafide work done by **Dr.THANGADURAI.R.R** during his MS (General Surgery) course 2010-2013, done under my supervision and is submitted in partial fulfillment of the requirement for the M.S.(BRANCH-I)- General Surgery of The Tamilnadu Dr.MGR Medical University, April 2013 examination.

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DECLARATION

I, certainly declare that this dissertation titled **“PROSPECTIVE STUDY ON THE DIAGNOSTIC VALUE OF HYPERBILIRUBINEMIA AS A PREDICTIVE FACTOR FOR APPENDICULAR PERFORATION IN ACUTE APPENDICITIS”** represents a genuine work of mine. The contributions of any supervisors to the research are consistent with normal supervisory practice, and are acknowledged.

I also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other University board, either in India or abroad. This is submitted to The TamilNadu Dr. M.G.R Medical University, Chennai in partial fulfillment of the rules and regulations for the award of Master of Surgery Degree Branch I (General Surgery).

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ACKNOWLEDGEMENT

As I walk down the memory lane I realize with a deep sense of humility that what I have done now would not have materialized, but for certain luminaries, who have enlightened my path to wisdom.

“Surgery is learnt by apprenticeship and not from textbooks, not even from one profusely illustrated” – Ian Aird.

While I put these words together it is my special privilege and great pleasure to record my deep sense of gratitude and indebtedness to my revered Professor and Guide **Prof.Bavani Sankar, M.S.** Madras Medical College and Rajiv Gandhi Government General Hospital (MMC & RGGGH) Chennai, but for whose constant guidance, help and encouragement this research work would not have made possible. The unflinching academic, moral and psychological support will remain ever fresh in my memory for years to come. Words cannot simply express my gratitude to him for imparting to me the surgical skills I have acquired.

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My sincere thanks to the entire Institute of Biochemistry and Institute of Pathology as well for granting me permission and helping me to conduct this study.

All along the way I have been supported and encouraged by all my associate professors and assistant professors who helped me to reach where I am.

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I thank the Dean, MMC & RGGGH for permitting me to conduct this study.

With deep reverence, I salute my parents and I thank the Almighty for blessing me a wonderful family to whom I have dedicated this thesis and leave unsaid what they mean to me.

The Declaration of Geneva is a declaration of physicians' dedication to the humanitarian goals of medicine. The Declaration of Geneva was intended as a revision of the Oath of Hippocrates to a formulation of that oath's moral truths that could be comprehended and acknowledged in a modern way.

The Declaration of Geneva, as currently amended, reads:

*AT THE TIME OF BEING ADMITTED AS A MEMBER OF
THE MEDICAL PROFESSION:*

- I SOLEMNLY PLEDGE to consecrate my life to the service of humanity;*
- I WILL GIVE to my teachers the respect and gratitude that is their due;*
- I WILL PRACTICE my profession with conscience and dignity;*
- THE HEALTH OF MY PATIENT will be my first consideration;*
- I WILL RESPECT the secrets that are confided in me, even after the patient has died;*

- *I WILL MAINTAIN* by all the means in my power, the honour and the noble traditions of the medical profession;
- *MY COLLEAGUES* will be my sisters and brothers;
- *I WILL NOT PERMIT* considerations of age, disease or disability, creed, ethnic origin, gender, nationality, political affiliation, race, sexual orientation, social standing or any other factor to intervene between my duty and my patient;
- *I WILL MAINTAIN* the utmost respect for human life;
- *I WILL NOT USE* my medical knowledge to violate human rights and civil liberties, even under threat;
- *I MAKE THESE PROMISES* solemnly, freely and upon my honour.

*Surgeons must be very careful
When they take their knife !
Underneath their fine incisions
Stirs the Culprit – Life !*

- **Emily Dickinson**

It is necessary that a surgeon should have a temperate and moderate disposition. That he should have well-formed hands, long slender fingers, a strong body, not inclined to tremble and with all his members trained to the capable fulfilment of the wishes of his mind. He should be of deep intelligence and of a simple, humble, brave, but not audacious disposition. He should be well grounded in natural science, and should know not only medicine but every part of philosophy; should know logic well, so as to be able to understand what is written, to talk properly, and to support what he has to say by good reasons.

- **Guido Lanfranchi**

CONTENTS

S.No.	TITLE	PAGE No.
1	INTRODUCTION	1
2	AIMS AND OBJECTIVES	3
3	REVIEW OF LITERATURE	4
4	MATERIALS AND METHODS	48
5	DATA ANALYSIS AND RESULTS	51
6	DISCUSSION	74
7	CONCLUSION	76
	BIBILIOGRAPHY	
	PROFORMA	
	MASTER CHART	
	KEY TO MASTER CHART	

INTRODUCTION

The most common emergency encountered in surgical practice is acute appendicitis.

The diagnosis of any form of appendicular pathology is clinical, clinical & clinical.

However even in experts hands there is possibility of missing the diagnosis as well as overt diagnosis.

The currently available blood tests and radiological imaging can aid in diagnosis but not very specific and not pertinent to the pathology involved.

Recent studies have shown that elevated bilirubin levels are associated with acute appendicitis & appendicular perforation.

These studies emphasized that hyperbilirubinemia can be used as a marker for both acute appendicitis and appendicular perforation.

Most of the studies conducted were retrospective on a large scale, few were prospective and were conducted on a small scale.

Taking the challenge to conduct a prospective study on this subject on a large scale basis & eliminating the bias, a step ahead to see whether the elevated bilirubin levels have a predictive potential for appendicular perforation thereby differentiating between the acute appendicitis and perforation seems fairly possible, to predict the preoperative diagnosis to precision thereby proper planning could be made and reducing the morbidity involved motivated me to conduct and complete this study.

AIMS & OBJECTIVES

To evaluate whether elevated bilirubin level has a predictive potential for the diagnosis of appendicular perforation.

The diagnosis of appendicular perforation should no longer be a diagnostic dilemma by availing the bilirubin level which would complement the clinical assessment.

To predict the preoperative diagnosis to precision thereby proper planning in management could be done and thence reducing the morbidity.

REVIEW OF LITERATURE

HISTORICAL REVIEW

Claudius Amyand, first removed the appendix in 1735, during the course of operation for hernia.

Mestivier (1759) was the first to willfully open and drain appendiceal abscess.

Hancock belongs the distinction of contributing the greatest surgical advance of treating appendiceal abscess; in 1848 he performed the first deliberate laparotomy for the same.

Willard Parker in 1867 again practiced this “bold” method of treatment.

In 1886, *Reginald Fitz* described acute and chronic appendicitis,^[2]

Kronlein (1884) has the credit in first in removing the appendix for acute disease employing an incision through the linea alba but his patient did not recover.

Sands (1887) closure of perforation of the appendix with suture.

Treves (1888) did the first interval appendicectomy.

Lawson Tait (1889) split open and drained an inflamed appendix without removing it, and his patient recovered.

Thomas G. Morton of Philadelphia first removed the appendix for alternative diagnosis of disease in the organ which was done deliberately.

The appendix first appears at 8th week of gestation as an outpouching of the caecum and it becomes fixed in the right lower quadrant after the medial rotation.

The sub mucosa contains lymphoid follicles, could have an undefined immune function early in life. The average length of appendix is 9 cm in adults.

The appendix is contained within the visceral peritoneum that forms the serosa, the outer longitudinal layer derived from the taenia coli; the inner circular layer by the deeper interior muscle layers. Submucosal layer, contains the lymphoepithelial tissue. The mucosa consists of columnar epithelium with few glandular elements and argentaffin cells. Taenia coli converge on the posteromedial area of the caecum which is the site of the appendiceal base. The appendix runs into a serosal fold of peritoneum the so called mesoappendix where ileocolic artery gives rise

to appendicular artery and sometimes posterior caecal artery may give rise to accessory appendicular artery.

EPIDEMIOLOGY

Appendicitis is one of the most common surgical emergencies. Incidence is 1.1 cases per 1000 per year. There is usually a slight male predominance. The incidence of appendicitis usually peaks in the second and third decades, and gradually declines in the geriatrics years.

ETIOPATHOGENESIS

Primary obstruction of the appendix lumen is the main pathology involved ^{[7][8]} Once this obstruction occurs, edema sets in, with increasing pressures within the lumen and the walls of the appendix, resulting in thrombosis and occlusion of the small vessels, followed by stasis of lymphatic flow.

Acute appendicitis may show focal uptake of labeled WBCs in the right lower quadrant in Technetium-99 radionuclide scan. Subsequently, the appendix becomes ischemic and then necrotic and finally suppuration sets in. The end result of this cascade is appendiceal rupture causing peritonitis, subsequently septicemia and even death.

The causative agents include most commonly appendicoliths or fecaliths, lymphadenitis, foreign bodies, pathological lead point in the form of benign or malignant lesion in proximity, intestinal worms.^[9]

The fecaliths are calcifications around the faecal deposits ;the lumen of appendix is small and this configuration may predispose to closed loop obstruction.

The occurrence of obstructing fecaliths is more frequent in developed than in developing countries,^[10] and hence the complicated appendicitis with similar results..^[11]

The occurrence of a fecalith in the appendix seems to be attributed to the fecal retention which is more in the right colon compared to the left and because of prolonged transit time which increases the occurrence of faecolith reservoir in the colon.^{[13][14]}.

Another factor involved in the pathogenesis of appendicitis is low fiber diet.^{[17][18][19]}

CLINICAL FEATURES

Pain, vomiting followed by fever last are the typical symptoms in that order in acute appendicitis. Both the appendix as well as the umbilical region are having the same dermatome i.e, T10 level, the pain starts in the umbilical region.

Later, the involvement of parietal peritoneum tends to localize the pain in the right lower quadrant, except in children in whom the omentum is underdeveloped and because of poor muscle tone.

The position of the appendix is variable and can be ascertained using the 3-dimensional multidetector CT scanning.

5 % of the population shows the base of the appendix at the McBurney's point.

35% within 3 cm of the point

30% 3-5 cm from that point

35% > 5 cm

In case of a retrocecal appendix , the caecum is distended with gas, protects the inflamed appendix from the pressure, hence even deep pressure in the right lower quadrant may fail to elicit tenderness.

In pelvic appendicitis, digital rectal examination elicits tenderness in the rectovesical pouch.

There should be a strong suspicion of peritonitis if the abdomen on palpation is rigid, requiring urgent surgical intervention.^[6]

DIAGNOSIS

Appendicitis needs to be considered in the differential diagnosis of nearly every patient with acute abdominal pain.

Early diagnosis remains the most important clinical goal in patients with suspected appendicitis and can be made primarily on the basis of history & physical examination in most cases.

The classical pattern of migratory pain is the most reliable sign of acute appendicitis. Typical appendicitis usually includes abdominal pain beginning in the region of the umbilicus for several hours, associated with anorexia, nausea or vomiting.

The pain then localises into the right lower quadrant where tenderness develops. The main features are pain, anorexia, leukocytosis, and fever.

This kind of typical progression is absent in atypical histories and may include pain in the right lower quadrant as an initial symptom. Hence, these patients often require imaging with ultrasound and/or CT scanning.^[21]

A pregnancy test is vital in all women of child bearing age so as to exclude ectopic pregnancies. The consequences of missing an ectopic pregnancy are serious, and potentially life threatening.

CLINICAL SIGNS

Dunphy's sign - any movement including coughing may cause increased pain.

Rovsing's sign - pain in the right lower quadrant during palpation of the left lower quadrant.

Obturator sign - pain on internal rotation of the hip

Suggests pelvic appendicitis.

Iliopsoas sign - pain on extension of the hip

Suggests retrocaecal appendix.

Aaron sign - pain or pressure in the epigastrium or anterior chest with persistent firm pressure applied to Mc Burney's point

Ten Horn sign - pain caused by gentle traction of right testicle

All the above signs are seen in acute appendicitis.

Bassler sign - sharp pain caused by compressing appendix between abdominal wall & iliacus indicates chronic appendicitis.

APPENDICITIS IN PREGNANCY

It is the most common cause of non-obstetric surgical disease of the abdomen during pregnancy. Diagnosis may be difficult because symptoms of nausea, vomiting, and anorexia, as well as elevated WBC count are common in pregnancy.

Moreover the location of tenderness varies with gestation. After the 5th month, the appendix is shifted superiorly above the iliac crest & the appendiceal tip is rotated medially into the right upper quadrant by the gravid uterus.

If Ultrasound is equivocal, MRI is suggested.

The main challenge is to recognize the possibility of appendicitis in pregnant patients and intervene promptly because peritonitis significantly increases the rate of fetal loss (2.5 -10 %).

INVESTIGATIONS

- An abnormal rise in the WBC count may signify infection or inflammation anywhere in the body system. Such a rise is not specific to appendicitis alone.

If it is abnormally elevated, with a good clinical history and examination, the likelihood of having the disease is higher.

- C-reactive protein (CRP) is a crude marker of infection or inflammation. Inflammation at ANY site can raise CRP protein produced by the liver in response to any infection or inflammatory process in the body. However it is not a specific test.

A significant rise in CRP, with clinical correlation may suggest the diagnosis of appendicitis. If the CRP continues to be normal even after 3 days of the onset of pain, there is high likelihood that it will resolve on its own without intervention.

Impending perforation or rupture and abscess formation may be indicated by the worsening CRP with good history.

IMAGING STUDIES

Because of the health risks involved in radiation exposure, it is prudent to use the ultrasound as a preferred modality first choice modality.^{[26][27][28]}

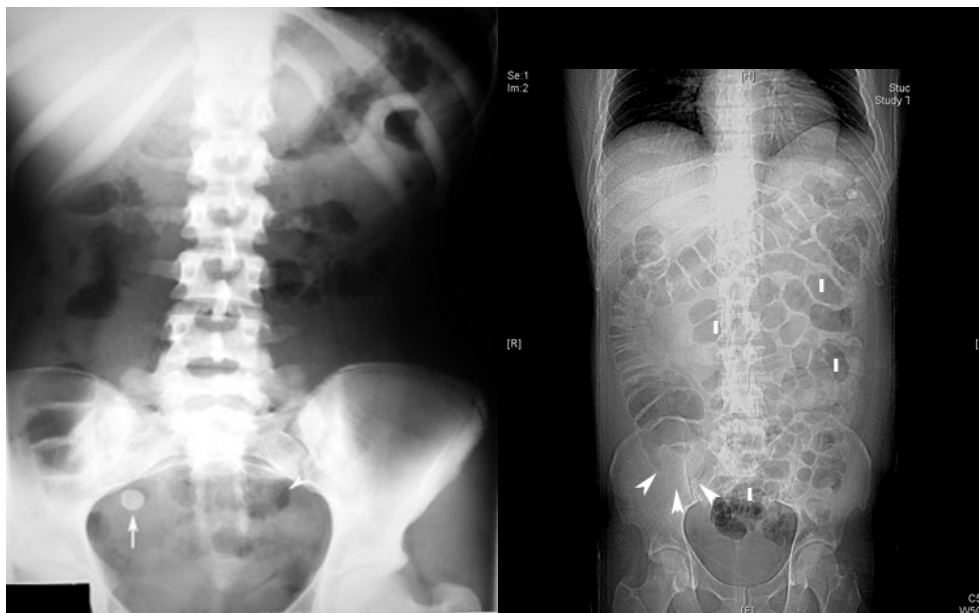
CT scan is more accurate for the diagnosis of appendicitis in adults and adolescents.

CT scan has a sensitivity of 92%, specificity of 90%. Ultrasonography had an overall sensitivity of 85%, a specificity of 80%.^[29]

RADIOGRAPHY

The radiological findings of appendicitis in plain abdominal radiograph

There are no specific signs of appendicitis in plain films but you may see

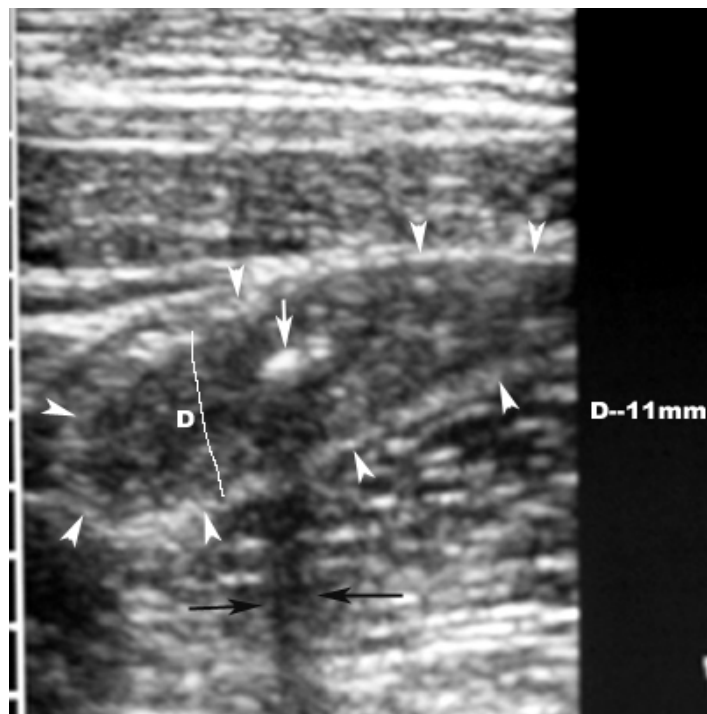


- Arrow points to appendicolith
- Arrowheads point to a soft-tissue mass producing deformity of the cecal air.
- I: Ileus

- sentinel loop (dilated adjacent ileum)
- evidence for complications like perforation or appendiceal abscess
- widening and blurring of peritoneal fat line
- right lower quadrant haze due to fluid, edema and mass
- mass indenting the cecum

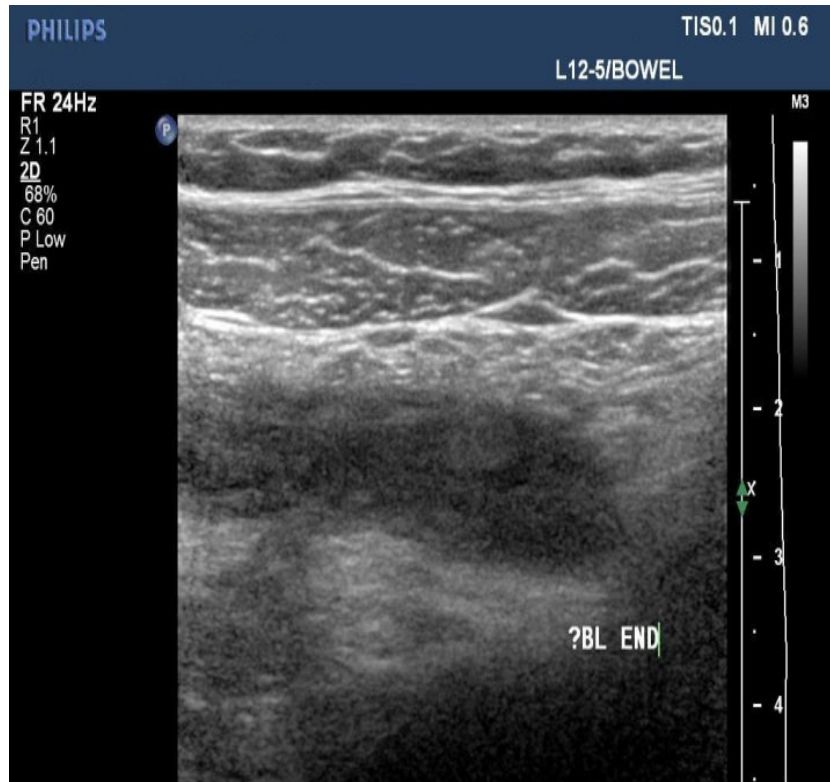
ULTRASOUND ABDOMEN

- The most sensitive sign of appendicitis from ultrasound is a non-compressible appendix with a diameter of 7mm or greater.



Appendicitis With Appendicolith

- White arrow points to appendicolith.
- D is the diameter of the appendix measuring more than 7 mm.
- Arrowheads point to distended appendix.
- Black arrows point to posterior shadowing.



USG FINDING OF DILATED APPENDIX

Other findings may include :

Thickened appendiceal wall abscess or fluid around the appendix

Free fluid is easily detectable by ultrasonography ; Color Doppler may show absence of blood flow with a visible appendix. In 10-15 % of the cases, especially in early appendicitis the bowel gas and fat in large amounts may interfere the appearance of appendix. Hence ultrasonography of the iliac fossa may produce false negative results without revealing abnormalities. The sonographic accuracy is higher in experienced hands can often distinguish appendicitis from other diseases.

The ACEP 2010 clinical policy update recommends using using ultrasonography for confirmation, but not exclusion, of acute appendicitis in paediatric patients. For this purpose,CT is recommended for excluding acute appendicitis.

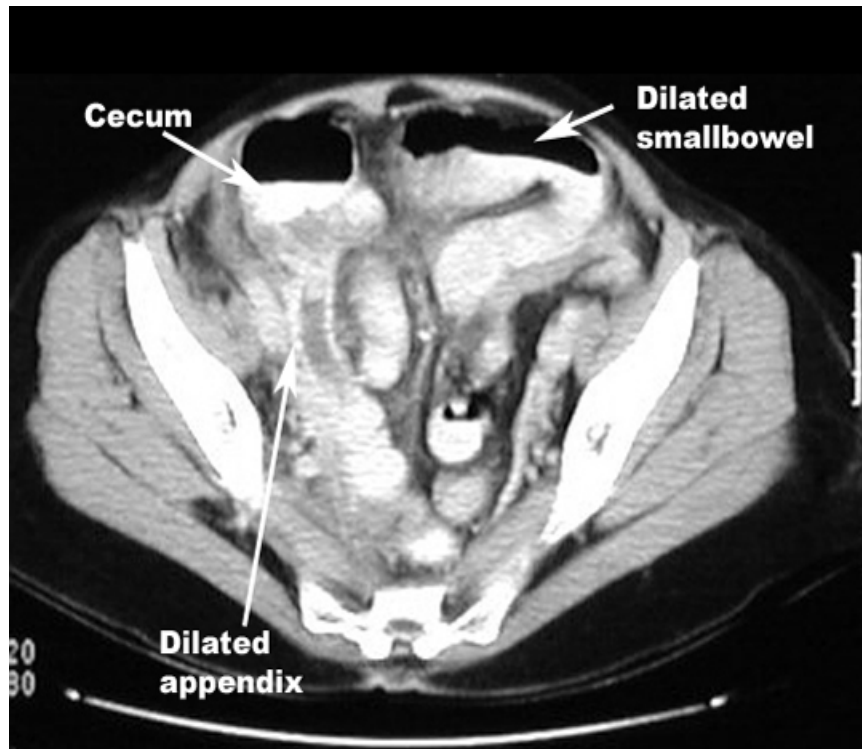
CT (*Computed tomography*) ABDOMEN

The classical finding includes

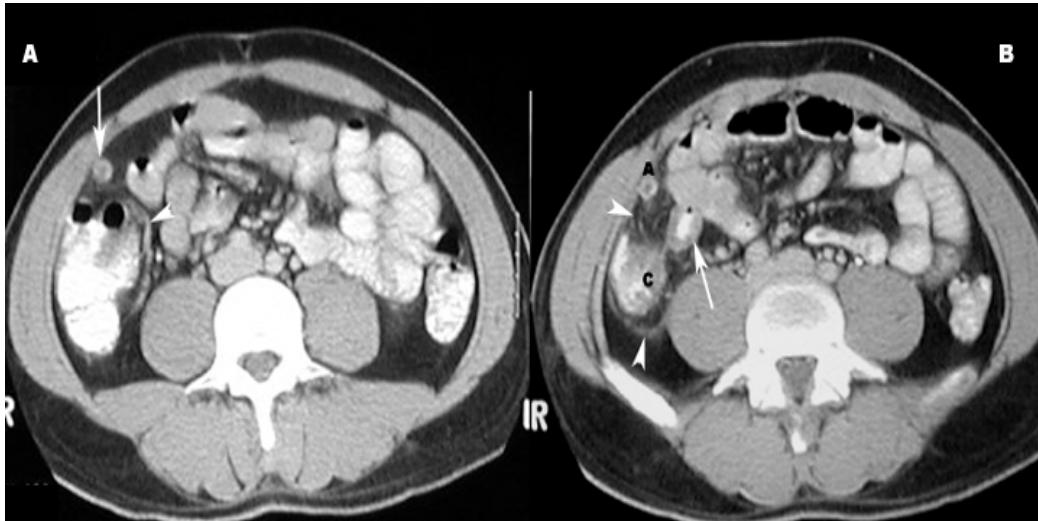
- Failure of the appendix to fill with oral contrast medium
- Dilated loops of bowel
- Appendix > 6mm in diameter
- An appendicolith
- Enhancement of its wall with intravenous contrast medium
- Periappendiceal inflammation/inflammatory infiltration of fat
- Free fluid in cul de sac
- Extra luminal gas from perforation
- Pericecal lymphadenopathy
- Caecal wall thickening
- Abscess
 - * Inflammatory (phlegmon) mass
 - * Air pockets
 - * Contrast enhancement

Acute Appendicitis

Dilated appendix and dilated loops of bowel

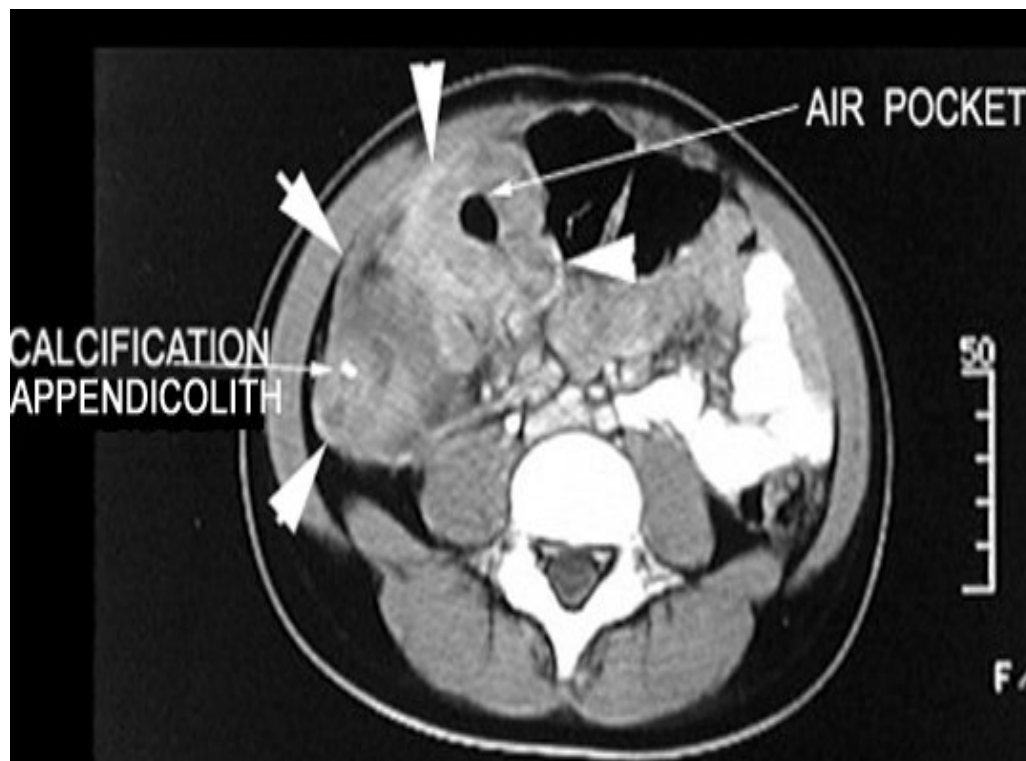


Appendicolith



- A. Arrow points to the appendicolith. Arrowhead points to the appendix.
- B. Arrow points to the thickened bowel wall. Arrowheads point to inflammatory infiltration of the fat.

Acute Appendicitis Appendiceal Abscess



Arrows point to the inflammatory mass in the right lower quadrant with an air pocket, indicating an abscess.

Mass demonstrates contrast enhancement.

The use of CT scan may be needed in patients with atypical histories. A properly performed CT scan with improved technology has a detection rate (sensitivity) of over 90%, and a similar specificity.

The clue to detect early appendicitis is "fat stranding". The CT scanning is very much useful in reducing the negative appendectomy rates.

The use of CT for diagnosis of appendicitis in Boston, MA has decreased the negative appendectomy rates from 20% to less than 5% in the Massachusetts General Hospital.

DIAGNOSTIC LAPAROSCOPY

It provides both a direct examination of the appendix and survey of the abdominal cavity for other possible causes of pain. This technique is primarily used for women of child bearing age in whom the preoperative pelvic USG or CT.

SCORING SYSTEMS

Alvarado score

Criteria	Points
Right iliac fossa tenderness	2
Leukocytosis	2
Fever	1
Migratory right iliac fossa pain	1
Rebound tenderness	1
Nausea and vomiting	1
Anorexia	1
Shift to left (segmented neutrophils)	1
Total score	10

A number of scoring systems have been devised to assist diagnosis using clinical and laboratory criteria of which the most preferred is Alvarado scoring system .^[30]

While a score of ≥ 7 the probability of acute appendicitis is much higher.

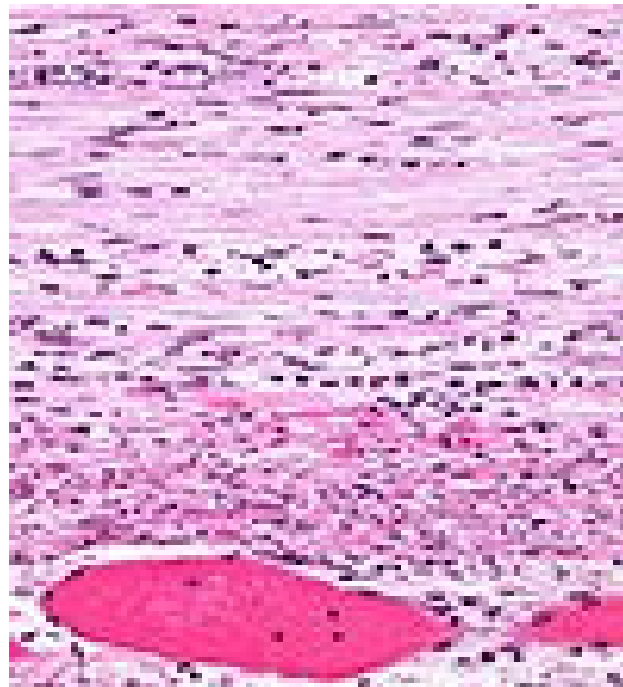
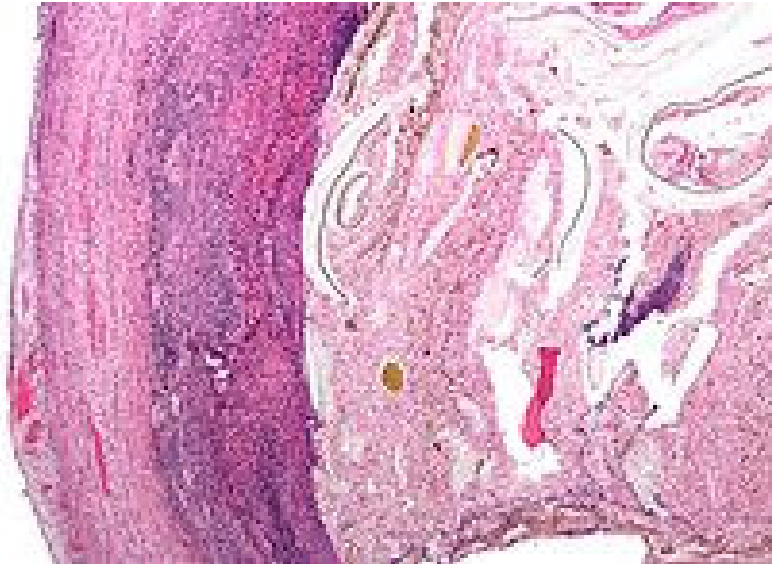
Score < 5 the chance is low and hence equivocal score may necessitates the use of CT to further reduce the frequency of unnecessary appendicectomies.

TZANAKIS SCORING

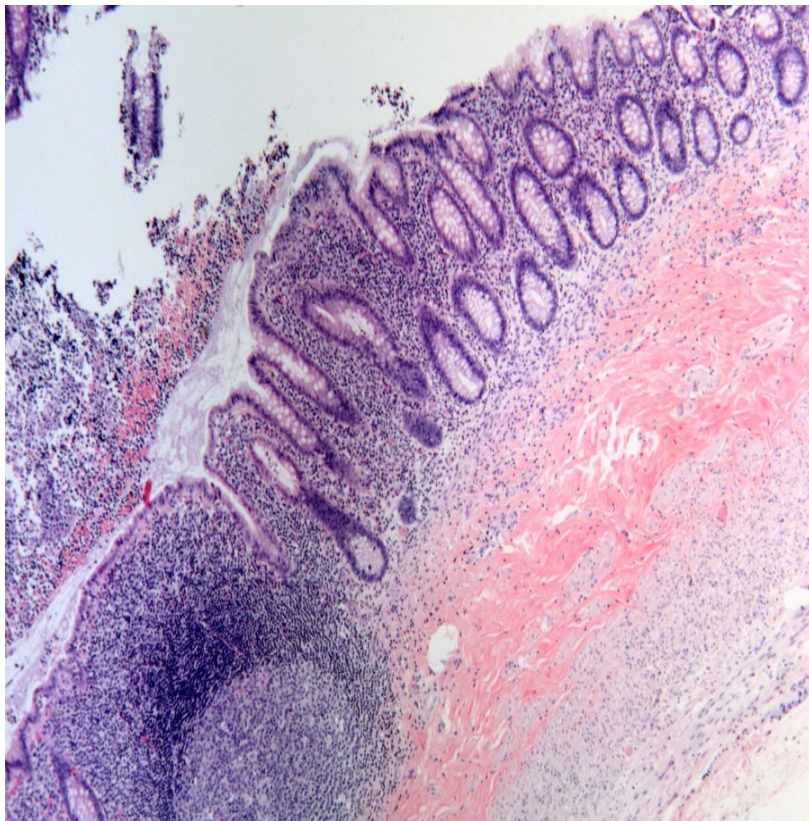
Tzanakis scoring system was introduced in 2005 to come to the diagnosis of appendicitis which has four variables namely right lower abdominal tenderness is given 4 points versus rebound tenderness, a score of 3, and WBC count $> 12,000 /\mu\text{L}$ a score of 2), as well as positive ultrasound findings has the highest score of 6, this would lead on to the total score of 15.

Score ≥ 8 implies that in more than 95 % of the cases, appendicitis exists.

HISTOPATHOLOGY



Microscopy (H&E) showing feature pathognomonic of appendicitis i.e., neutrophilic infiltration of the muscularis propria.



The definitive diagnosis is based on the pathological finding. The histologic finding pathognomonic of appendicitis is neutrophils infiltrating the muscularis propria.

DIFFERENTIAL DIAGNOSIS

In any case with acute abdomen , the possibility of appendicitis should be borne in mind.

The diagnosis of appendicitis is particularly difficult in the very young and in the elderly where imaging studies are strongly considered.

In pre-school children the differential diagnosis includes intussusceptions, meckel's diverticulitis, and acute gastroenteritis.

In school-aged children, the most common mimicker is mesenteric lymphadenitis

In adults, it is important to consider other regional inflammatory conditions such as pyelonephritis, colitis, and diverticulitis.

In women of childbearing age, consider pelvic pathology including pelvic inflammatory disease (PID), tubo-ovarian abscess, ruptured ovarian cyst or ovarian torsion, and ectopic pregnancy.

MANAGEMENT

The definitive modality of choice is prompt surgical removal of the appendix. A brief period of resuscitation (nil per oral with adequate hydration with intravenous fluids) is usually sufficient to ensure the safe induction of general anaesthesia.

Preoperative antibiotics cover aerobic and anaerobic colonic flora.^[32]

For patients with non-perforated appendicitis, a single preoperative dose of antibiotics reduces postoperative wound infections and intra-abdominal abscess formation. Postoperative antibiotics do not further reduce the incidence of infectious complications in these patients. For patients with perforated appendicitis it is recommended to continue postoperative intravenous antibiotics until the patient is afebrile.

The rupture of appendix will increase the complication rate rises from < 5 % to almost 60 %.^[38]

The assumption that delayed diagnosis of acute appendicitis results in higher morbidity does not hold good.

Eldar et al conducted a study to define the effect of patient and physician delay on the outcome of patients with acute appendicitis.

Conclusion is that the delay in patient presentation adversely affects the stage as well as the prognosis of the disease.

Observation of patients in hospital does not alter the outcome by any means in order to clarify the diagnosis is justified, as it does not adversely affect outcome.

ALGORITHM FOR EVALUATION & MANAGEMENT

Surgical consultation for acute abdominal pain



Clinical probability of acute appendicitis (assessment)

I) high- → operate

II) intermediate

USG / CT abdomen t & re-examine -- If + ve -> operate

If -ve → discharge

If uncertain - → D-Lap or admit & re-examine

III) low – If reliable & local -> discharge follow-up <24 hrs

If elderly / unreliable/ long distance → CT & re-examine

If + ve → operate

If - ve → discharge & follow up < 24 hrs

The patients are considered to have the so-called simple appendicitis if the duration of symptoms is less than 48 hours or the imaging shows the absence of phlegmon; these patients typically undergo appendectomy.

Several prospective randomized studies have compared laparoscopic and open appendectomy, and the overall differences in outcomes remain small.

Open appendectomy is usually easily performed through a transverse right lower quadrant incision (Davis-Rockey) or an oblique incision (Mc Arthur-Mc Burney) in cases with a large phlegmon or diagnostic uncertainty, a subumbilical midline incision may be used.

For uncomplicated cases a transverse, muscle-splitting incision lateral to the rectus abdominis muscle over McBurney's point.

Once the peritoneum is entered, the inflamed appendix is identified by the Taenia coli and its firmness.

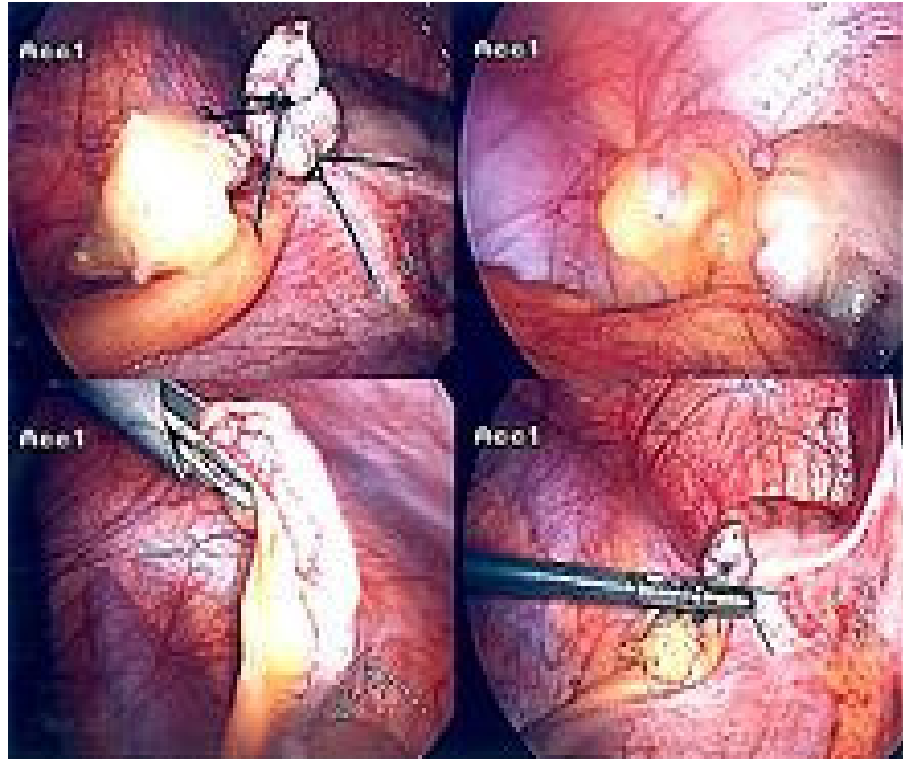
The base of the appendix is skeletonised at its junction with the caecum, absorbable suture material is tied and placed around the base of the appendix, and the specimen is clamped and divided.

If the base of the appendix and adjacent caecum are extensively indurated, an ileocaecal resection is performed.

Laparoscopic appendicectomy offers the advantage of diagnostic laparoscopy combined with the potential for shorter recovery and the incisions are less conspicuous.

Open Surgical Method





Laparoscopic appendectomy was first reported by the gynaecologist, Kurt Semm.

Laparoscopic removal has advantages over an open procedures especially in young females and the obese.^[34]

Meta-analysis of randomized controlled trials (RCTs) comparing LA to OA was conducted by Temple LK et al. Mean operating time was significantly longer with LA. There were fewer wound infections in LA. This meta-analysis suggests that laparoscopic appendicectomy have a slighter advantage in return to normal activities .

A study on “ Negative appendicectomy rate as a quality measure in the management of appendicitis: impact of computed tomography, Alvarado score and the definition of negative appendicectomy” was conducted by Mariadason JG et al ⁵⁹ both computed tomography and Alvarado coring reduces the frequency of unnecessary appendicectomies. This study examined the impact of CT, Alvarado score and definition on the NAR.

CT reduces the NAR regardless of definition but routine CT is not required for patients with positive Alvarado scores.

Early/mild appendicitis may resolve without surgery and CT may contribute to morbidity in the form of an unnecessary surgery. CT can be selectively used by Alvarado scoring in suspected appendicitis.

PROGNOSIS & OUTCOMES

The most important factor affecting the prognosis is the surgical treatment and if treatment is delayed or if peritonitis sets in, complications are the rule rather than exception.

Recovery time usually varies between 1.5 – 4 weeks. For young children, the recovery takes a little longer.

The mortality rate after appendicectomy is less than 1 percent.

The morbidity of perforated appendicitis is higher than that of non-perforated cases and is related to increased rates of wound infection, intra-abdominal abscess formation, increased hospital stay, and delayed return to full activity.

The complications mainly includes surgical site infections, small bowel obstruction and fistulae formation.

"Stump appendicitis" is because of inflammation occurring in the remnant of appendiceal stump after incomplete removal of appendix in appendicectomy.

Delay in surgery due to delayed presentation or mistaken judgment, leads to dreaded complications like gangrenous changes and perforation.

The rate of morbidity and mortality for patients operated for perforated or gangrenous appendicitis is much higher than those operated for non-gangrenous appendicitis.

Diagnosis of appendicitis is “clinical, clinical & clinical” and hence depends on clinical assessment and serial monitoring by the treating surgeon.

Various radiological investigations can aid in diagnosis which have a high precision but they are non-specific.

Escherichia Coli and *Bacteroids fragilis* account for majority of the flora seen in normal appendix, acute appendicitis and in perforated appendicitis.⁴³⁻⁴⁷

The appendix perforates about 48 hours after the onset of Acute appendicitis.

The delay in presentation is the main culprit behind most of the appendicular perforation. Overall rate of perforation is 25%.

Children <5 years and patients >65 years of age have highest rates of perforation. Appendicular perforation occurs most frequently distal to the point of luminal obstruction along the antimesenteric border.⁴³

**BACTERIA COMMONLY ISOLATED IN PERFORATED
APPENDICITIS {adapted from Bennion et al in fry DE (ed);
Surgical infections, Boston }**

AEROBIC	PATIENTS (%)
Escherichia coli	- 77
Streptococcus viridans	- 43
Group D streptococcus	- 27
Pseudomonas	- 18

ANAEROBIC	PATIENTS (%)
Bacteroides fragilis	- 80
Bacteriodes thetataomicron	- 60
Bilophilia wadsworthia	- 55
Peptostreptococcus species	- 46

LIVER - THE SENSOR OF BODY FUNCTIONS

↑
***NON-SPECIFIC HOST IMMUNE RESPONSE -> EDEMA,
INTRALUMINAL PRESSURE & ISCHEMIC NECROSIS
OF MUCOSA CAUSING GANGRENE & PERFORATION***



***TRANSMIGRATION / TRANSLOCATION OF BACTERIA / TOXINS
/ CYTOKINES (DIRECT INVASION / THROUGH PORTAL VEIN)***



ENDOTOXEMIA / BACTEREMIA



PHYSIOLOGICAL BILE FLOW OBSTRUCTION & HEMOLYSIS



HYPERBILIRUBINEMIA

Liver plays a central role in metabolism as well as in host defense mechanism and it receives substances absorbed or microorganism translocated from gastro intestinal tract (GIT).

Until recently the significance of hyperbilirubinemia is not taken seriously by the investigators.

This can be explained in that the jaundice can clinically be detectable at the bilirubin level above 2 mg % which is not in most of the cases;

The elevated bilirubin levels were neglected by the clinical features of acute appendicitis. Further it is important to note that hyperbilirubinemia is an independent variable¹. It is probably because of endotoxins caused by the appendiceal infection.

Utili et al ^[48-50] have demonstrated with an in vitro infusion of endo-toxin into an isolated rat liver which produced a dose-dependant decrease in the bile-salt excretion from the liver & direct damage at the cholangiolar level by E.coli endotoxin.

Sisson et al ^[51] demonstrated that the first morphological change to occur was mucosal ulceration in appendicitis.

This facilitates invasion of the bacteria into muscularis propria of the appendix, causing suppuration.

Then a cascade of events occur over a period of time causing bile-flow obstruction and primary hemolysis as explained below⁵²⁻⁵³ bacterial invasion is favoured by bacterial cytotoxi⁵⁴⁻⁵⁵.

In this model, Bennion et al.⁵²⁻⁵³ showed a stepwise that the bacterial endotoxin causes physiological bile flow obstruction.

It is important to exclude portal pyemia by ultrasonography of the portal vein.

It is difficult to differentiate the perforated appendicitis accurately from acute appendicitis on admission.⁵⁶

However, the likelihood of appendiceal perforation is > 2.5 times higher for patients with elevated serum bilirubin levels.

Therefore, a simple liver function tests could does a magic in detecting cases which are likely to undergo perforation when combined with clinical assessment along with the other imaging and tests.

Though various imaging modalities like computed tomography (CT) scan, magnetic resonance imaging (MRI) and ultrasonography may

help in early diagnosis of perforated appendix, they may not be readily available in many health centers of the third world and developing countries .⁵⁷

In such condition clinical and laboratory investigations may be the only, cheaper and readily available options for diagnosis.

A retrospective study conducted in Ruhr University, Germany found elevated bilirubin in all patients in the range of 0.1 – 4.3 mg/dl, while patients with Appendiceal perforation had Bilirubin in the range of 4.0 – 4.3 mg/dl.^{46A}

Study conducted by Dept. of Surgery, Nepalgunj Teaching Hospital, Nepalgunj, Nepal found elevated Total Serum Bilirubin (TSB) in 87% of cases.

The mean of elevated serum Bilirubin was 2.26mg/dl and in patients with gangrenous or perforated appendix; elevation of TSB was found to be much higher.⁴⁷

A retrospective study done in USC Medical Center, Los Angeles found elevated Bilirubin levels in 38 % of cases and a group of patients with perforation had significant elevated levels of bilirubin compared to patients with acute appendicitis.

The likelihood of appendiceal perforation are three times higher for patients with hyperbilirubinemia compared to those who are having normal range.

In a study conducted over for more than 100 patients of acute appendicitis jaundice occurred in 8 % after appendicectomy. This clinical abnormality is commonly associated with severe *E. coli* infection and the *E.coli* endotoxin has been shown to produce the physiological bile flow obstruction.

The jaundice tends to resolve fast. It tended to occur in the more severely infected cases, but it does not per se significantly increased the morbidity.

Hence it is worthwhile to recognize this form of jaundice so that the misinterpretation with its mimics may be avoided.⁵⁸

Advancement in the diagnostic and imaging techniques however does not have a greater impact on reducing the rates of negative findings on appendicectomy.

Hence monitoring the patient clinically is the most important factor in the management of patients with suspected acute appendicitis.

The use of CT scan or diagnostic laparoscopy as a routine is not recommended for all the patients in whom appendicitis is suspected because it is not cost-effective and hazardous because of the radiation exposure.

MATERIALS AND METHODS

STUDY DESIGN :

Prospective study

STUDY POPULATION:

378 patients.

STUDY PERIOD :

JAN 2012 - NOV 2012

Patients admitted with features of acute appendicitis or appendicular perforation in emergency surgical ward in RGGGH. The criteria for selection of cases based on clinical history, physical finding, radiological and haematological & biochemical investigations.

INCLUSION CRITERIA:

1. All patients diagnosed as acute appendicitis or appendicular perforation clinically on admission.
2. For both these groups, only patients with histopathological report suggestive of appendicitis would be included.

EXCLUSION CRITERIA:

All patients with positive HBs Ag / cholelithiasis / cancer on hepatobiliary systems.

All patients documented to have a past history of

Liver disease

Jaundice

Chronic alcoholism

Hemolytic disease

Congenital or acquired biliary disease

H/O drug intake causing cholestasis

INVESTIGATIONS

LIVER FUNCTION TEST on admission & followed up postoperatively till normalisation if raised previously

TOTAL BILIRUBIN-

Given below is the normal bilirubin range in adults:

* **Direct bilirubin:** 0.1 - 0.3 (mg %)

* **Indirect bilirubin:** 0.2 - 0.8

* **Total bilirubin:** 0.3 - 1.0

ALKALINE PHOSPHATASE

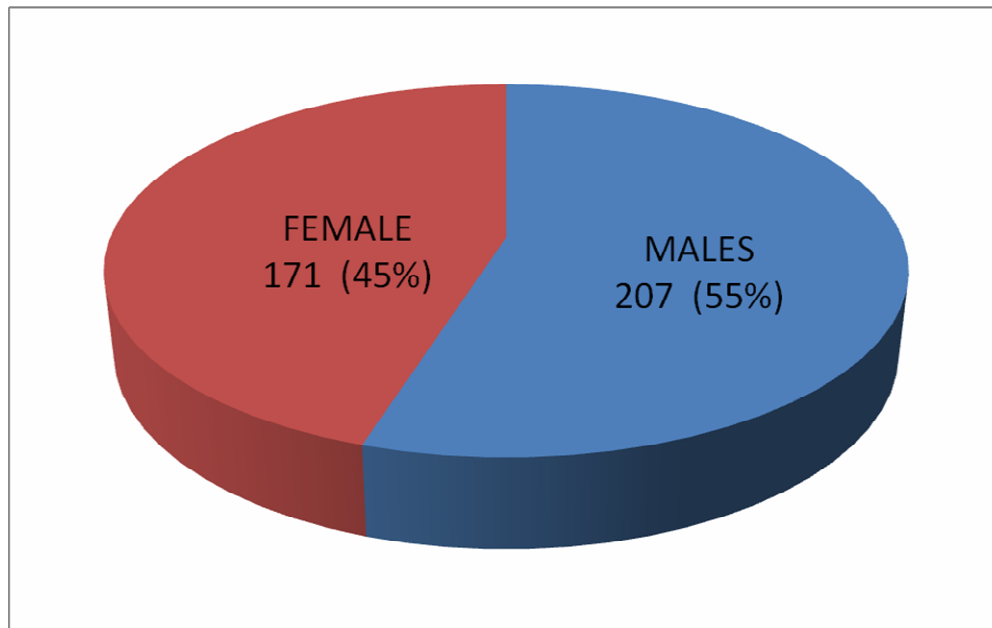
The normal range is 40 - 140 IU/L

Peripheral smear to R/O hemolytic anemia

Seropositivity for HBs Ag

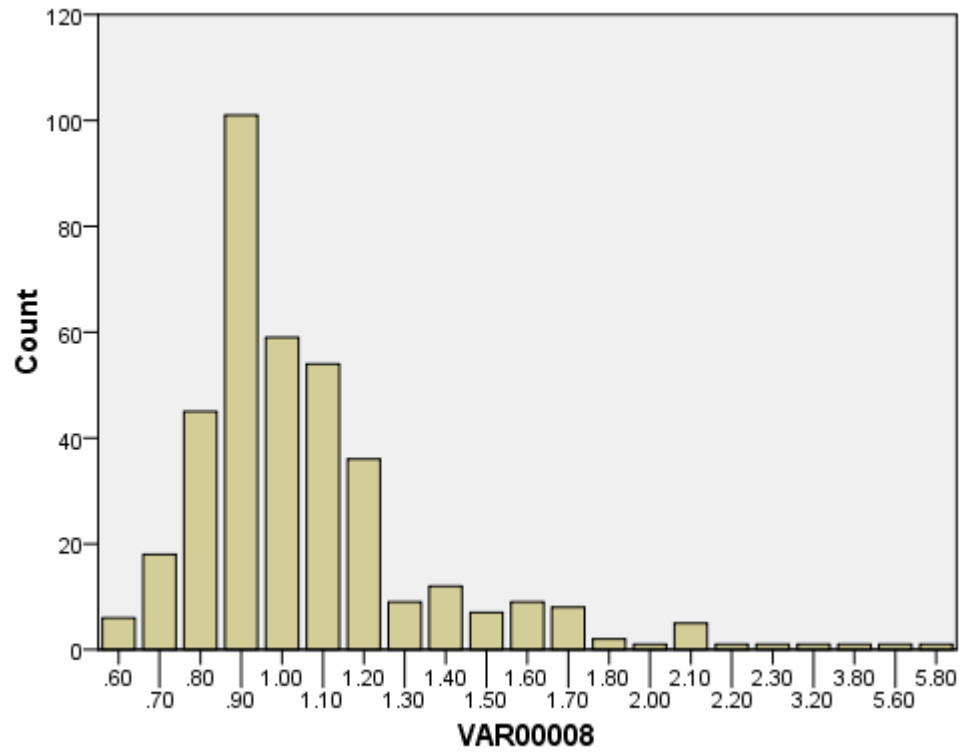
STATISTICAL ANALYSIS

SEX DISTRIBUTION



In our study, out of 378 study population 207 were males and 171 were females i.e 55 % were males and 45 % were females.

**FREQUENCY DISTRIBUTION WITH RESPECT TO BILIRUBIN
LEVELS**



	Frequency	Percent	Valid Percent	Cumulative Percent
Bilirubiin >1	67	17.7	17.7	17.7
≤ 1	311	82.3	82.3	100.0
Total	378	100.0	100.0	

DISTRIBUTION OF AGE GROUPS

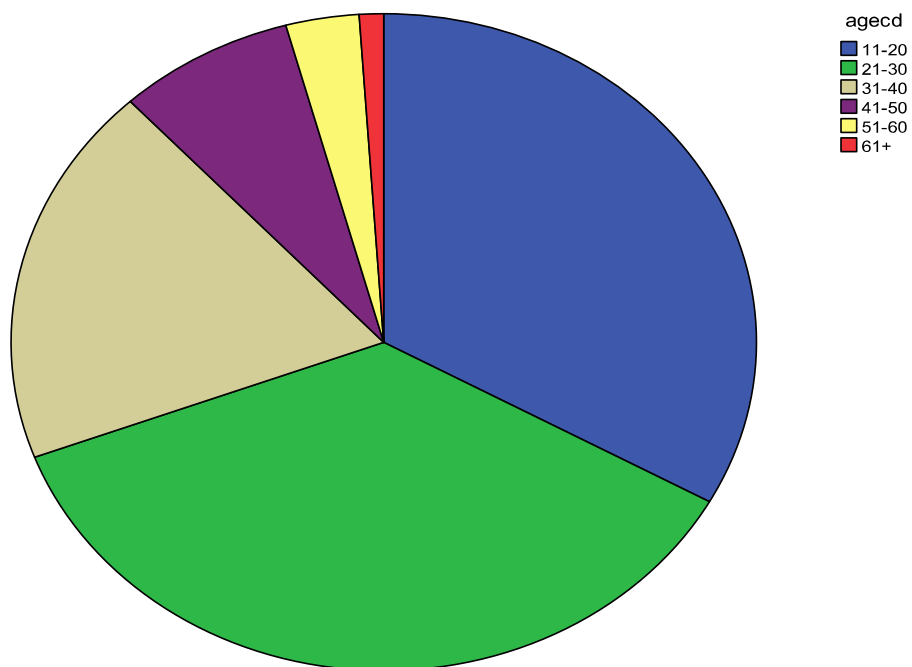
Age-groups	Frequency	Percent	Valid Percent	Cumulative Percent
11-20	125	33.1	33.1	33.1
21-30	137	36.2	36.2	69.3
31-40	71	18.8	18.8	88.1
41-50	29	7.7	7.7	95.8
51-60	12	3.2	3.2	98.9
61+	4	1.1	1.1	100.0
Total	378	100.0	100.0	

Out of 378 of study population, nearly 18 % had appendicular perforation & 82% had acute appendicitis.

Majority of the study population were between 15-35 years.

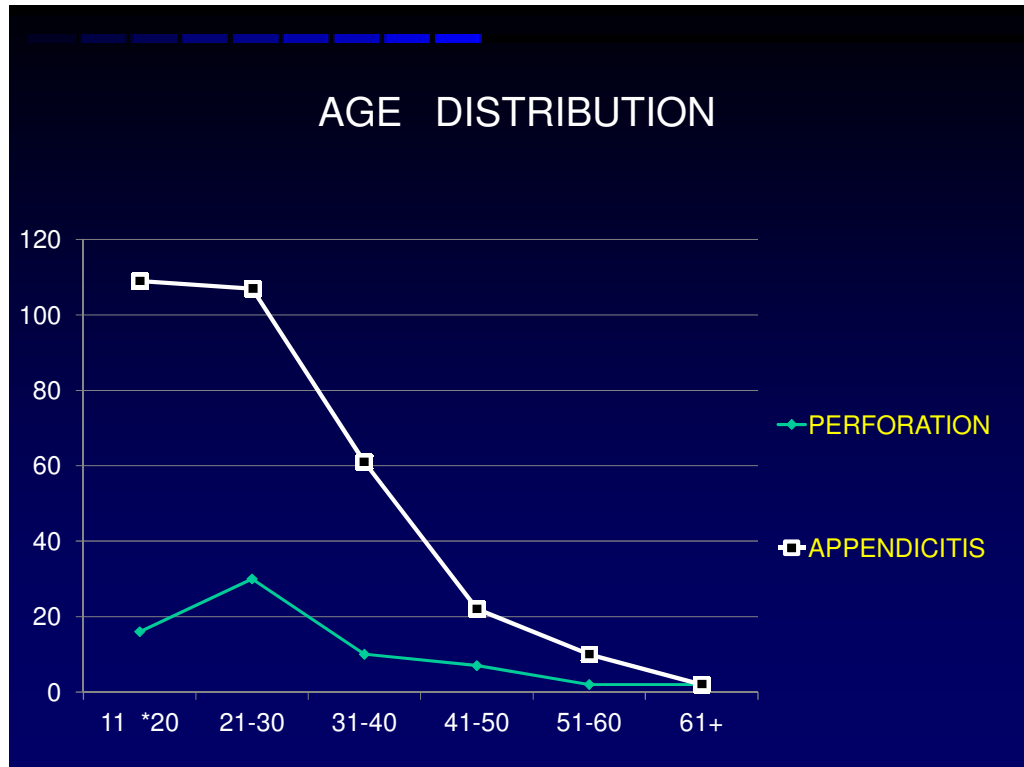
agecd * BILIRCD * PEROPCD Crosstabulation					
			BILIRUBIN		Total
			> 1	≤ 1	
PERFORATION	agecd	11-20	15	1	16
		21-30	27	3	30
		31-40	8	2	10
		41-50	6	1	7
		51-60	2	0	2
		61+	2	0	2
		Total	60	7	67
APPENDICITIS	agecd	11-20	28	81	109
		21-30	26	81	107
		31-40	16	45	61
		41-50	12	10	22
		51-60	7	3	10
		61+	0	2	2
		Total	89	222	311

PIE-CHART SHOWING DISTRIBUTION OF AGE-GROUPS



Majority of the study population were in the second and third decades of life and the frequency decreases as the age advances thereafter.

AGE DISTRIBUTION



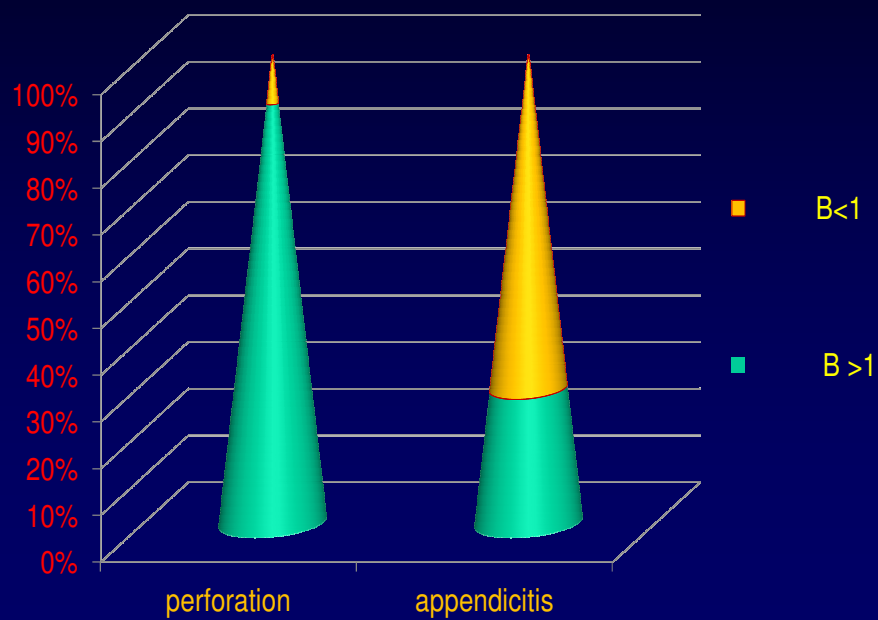
Fascinating it is to see the frequency distribution of age- groups in acute appendicitis peaked at 2nd followed by third decade where as perforation peaks at 3rd decade followed by second decade.

CROSS TABULATION

	BILIRUBIN (mg %)		Total
	> 1	≤ 1	
PERFORATION	60	7	67
APPENDICITIS	89	222	311
TOTAL	149	229	378

Out of 67 perforations, 60 patients have hyperbilirubinemia where as out of 311 patients with appendicitis, only 89 of them had elevated bilirubin i.e hyperbilirubinemia is more commonly associated with appendicular perforation than non-suppurative appendicitis that too with a significant elevation.

BILIRUBIN LEVELS IN APPENDICITIS & PERFORATION



In most of the cases with appendicular perforation, there is elevated bilirubin compared to patients with non-suppurative appendicitis where only 40% of the cases show hyperbilirubinemia.

PEARSON CORRELATION

	BILIRUBIN	PERFORATION
Pearson Correlation	1	-.535**
BILIRUBIN Sig. (2-tailed)		.000
N	378	378
Pearson Correlation	-.535**	1
PERFORATION Sig. (2-tailed)	.000	
N	378	378

** . Correlation is significant at the 0.01 level (2-tailed).

Hence the correlation with respect to the bilirubin and the appendicular perforation were statistically significant with 'p' < 0.01

CHI-SQUARE TEST

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	85.711 ^a	1	.000		
Continuity Correction ^b	83.178	1	.000		
Likelihood Ratio	89.709	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	85.484	1	.000		
N of Valid Cases ^b	378				

MANN-WHITNEY TEST

Ranks

	BILIRCD	N	Mean Rank	Sum of Ranks
PEROP CD	0	149	146.89	21887.0
	1	229	217.22	49744.0
	Total	378		

Test Statistics^a

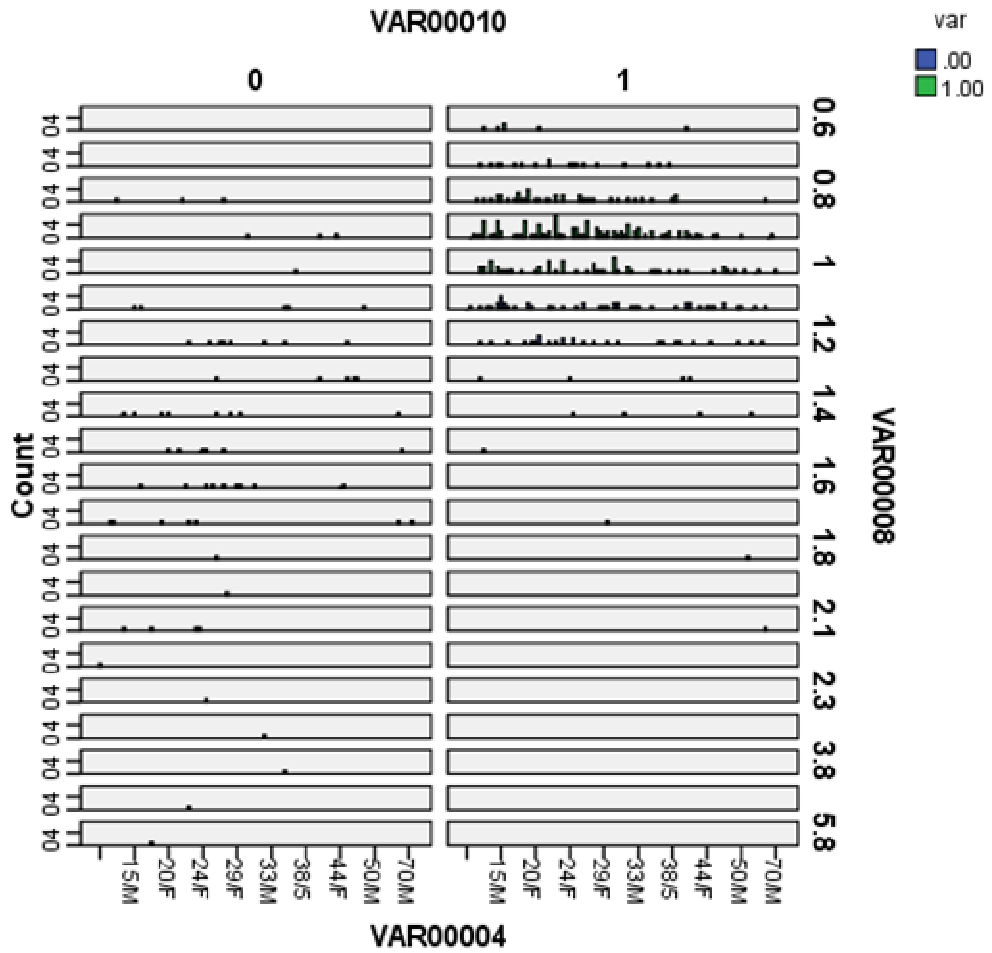
	PEROPCD
Mann-Whitney U	10712.000
Wilcoxon W	21887.000
Z	-9.246
Asymp. Sig. (2-tailed)	.000

NPar Tests

ONE SAMPLE KOLMOGOROV SMIRNOV TEST

		BILIRUBIN CODE
N		378
Normal Parameters ^a	Mean	.61
	Std. Deviation	.489
Most Extreme Differences	Absolute	.396
	Positive	.286
	Negative	-.396
Kolmogorov-Smirnov Z		7.691
Asymp. Sig. (2-tailed)		.000

PERFORATION VS APPENDICITIS



Clustering of cases in acute appendicitis occurs with the corresponding bilirubin levels between 0.8 – 1.2 mg %

Clustering of cases in appendicular perforation occurs with bilirubin levels corresponding to ≥ 1.3 mg %

This observation can be exploited in differentiating the patients with appendicular perforations & acute appendicitis having elevated bilirubin levels.

GROUP STATISTICS

<i>PERFORATION</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>
<i>BILIRUBIN</i> <i>0</i>	<i>67</i>	<i>1.6313</i>	<i>.87216</i>	<i>.10655</i>
<i>1</i>	<i>311</i>	<i>.9691</i>	<i>.18089</i>	<i>.01026</i>

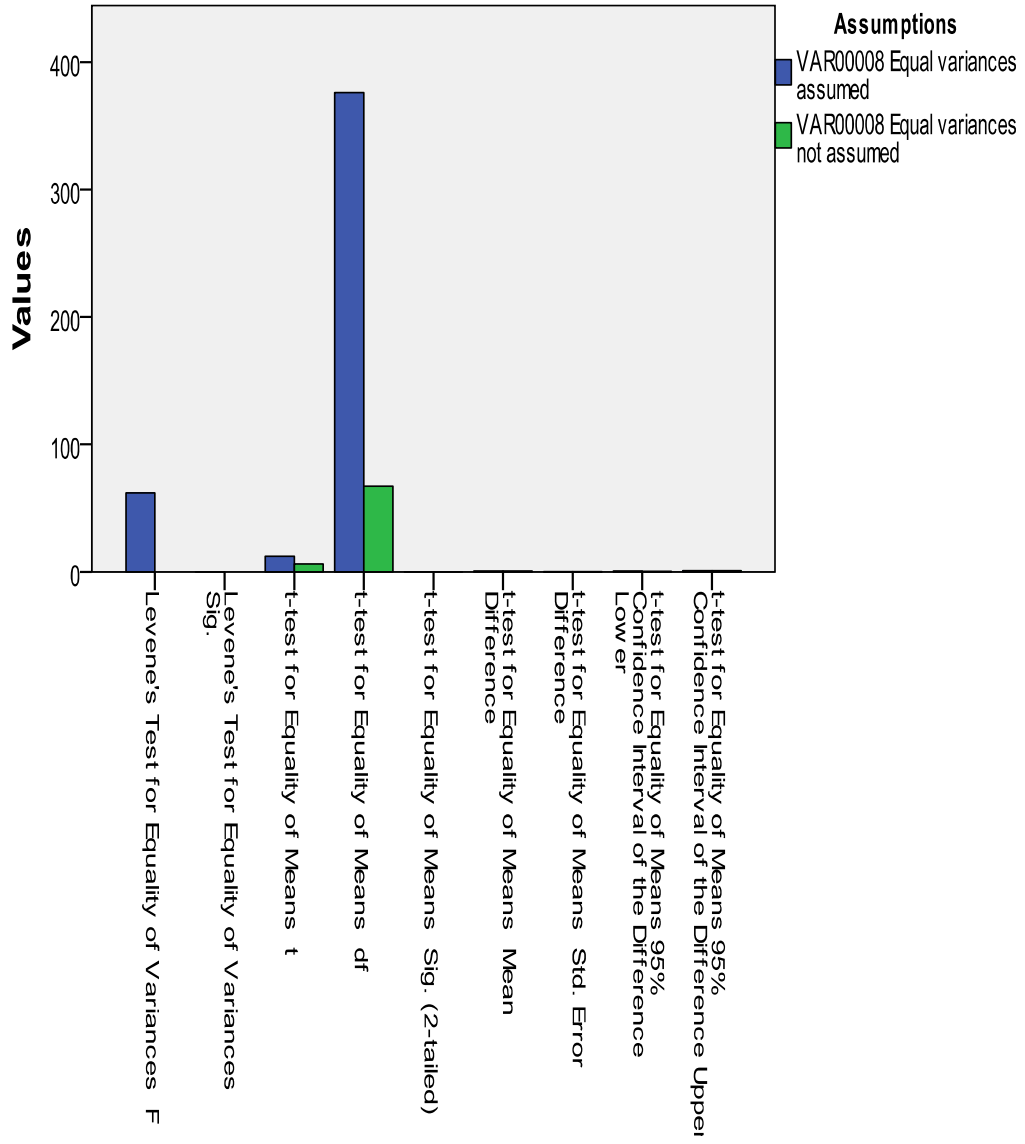
INDEPENDENT SAMPLES TEST

	f	sig	T	df	Sig (2-tailed)	Mean diff	Std error difference	lower	upper
Var 0008 Equal variances assumed	61.90	.000	12.27	376	0.000	.66	.054	0.56	0.77
Var 0008 Equal variances not assumed			6.19	67.22	0.000	.66	.107	0.45	0.88

- Var 0008 indicates the bilirubin level.

The mean value of bilirubin in appendicular perforation is 1.63 mg% and mean value in acute appendicitis is 0.97 mg% and the difference in the mean bilirubin levels is found to be statistically significant with 'p' < 0.001

Independent Samples Test



GROUP STATISTICS

		N	Mean	Std. Deviation	Std. Error Mean
ALP	PEFORATION	67	109.60	22.809	2.787
	APPENDICITIS	311	86.36	11.935	.677

INDEPENDENT SAMPLES TEST

	f	sig	t	df	Sig (2-tailed)	Mean diff	Std error difference	lower	upper
ALP Equal variances assumed	48.8	0.000	11.93	376	0.000	23.23	1.95	19.4	27.04
Equal variances not assumed			8.10	93.76	0.000	23.23	2.87	17.5	28.96

The mean alkaline phosphatase in appendicular perforation is 110 IU/L compared to appendicitis which is 86 IU/L (rounded)

The difference in the mean value is found to statistically significant with $p < 0.001$

RESULTS

SENSITIVITY = 89.6 %

SPECIFICITY = 71.4 %

POSITIVE PREDICTIVE VALUE , PPV = 27 %

NEGATIVE PREDICTIVE VALUE, NPV= 96.9 %

It is more prudent to set the bilirubin level cut-off at 1.3 mg% (as explained in the previous graph) so as to exclude the patients with appendicitis having elevated bilirubin levels because most of them fall in this category i.e, below 1.3 mg%

SENSITIVITY= 79% (in combining with clinical assessment = 97 %) because they are complementary to each other.

SPECIFICITY = 89 %

PPV = 93 %

NPV = 96 %

➤ Mean bilirubin level & ALP were

1.63 110 (perforation)

0.97 86 (non-perforated cases)

Statistically significant with 'p' < 0.001

In majority of the cases, direct bilirubin is much more elevated compared to the indirect bilirubin. Even in patients with normal total bilirubin, direct moiety is elevated (i.e, > 15 % of the total bilirubin). This supports the postulated physiological bile flow obstruction.

DISCUSSION

The results of our study (mean bilirubin 1.6 mg % in perforation vs 0.97 in acute appendicitis) is different & would challenge the retrospective study conducted by Sand M, Bechara G. et al Ruhr University, Bochum, Germany found elevated bilirubin in all patients in the range of 0.1 – 4.3 mg/dl, while patients with appendiceal perforation had bilirubin in the range of 4.0 – 4.3 mg/dl.^{46A} and also the prospective study conducted by Dept. of Surgery, Nepalgunj Teaching Hospital, Nepal which showed elevated Total Serum Bilirubin (TSB) in 87% of cases (40 % in our study) & the mean of elevated serum Bilirubin was 2.26mg/dl and in patients with gangrenous or perforated appendix elevation of TSB was found to be much higher.⁴⁷

It is important to note that the mean Alkaline phosphatase in most of the cases with appendicular perforation were in the high normal range and were normalized to their baseline postoperatively which was found to be statistically significant.

Normalisation of bilirubin &ALP occurs postoperatively within

48-72 hrs (perforation)

24-48 hrs (non-perforated cases)

Only 52/67 perforations were clinically detectable.

By combining the clinical diagnosis and bilirubin levels (cut-off 1.3 mg %) the detection rate of appendicular perforation i.e., from 55/67 → 65/67 (82 % →97 %) which is very much significant and this is possible because they are complementary to each other.

CONCLUSION

- The inclusion of hyperbilirubinemia as a standard criterion in the interpretation of appendicular perforation should be considered strongly along with the clinical assessment.
- Bilirubin level ≥ 1.3 mg % indicates clearly that there is a high likelihood of appendicular perforation.
- Hyperbilirubinemia as a predictive tool is easy to interpret, feasible and cost-effective.

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- . Bowel habits
- . Weight loss
- .Appetite
- .Smoker
- .Alcoholic
- .Sleep

5. Menstrual history (females)

6. Obstetric history (females)

7. Family history

8. General physical examination

Vital signs

- | | | | |
|----------|---|-------------------|---|
| Pallor | : | Pulse | : |
| Cyanosis | : | Blood pressure | : |
| Clubbing | : | Respiratory rate: | |
| Oedema | : | Temperature | : |
| Jaundice | : | Hydration | : |

Lymph node:

9.Systemic examination

Cardiovascular system

Respiratory system

Central nervous system

Examination of abdomen

Inspection

- . Shape :
- . Distention:
- .Respiratory movements of each region
- . Any skin changes:
- . Scars:
- . Any mass:
- .Hernial sites:

- . Renal angles:
- . Supraclavicular fossa:

Palpation

- . Cutaneous hyperaesthesia:
- . Tenderness:
- . Rebound tenderness :
- . Muscle rigidity
- . Any mass palpable
- . Palpation of hernial orifice
- . Supraclavicular fossa
- . Testes

Percussion

Auscultation

Per rectal examination

Per vaginal examination

10. Investigations

LIVER FUNCTION TEST on admission & followed up postoperatively till normalisation if raised previously

TOTAL BILIRUBIN , ALKALINE PHOSPHATASE , S.TOTAL PROTEINS , S.ALBUMIN

Peripheral smear to R/O hemolytic anemia

Seropositivity for HBs Ag

HB: TC: DC: BT: CT:

ESR: Urea: RBS: Blood grouping and typing

Urine

Sugar: Albumin: Microscopy:

ECG

X-RAY- Chest X-ray PA view

Abdomen erect and supine views

11. Preoperative diagnosis

1. Treatment

Preoperative treatment

Hourly Pulse								
Blood pressure								
Temperature								
Respiratory rate								
Iv fluids								
RTA								
UOP								
Abdominal girth								

Blood transfusions:

Drugs :

13. Operative management

Anaesthesia:

Incision :

Gross appearance: Color

Peritoneum

APPENDIX - Color:

Gangrene:

Perforation:

Pathology note

Surgical procedure

Postoperative treatment

**POST OP LIVER FUNCTION TEST ON DAY 1, DAY 3 ,
DAY 5**

Post-op complications if any

Histopathological report of specimen

Condition at the time of discharge

Advice on discharge

Follow –up for any complaints

Remarks

MASTER CHART

SL NO	NAME	AGE SEX		DATEAD	PEROP	BILI RUBIN	ALP
		IPNO	IP No				
1	SELVI	32/F	217	2/1-8/1		0.90	90
2	KARTHICK	14/M	1173	4/1 -8/1		1.10	92
3	SAKUNTHALADEVI	27 /F	2543	9/1-19/1		0.80	69
4	SHYAMALA	20 /F	3511	11/1-14/1		0.90	68
5	ANITHA	26 /F	3333	11/1-14/1		1.10	87
6	MANIMEGHALAI	16 /F	4578	16/1-19/1		0.60	75
7	PREMA	26 /F	4768	16/1-19/1	GANGRENOUS	1.30	64
8	LAWYRAALI	53 /F	4947	17/1- 20/1		1.20	62
9	LOKESH	20/M	6493	21/1-28/1		0.90	96
10	GEETHALAKSHMI	18/F	6536	22/1-26/1		1.00	70
11	BASHVERIA	15/F	7012	23/1-24/1		0.90	81
12	VENKATESAN	23/M	8517	27/1 -31/1		0.80	76
13	PANDIYAN	22/M	8559	27/1-1/2		0.90	81
14	JOTHY	17/M	8618	27/1-31/1	PERFORATION	2.10	121
15	KUMARAVEL	20/M	8910	28/1 – 3/2		1.20	83
16	MAHENDRAN	22/M	10392	1/2- 5/2		1.20	80
17	RAJAN	17/M	10433	2/2-7/2		0.80	89
18	DEVIKA	15/F	11919	6/2-18/2		0.90	76
19	MONA	18/F	12681	8/2-11/2		0.80	90
20	RANI	60/F	13973	12/2-29/2	PERFORATION	1.70	128
21	GEENATH	34/F	14266	13/2-18/2		0.80	75
22	KOTTESWARI	33/F	14452	14/2-18/2		0.90	86
23	UDAYALASM	26/M	17583	22/2-25/2		0.90	80
24	RAMYA	13/F	17427	22/2-25/2		1.30	79
25	JABIN	20/F	17618	22/2-25/2	PERFORATION	1.50	109
26	VINAYAGAM	31/M	17650	22/2-25/2		0.90	92
27	VIYAYA SANTHY	20/F	18094	24/2-29/2		0.80	77
28	JOTHI	25/F	18369	25/2- 3/3		0.70	70
29	SUGANYA	42/F	18535	25/2-12/3		1.10	90
30	THULASI	58/F	18648	26/2-9/3		1.20	112
31	KUPPUSAMY	36/M	18963	27/2-3/3	PERFORATION	1.00	87
32	RAJESH	23/M	19039	27/2- 3/3		0.90	82
33	RAMYA	12/F	19682	29/2-3/3		0.90	90
34	GIRIJA	13/F	19734	27/10-3/10	PERFORATION	1.70	124
35	SATHYAMOORTHY	28/M	19848	29/2-6/3		0.90	80
36	IQBAL	30/M	20286	3/3-11/3		1.10	82
37	SUMATHY	29/F	20801	3/3-9/3		1.10	86
38	MONISHA	13/F	20889	4/3-14/3		0.90	79
39	SATHYA	13/F	21903	7/3-17/3		1.00	81
40	GOUTHAMKUMAR	23/M	22195	7/3-13/3		1.10	86

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
41	KALAIYARASI	36/F	23557	12/3-20/3		1.20	90
42	VALARMATHY	25/F	23874	12/3-22/3		0.90	90
43	DEVI	26/F	23875	12/3-20/3		0.80	87
44	BAKKIYALAKSHMI	17/F	24320	14/3-19/3		0.70	90
45	SATHISHKUMAR	20/M	24476	14/3-20/3		1.20	64
46	GOWRI	48/F	24614	14/3-23/3	GANGRENOUS	1.30	68
47	BHARATHI	15/M	24632	14/3-17/3		1.10	90
48	SUMATHI	30/F	25500	17/3-23/3		1.00	80
49	GEETHA	32/F	25565	17/3-23/3		0.90	81
50	ANUSUYA	22/F	25883	19/3-27/3	PERFORATION	1.60	112
51	PONNUTHAI	40/F	26165	19/5-23/5		1.10	85
52	MURUGAN	54/F	26433	20/3-24/5		1.10	80
53	SASIKALA	37/F	27662	24/3-1/4		0.90	81
54	KARTHIKADEVI	29F	28181	26/3-2/4		0.80	84
55	PRAKASH	14/M	28656	24/3-1/4	PERFORATION	1.40	108
56	ELUMALAI	30/M	29989	31/3-8/4		0.90	72
57	SANJAY SHARMA	13/M	30350	2/4-5/4		1.00	81
58	SAMUNDI	24/M	30701	2/4-8/4		1.40	112
59	GILBERT	23/M	31622	5/4-9/4		0.80	88
60	MALLESWARI	38/F	31674	5/4-16/4		1.10	87
61	ANWAR	27/M	31721	5/4-9/4		1.20	83
62	ALAMELU	48/F	31915	6/4-22/4		1.00	84
63	RAJALAKSHMI	32/F	31753	6/4-15/4		1.00	87
64	ALAMELU	48/F	31959	6/4-10/4		1.10	80
65	LAKSHMI	28/F	32297	8/4-11/4		1.00	72
66	JAYTHUMBEE	28/F	32572	9/4-15/4		0.90	102
67	SUNDARAMOORTHY	14/M	34047	13/4-20/4		0.80	87
68	MEENA	35/F	34512	16/4-6/5		1.10	73
69	RAMESH	26/F	34528	16/4-24/5	PERFORATION	1.80	127
70	SARALA	26/F	34952	16/4-24/4		1.10	82
71	SAMBAIYAH	26/M	35017	16/4-24/4		0.90	87
72	SATHISH KUMAR	22/M	37442	23/4-24/4		0.80	77
73	SAMEERA	13/F	37860	25/4-1/5		0.70	88
74	SARAVANAN	29/M	38537	26/4-31/5		0.90	90
75	HARITHA	15/F	38914	28/4-6/5		1.10	82
76	ALAGESAN	36/M	39679	30/4-3/5		0.90	84
77	SURIYA	19/F	40398	2/5-8/5	ABSCCESS	1.40	108
78	TAMILSELVAN	15/M	40500	3/5-11/5	PERFORATION	1.10	92
79	SATHYA	30/F	40505	3/5-9/5		1.00	78
80	SATHISH BABU	21/M	41908	7/5-13/5		0.90	77
81	BHUVANESHWARI	25/F	42591	9/5-15/5		0.90	89
82	ARUL	40/M	42608	9/5-15/5		1.10	70
83	SURENDRAN	23/M	42839	9/5-15/5		1.00	78

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
84	REVATHI	30/F	42921	9/5-15/5		1.10	81
85	RENUGA	24/F	43000	10/5-19/5	PERFORATION	1.50	112
86	RAJI	30/F	43316	10/5-16/5		0.90	92
87	YAVASRI	15/F	43321	10/5-16/5		0.80	70
88	ANITHA	20/F	44028	13/5-18/5	PERFORATION	1.40	107
89	RAJENDRAN	41/M	44185	14/5-21/5		0.90	80
90	AJITH	12/M	44191	14/5-20/5		0.80	88
91	RAJESHKUMAR	23/M	44557	14/5-21/5		1.00	82
92	NAVANEETHAM	45/F	45222	16/5-30/5		1.20	90
93	PONNUTHAI	40/F	45371	16/5-21/5		1.10	82
94	VALLIAMMAL	21/F	46051	18/5-20/5	PERFORATION	1.50	87
95	NALINI	24/F	47311	22/5-30/5		1.30	108
96	SRIDHAR	20/M	47916	24/5-30/5		1.00	97
97	KASI	40/M	47963	24/5-4/6		0.90	81
98	MALAR	38/F	48055	24/5-30/5		0.80	91
99	PRIYA	17/F	48047	24/5-30/5		0.90	76
100	JEREHA	19/F	48100	24/5-30/5		1.10	93
101	NAGARAJ	25/M	48128	25/5-30/5	PERFORATION	1.60	119
102	SHANKAR	29/M	48714	27/5-1/6		0.90	101
103	KALI	23/M	49337	29/5-1/6		1.20	98
104	MARY	26/F	49931	30/5-3/6		0.90	78
105	RAMACHANDRAN	35/M	49957	30/5-4/6	PERFORATION	1.10	90
106	SELVARAJ	45/M	49969	30/5-4/6		1.00	93
107	JAYAMALA	15/F	50353	31/5-5/6		0.80	78
108	KANNIYAMMAL	28/F	50378	31/5-10/6		0.90	91
109	VIJAY	15/M	50402	31/5-6/6		1.10	96
110	ANUSIYA	29/F	50500	1/6-9/6	PERFORATION	1.60	109
111	KRISHNAN	38/M	52421	7/6-20/6		0.90	101
112	GOWTHAM	22/M	52456	7/6-13/6		0.80	78
113	SATHISH KUMAR	19/M	52610	8/6-14/6		0.90	83
114	SWARNABHARATHI	13/F	52613	8/6-9/6		1.10	96
115	SOKKALI	48/M	53213	10/6-13/6		1.00	80
116	MASHEK	18/M	53339	10/6-18/6		1.20	92
117	MUTHU	25/M	53406	11/6-14/6		0.90	81
118	JOTHIRAMAN	15/M	53786	11/6-18/6		0.80	78
119	SARAVANAN	24/M	55073	14/6-17/6		0.70	89
120	KARTHIKEYAN	13/M	55142	15/6-20/6		0.90	92
121	KARTHIKEYAN	24/M	55832	17/6-20/6	PERFORATION	1.50	109
122	SELVAM	40/M	57182	20/6-30/6		1.10	112
123	SARASU	45/F	57694	22/6-3/7	PERFORATION	1.60	134
124	ESTHAR	19/F	57935	22/6-28/6		0.80	91
125	JAYARAMAN	14/M	57992	6/6-11/6		0.70	82
126	SIVAGAMI	47/F	58105	23/6-27/6		0.90	81

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
127	DHARTHI	30/F	59050	26/6-29/6		1.00	74
128	RAJESH	16/M	59852	25/6-8/7		1.10	82
129	SEKAR	31/M	59933	28/6-5/7		1.40	107
130	INDUMATHI	25/F	60090	29/6-3/7	PERFORATION	1.20	91
131	HARI	38/M	60677	1/7-9/7		1.00	82
132	PONNI	15/F	61677	4/7-9/7		0.90	96
133	NANDHINI	19/F	61780	4/7-10/7		0.80	81
134	RAJESHWARI	40/F	61889	5/7-12/7	ABSCESS	1.30	106
135	GNANA MOORTHY	11/M	61920	4/7-14/7		1.10	92
136	SUDHAKAR	34/M	61972	4/7-12/7		0.90	95
137	THOTTAKKAL	60/F	62228	5/7-16/7		0.80	86
138	AMUDHA	38/F	62344	5/7-12/7		1.20	89
139	RUPAVATHY	30/F	62357	5/7-11/7	PERFORATION	0.90	101
140	KALA	30/F	62394	6/7-12/7		1.00	78
141	LAVANYA	15/F	62889	7/7-13/7		1.10	74
142	AJITH	14/M	62925	7/7-13/7		1.00	89
143	KUMAR	39/M	62977	8/7-12/7		1.30	99
144	VARALAKSHMI	40/F	62999	8/7-16/7	PERFORATION	0.90	91
145	KESAVALU	75/M	63062	8/7-16/7	PERFORATION	1.70	119
146	HONESTRAJ	15/M	63189	9/7-11/7		1.00	78
147	NARESHKUMAR	21/M	63387	9/7-13/7		1.00	82
148	DEVARAJ	19/M	63797	10/7-14/7		1.20	97
149	MADHAN KUMAR	24/M	64487	11/7-20/7	PERFORATION	2.10	111
150	DEVIKUMAR	33/F	64818	12/7-27/7		1.10	89
151	SELVAM	29/M	65374	14/7-18/7		1.20	72
152	RAJESH	28/M	66355	17/7-21/7		0.90	84
153	SURESH	17/M	66508	18/7-22/7		0.80	79
154	SUSEELA	60/F	66515	18/7-24/7		1.10	72
155	VIGNESH	13/M	65657	16/7-20/7		1.00	84
156	MURUGAN	40/M	66749	23/7-28/7		1.30	77
157	PRAVEEN	16/M	67568	21/7-30/7	PERFORATION	1.60	139
158	RAGHUMAN	26/M	67892	22/7-26/7		0.90	82
159	VINOTH	20/M	67978	22/7-3/8	ABSCESS	2.20	124
160	TAMILSELVI	35/F	68296	23/7-26/7	MASS	1.20	97
161	CHANDRA	30/F	68806	24/7-27/7		1.00	85
162	DURAIVEL	21/M	68918	25/7-3/8		0.80	98
163	MAHESHWAR SENAPATHY	22/M	69123	26/7-5/8	PERFORATION	5.60	137
164	SHANKAR	38/M	69371	26/7-9/8		1.20	98
165	RAMESH	32/M	69612	28/7-7/8	PERFORATION	3.20	162
166	MANIKANDAN	21/M	69983	29/7-3/7		1.10	79
167	MANIKANDAN	33/M	70096	28/7-2/8		0.90	82
168	SARALA	15/F	70202	28/7-13/9		0.90	80
169	MITHUN	21/M	70241	28/7-2/8	PERFORATION	0.80	87

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
170	CHINNA PONNU	70/F	71229	31/7-7/8		0.90	74
171	GOVINDAN	56/M	70263	28/7-9/8		1.00	98
172	ABBAS	19/M	70410	29/7-3/8		1.10	97
173	YUVARAJ	13/M	70826	30/7-2/8		0.90	81
174	GOPALAKRISHNAN	30/M	70864	1/8-10/8		1.00	89
175	ARUN	24/M	71287	1/8-10/8	PERFORATION	1.60	110
176	PARIMALA	35/F	71320	1/8-10/8	GANGRENOUS	3.80	132
177	RAMESH	14/M	71497	1/8-8/8	PERFORATION	2.10	129
178	DHANALAKSHMI	30/F	71521	1/8-6/8		1.10	101
179	SARATHI	27/M	71632	1/8-10/8		1.00	78
180	JAYASELVI	28/F	71645	31/7-7/8		0.90	86
181	ADHILAKSHMI	60/F	71703	5/8-11/8		2.10	117
182	SARATHY	27/M	71984	7/8-11/8		1.00	86
183	BAISUR RAHMAN	18/M	72244	7/8-12/8		0.90	104
184	TAMILSELVI	35/F	72757	7/8-13/8		0.90	81
185	SUMATHI	36/F	73106	6/8-10/8		0.70	98
186	SADHASIVAM	27/M	73223	6/8-11/8	PERFORATION	2.00	141
187	SATHEESH	26/M	73391	7/8-11/8	ABSCESS	1.20	103
188	KANNIGAPARAMESHWARI	49/F	74065	8/8-17/8	PERFORATION	1.10	98
189	IYYAPPAN	14/M	74533	10/8-13/8		1.00	88
190	PRASANTH	21/M	75000	11/8-19/8		0.70	78
191	SATHISH	22/M	75071	12/8-16/8		0.90	84
192	JAYARAJ	30/M	75355	13/8-17/8		0.80	77
193	ASWATHY	15/F	75538	13/8-18/8		0.70	85
194	RANJITH	18/M	75722	13/8-7/8		0.90	91
195	JAYACHITRA	27/F	75783	18/8-27/8	PERFORATION	1.50	148
196	UMAPATHY	45/M	76007	14/8-20/8	ABSCESS	1.20	113
197	PAULRAJ	14/M	76068	14/8-17/8		1.00	90
198	GUNA	26/M	76107	14/8-14/8		0.90	89
199	SUNDAR	15/M	76107	14/8-18/8		0.90	83
200	ANUSIYA	18/F	76221	15/8-21/8		0.70	84
201	AMARNATH	14/M	76291	15/8-28/8		1.20	95
202	SATHISH RAJ	22/M	76454	17/8-21/8	PERFORATION	1.70	106
203	SARIGA	20/F	76903	17/8-25/8		0.70	99
204	ABIMANYU	20/M	76943	17/8-26/8		1.00	78
205	BABU	18/M	77002	17/8-21/8		0.90	89
206	VALLI	48/F	77054	17/8-21/8		1.10	79
207	ANAND	20/M	77127	18/8-23/8		0.90	73
208	NIRMAL	16/M	77226	18/8-25/8		1.00	82
209	KOTHANDAN	70/M	77382	19/8-24/8		1.00	74
210	VIJAYAMOORTHY	17/M	77411	19/8-24/8		0.90	88
211	STALIN	29/M	77415	20/8-28/8	PERFORATION	1.60	120
212	MOHAMMED MEERAN	45/M	77588	20/8-27/8		1.10	91

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
213	REHA	25/F	77637	21/8-29/8		0.90	89
214	KOTTESWARAN	37/M	77815	20/8-24/8		0.90	81
215	INDHUMATHI	19/F	77887	20/8-25/8		0.80	80
216	RAJESH	21/M	77950	21/8-26/8		1.20	92
217	MOHAN	31/M	78271	21/8-2/9		0.70	81
218	GANAPATHY	36/M	79131	24/8-31/8		1.20	102
219	JAMEEL	22/M	79182	23/8-29/8		0.90	88
220	SARAVANAN	24/M	79273	24/8-28/8		0.90	74
221	RAJASEKAR	15/M	79295	24/8-28/8	PERFORATION	1.40	108
222	MANONMANI	65/F	79611	25/8-29/8	GANGRENOUS	1.50	125
223	MEENA	15/F	79620	25/8-4/9		0.90	83
224	MANIKANDAN	22/M	79723	25/8-3/9		0.90	86
225	RAJASEKAR	15/M	79295	24/8-28/8		0.90	84
226	SANTHOSH	29/M	79945	25-30/8	PERFORATION	1.40	80
227	VISHAL	13/M	80155	27/8-31/8		0.90	90
228	SARANYA	16/F	80557	28/8-30/8		1.10	78
229	RAKSHIDA	29/F	80565	28/8-12/9		0.90	73
230	GANESH	26/M	80571	28/8-2/9		1.00	92
231	AMUL	35/F	80576	28/8-3/9		1.00	79
232	ANKAMMAL	32/F	80767	28/8-5/9		0.90	93
233	VENKATESH	13/M	81089	29/8-6/9		0.90	85
234	JAYAKUMAR	32/M	81356	30/8-3/9	MASS	1.20	111
235	PAVANI	50/F	81368	30/8-8/9		1.10	90
236	LAKSHMI	40/F	81818	31/8-6/9		1.00	70
237	SUNDARAMOORTHY	45/M	81998	1/9-5/9		0.90	89
238	MURALI	16/M	822004	1/9-6/9		1.20	90
239	ANNAMALAI	50/M	822335	1/9-10/9		1.10	78
240	KALPANA	26/F	823977	3/9-10/9		1.20	95
241	RAKSHIDA	21/F	830447	3/9-7/9		0.90	73
242	VIJAYANAND	25/M	83211	4/9-8/9		0.80	85
243	PRAKASH KUMAR	16/M	84009	6/9-10/9	ABSCESS	1.10	97
244	MANONMANI	52/F	84023	6/9-12/9		1.80	134
245	RAMAN	25/M	84048	7/9-14/9		0.80	91
246	MURALI	18/M	84235	7/9-13/9		0.90	83
247	RAJ	35/M	84287	7/9-7/9		1.00	93
248	BHARANI KUMAR	29/M	84344	8/9-13/9		1.70	122
249	KAUSALYAN	16/M	84670	9/9-14/9		0.80	72
250	RADHAKRISHNAN	45/M	84720	9/9-19/9	GANGRENE	1.30	101
251	KOUSALYA	15/F	85279	10/9-15/9		1.00	90
252	SARITHA	22/F	85294	12/9-15/9		1.10	87
253	KANJANA	40/F	85498	11/9-17/9		0.90	90
254	SELVAMANI	21/F	85540	12/9-20/9		0.80	93
255	RANI	30/F	85599	12/9-20/9		0.90	84

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
256	VANITHA	16/F	85661	12/9-17/9		1.00	78
257	PRADEEP	33/M	85728	12/9-18/9		1.10	71
258	DURGA	20/F	85965	12/9-20/9		1.20	98
259	GIRIJA	20/F	86324	13/9-18/9		1.00	75
260	PRABHAKARAN	18/M	86378	13/9-17/9		0.90	91
261	SALSA	33/F	86389	13/9-17/9		0.80	89
262	ALAMELU	40/F	86631	14/9-20/9		0.90	76
263	KRISHNAVENI	45/F	86780	14/9-22/9		1.10	99
264	SADHANANTHAM	33/M	86946	15/9-20/9		0.90	78
265	LOKESH	14/M	87201	16/9-25/9		1.00	80
266	ABDULKADHAR	53/M	87754	17/9-22/9		1.40	115
267	RAJENDRAN	43/M	87993	18/9-6/10	PERFORATION	0.90	81
268	KALAIVANI	13/F	88004	18/9-23/9		1.00	84
269	SEETHA	25/F	88108	18/9-23/9		1.00	80
270	MANIVANNAN	22/M	88201	19/9-27/9		0.90	85
271	ROSHAN	14/F	88267	19/9-29/9		1.10	78
272	ANITHA	18/F	88319	19/9-25/9		0.90	89
273	SYEDAMIN	15/M	88426	19/9-25/9		0.70	72
274	VASANTHA KUMARI	17/F	88435	19/9-29/9		0.80	98
275	INDRANI	27/F	88487	20/9-24/9	PERFORATION	1.60	157
276	BHARATHI	32/F	88499	20/9-2/10		1.00	92
277	KALAISELVI	42/F	88832	20/9-24/9		0.90	95
278	SELVAM	28/M	88849	20/9-25/9		1.10	109
279	MURALI	21/M	88856	20/9-24/9		0.90	79
280	KURALARASAN	17/M	89008	21/9-3/10	ABSCESS	5.80	122
281	HARISH	15/M	89079	21/9-25/9		1.10	97
282	MAHESHWARI	17/F	89264	21/9-25/9		1.10	88
283	KANNAN	49/M	89551	22/9-2/10		1.00	72
284	ANANYA	26/F	90255	22/9-27/9	PERFORATION	1.40	96
285	ANBU	24/M	90538	25/9-29/9		0.90	89
286	BALAKRISHNAN	26/M	90634	25/9-30/9		0.90	83
287	BHAVANI	35/F	90693	25/9-29/9		0.80	86
288	AMUL	19/F	90693	25/9-26/9		1.10	3
289	SELVAM	37/M	90815	26/9-2/10		1.00	81
290	BHUVANESWARI	26/F	90848	26/9-6/10		0.70	93
291	MURALI	14/M	90944	26/9-2/10		0.90	80
292	RAGIA	31/F	90980	26/9-6/10		0.90	76
293	ELAKKIYA	15/F	91054	26/9-2/10		0.60	99
294	RANI	28/F	91371	27/9-23/10	PERFORATION	1.20	103
295	KURALARASAN	20/M	91398	27/9-3/10		0.90	88
296	SATHYARAJ	20/M	91409	11/9-5/10		0.80	87
297	SUBRAMANI	51/M	91868	29/9-7/10		1.00	98
298	GOVINDAMMAL	35/F	91983	30/9-8/10	ABSCESS	1.10	93

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299	PRABHU	22/M	92516	1/10-4/10		1.00	92
300	VICKY	21/M	92640	1/10-4/10		1.00	78
301	SUNDARAM	38/M	92750	2/10-9/10		0.90	90
302	LOURTHAMARY	60/F	92772	1/10-8/10	PERFORATION	1.40	112
303	SELVAKUMAR	30/M	92821	2/10-10/10		1.10	94
304	GOKUL	13/M	92830	2/10-5/10		0.80	91
305	MANI	33/M	92919	2/10-6/10		0.90	86
306	VIJAYAKUMAR	28/M	92954	2/10-8/10		1.00	85
307	JAYA	25/F	92958	2/10-7/10		1.10	93
308	NAVEEN	12/M	93023	3/10-5/10	PERFORATION	1.70	112
309	SOWKATH AHMED	23/M	93127	3/10-7/10		1.00	90
310	MANOJ	13/M	93182	3/10-12/10		0.90	89
311	KASTHURI	33/F	93237	3/10-18/10		0.90	85
312	STALIN RAMESH	37/M	93355	3/10- 8/10		0.70	91
313	RANI	38/5	93358	3/10-12/10		0.80	95
314	VENKATESH	30/M	93433	4/10- 8/10		1.20	98
315	GOVINDAMMAL	35/F	93762	4/10-12/10		0.90	84
316	RANI	50/F	94062	5/10-9/10		1.20	112
317	JAYANTHI	19/F	94005	5/10-11/10		0.80	80
318	MADHAN	21/M	94500	6/10/2010		0.70	84
319	KUMARAN	24/M	94542	7/10-11/10		1.20	94
320	VAITHESHWARI	19/F	94632	7/10-13/10	PERFORATION	1.70	102
321	VIVEKANANDAN	15/M	94684	8/10-10/10		1.10	97
322	KAVITHAKUMARI	32/F	94707	8/10-13/10		0.90	81
323	YUGESH	13/M	95839	10/10-23/10		0.60	89
324	GUNA	29/F	96114	11/10-19/10		1.00	93
325	ASHOK KUMAR	24/M	96174	11/10-16/10		1.20	99
326	ANITHA	15/F	96231	11/10-15/10		1.00	90
327	SRIKANTH	22/M	96364	11/10-13/10		0.90	84
328	SUDHAKAR	27/M	96385	11/10-15/10		0.80	72
329	AJITH MOHAN	17/M	96647	12/10-16/12		0.80	79
330	ANITHA	31/F	96761	12/10-16/10		0.90	89
331	MAGIMAIDOSS	29/M	96764	12/10-16/10		1.10	81
332	VIJAYAKUMARI	36/F	96780	12/10-17/10		1.00	76
333	SARANYA	24/F	96818	13/10-16/10		0.70	92
334	SRINIVASAN	32/M	96981	14-19/10		1.00	82
335	SAKTHIVEL	20/M	97749	14-18/10		0.60	85
336	NANDHAKISHORE	13/M	97651	15-19/10	PERFORATION	0.80	78
337	NITHISH KUMAR	22/M	96794	14-23/10	GANGRENOUS	1.20	89
338	SUGANTHI	44/F	97102	14/10-18/10		1.10	72
339	MEENATCHI	48/F	97999	16/10-21/10		1.00	82
340	MUTHULAKSHMI	28/F	98241	16-23/10	PERFORATION	1.40	77
341	SASIDHARAN	20/M	98636	17-22/10		1.20	93

SL NO	NAME	AGE SEX IPNO	IP No	DATEAD	PEROP	BILI RUBIN	ALP
342	SANDHANU	20/M	98636	17/10-23/10		0.90	89
343	JEGAN	23/M	98777	18/10-19/10		1.20	88
344	DHANAPAL	23/M	98954	18/10-26/10		1.00	95
345	CHINARAM	18/M	98994	18/10-23/10		0.80	82
346	RAMESH	26/M	99002	18/10-23/10		0.80	109
347	SEKAR	22/M	99402	20/10-3/11		0.90	137
348	MUNUSAMY	23/M	99714	22/10-30/10	PERFORATION	1.70	121
349	CHANDRU	12/M	100027	22/10-1/11		0.90	89
350	SATHISH	15/M	100206	23/10-26/10		0.80	90
351	PRIYADHARSHINI	16/F	100212	24/10-31/10		0.60	89
352	FEROCH	27/F	100233	24-4/11	PERFORATION	1.20	78
353	GIRIJA	13/F	100433	24-27/11		1.20	73
354	VELMURUGAN	21/M	100584	24/10-4/11		1.00	82
355	VIJAYA	42/F	100731	25/10-3/11		1.40	124
356	VARADHARAJAN	47/M	101662	27/10-8/11	PERFORATION	1.30	75
357	KAYALVIZHI	27/F	101846	28/10-31/10	MASS	0.80	82
358	KEERTHANA	16/F	101393	28/10-30/10		1.10	80
359	VALARMATHY	32/F	106326	9/11-13/11		0.80	81
360	EBINESAR	27/M	106364	9/11-13/11		1.00	92
361	ELIZABETHRANI	31/F	105899	10/11-14/11	PERFORATION	1.60	155
362	VIJAYA	38/F	105921	11/11-18/11		0.80	89
363	LAKSHMI	41/F	103851	12/11-16/11		1.20	83
364	MAHALAKSHMI	23/F	105218	13-19/11		0.90	79
365	INDRAJITH	21/M	106753	13/11-17/11		1.00	75
366	MANJUNATHAN	24/M	106848	13-24/11	PERFORATION	2.30	136
367	VEERARAGHAVAN	37/M	107909	14-17/11		0.90	84
368	SELVARAJ	50/M	108566	16-20/11		0.90	83
369	MONIKA	15 F	890	3/1-14/1		0.90	80
370	DINESH	17 M	713	3/1-8/1		1.00	98
371	BUDHAR PIRAN	23/M	5250	18/1-19/1	PERFORATION	2.10	172
372	VASANTHI	35/ F	5606	19/1-28/1		0.70	72
373	MAXIMICHEL	32/M	7113	2/1-28/1		1.10	90
374	THIYAGARAJAN	24/M	4579	16/1-24/1		0.90	76
375	MOSES	13/M	5853	19/1-24/1		1.50	127
376	KAMATCHI	40/F	4999	17/1-20/1		0.60	72
377	SHEELA	28/F	113711	19/2-1/2		0.70	138
378	RIYA	21 F	6854	23/1-31/1		0.90	101

KEY TO MASTER CHART

IP No.	:	In Patient Number
Date AD	:	Date of Admission and Discharge
ALP	:	Alkaline Phosphatase
Perop	:	Peroperative Finding Confirmed with Histopathological Diagnosis

Blank spaces in the Perop column indicates Acute Appendicitis