“C Reactive Protein And Serum Bilirubin As Predictors Of Severity Of Acute Appendicitis’’

Dissertation submitted

To

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

In partial fulfillment of the regulations for the award of the degree of

M.S (General Surgery)

Branch-I

Government Kilpauk Medical College

Chennai- April -2015

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled '**C REACTIVE PROTEIN AND SERUM BILIRUBIN AS PREDICTORS OF SEVERITY OF ACUTE APPENDICITIS''** is a bonafide and genuine research work carried out by me under the guidance of Prof. USHA DORAIRAJAN, M.S, FRCS, in the Department of General Surgery, Kilpauk Medical College, Chennai-10.

This dissertation is submitted to **THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI** in partial fulfillment of the degree of M.S. General Surgery examination to be held in **April 2015**.

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On

"C REACTIVE PROTEIN AND SERUM BILIRUBIN AS PREDICTORS OF SEVERITY OF ACUTE APPENDICITIS''

during his course in M.S. General Surgery from May 2012 to April 2015 at Government Kilpauk Medical College, Chennai-10.

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CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval ""A Study on C Reactive protein and serum bilirubin as predictor of severity of acute appendicitis" – For Research Work – For dissertation purpose Submitted by Dr.V.Varadharajan, MS (GS), PG Student, KMC, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

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ACKNOWLEDGEMENTS

I would like to thank God for the things he has bestowed upon me.

I would like to thank my parents for making me who I am today and for supporting me in every deed of mine

I thank each and every person involved in making this manuscript from inception to publication.

I am most thankful to Prof .N.Gunasekaran, M.D, D.T.C.D, Dean, Kilpauk Medical College and Hospital for the opportunity to conduct this study in the Department of General Surgery, Government Kilpauk Medical College Hospital, Kilpauk Medical College, Chennai-10.

My deepest gratitude to my guide and mentor Prof. USHA DORAIRAJAN, MS, FRCS, Chief of Surgical Unit II, Department of General Surgery, Kilpauk Medical College, who has inspired me immeasurably during my training as a post graduate student.

I am very grateful to Prof P.N.Shanmugasundaram, MS, Head of the department of General Surgery for the encouragement and unrestricted permission to use the Department of General Surgery.

I also acknowledge the invaluable advice and counseling received from Dr.V.Vijayalakshmi, MS, Dr.N.B.Thanmaran, MS, Dr.A.K.Kalpanadevi, MS and Dr.K.Ramachandran, MS.

This study would have not been possible without the support of my fellow post graduates and interns who have been a source of help in need.

The most important part of any medical research is patients. I owe great deal of gratitude to each and every one of them.

C REACTIVE PROTEIN

AND

SERUM BILIRUBIN

AS PREDICTORS OF

SEVERITY OF

ACUTE APPENDICITIS

TABLE OF CONTENTS

INTRODUCTION

Acute appendicitis is the most common yet the most deceiving abdominal surgical emergency presenting to a general surgeon. Seldom does a patient present with the classic triad of Right Iliac fossa pain, fever and vomiting. There are numerous causes that may cause the above triad and so just the presence of these three symptoms may not be sufficient enough to arrive at a correct diagnosis of acute appendicitis. Even after the advent of Computerised Tomography and Ultra sonogram, the diagnosis of acute appendicitis still remains based mainly on clinical grounds and no single test has been found to be sensitive or specific to pre-operatively predict acute appendicitis.

Ever since earlier days the dictum regarding appendicitis has been "When in doubt, open". This has been because of the thought that appendix is a vestigial organ. This was associated with a very high negative appendectomy rate and unwanted surgery related morbidity at large[1]. Ever since advent of imaging modalities the rate of negative appendectomies has come down dramatically[2]. But even Computerised tomography has not been found to be sensitive in detecting perforation in a case of appendicitis. Missing a case of perforated appendix and managing it conservatively as a case of Uncomplicated acute appendicitis is associated with significant morbidity and mortality to the patient[3]. So, any

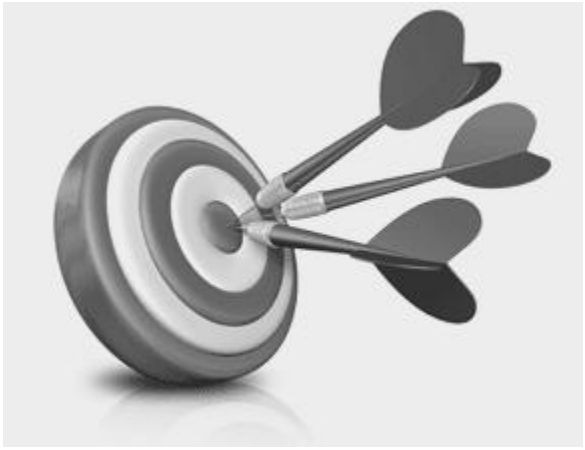
investigation which could detect the severity of acute appendicitis pre-operatively would be useful for the surgeon in deciding further course of management.

Several scores were designed which were said to be helpful in diagnosing the severity of acute appendicitis but multiple randomised control trials showed that they have low sensitivity and specificity and is highly variable and operator dependent . So these scores have been abandoned nowadays.

Imaging studies and Blood investigations which are more reliable and less operator dependent can be used in assessing the severity of appendicitis. Ever since the advent of computerised tomography, the negative appendectomy rate has come down but still CT is not sensitive in differentiating a gangrenous appendix from a phlegmonous one.

C reactive protein is an acute serum marker of inflammation. It is said to be one of the most sensitive of Acute phase reactants. Levels of CRP were found to have a positive co relation to the degree of inflammation[4]. Hence CRP could be used as a predictor of severity of acute appendicitis. But it was found that there

were numerous other conditions where CRP levels were shown to rise like myocardial infarction, pancreatitis, rheumatoid arthritis, stress, tumours and trauma. Also of considerable interest in recent times has been the association of Serum bilirubin with severity of acute appendicitis. Hence combining both these Serum markers together may prove to be helpful in predicting and differentiating cases of acute appendicitis based on their severity. This may be useful for the treating surgeon to decide when to go for the conservative management and when the patient needs to be definitely operated upon.



AIMS

AND

OBJECTIVES

Clinical examination remains THE mainstay in diagnosing a case of acute appendicitis[5]. The Aim of this study is to find out Serum markers that could be used as a tool for diagnosing severity of acute appendicitis and aid the surgeon in his clinical assessment and management for a case of suspected to be appendicitis. Though CRP has been suggested as an acute phase reactant that could be used for this purpose it has its own limitations. Certain studies have shown Hyperbilirubinemia as a better predictor of acute appendicitis than C Reactive Protein. So this study tries to combine both and to find if that will help in improving accuracy.

So the Aims are

1) To evaluate efficacy of Serum bilirubin and C Reactive Protein in pre operative prediction of severity of Acute appendicitis
2) To help reduce the incidence of negative appendectomies
3) To reduce the delay in operating on a case of Gangrenous/perforated appendicitis
4) To check if C reactive Protein and Bilirubin may be used for diagnosing cases of Appendicular abscess and Appendicular mass
5) To Aid the operating surgeon diagnose cases of Appendicitis with non classic presentation

REVIEW OF LITERATURE

Harrison et all[6]*, Savrin et al*[7] *and Scher KS et al*[8] in their studies in 1980s discussed in detail regarding the morbidities associated with the complications of acute appendicitis and how important it is to detect and treat them as early as possible

Hoffmann et al[9]discussed various modalities that may be helpful for a surgeon in appendicitis but still pointed out that clinical skill was still the keystone in case of acute appendicitis.

Alvarado et al[10] in 1986 gave a simplified scoring system which will help in diagnosis of acute appendicitis incorporating symptoms, signs and laboratory investigations

Ohmann et al[11] *and Zielke et al*[12] were of the opinion that Scoring systems improved diagnostic accuracy and may help in reducing negative appendectomy rates

Rettenbacher et al[13] analyzed if imaging was required in highly suspicious cases of appendicitis and concluded that imaging may be necessary to detect normal appendix and for excluding differential diagnoses

With respect to CT or USG imaging in diagnosing acute appendicitis *Lee et al*[14] was of the opinion that Computed tomography and ultrasonography do not improve and may delay the diagnosis and treatment of acute appendicitis.

Hong et al was of a similar opinion and suggested that Clinical assessment unaided by CT identifies patients with acute appendicitis reliably, and routine use of abdominal/pelvic CT is not necessary.

But *Balthazhar et a*l[15] was of a different opinion and suggested that computed tomography imaging may be used in suspicious cases to decrease negative appendectomy and predicting perforation

Flum DR et al[16] found that diagnostic imaging may help in reducing misdiagnosis of appendicitis and avoid unnecessary surgeries.

Larsson et al[17] *, Lamparelli et al*[18] *and Bruwer et al*[19] studied the role of Laparoscopy in acute appendicitis and found that it was beneficial and more so in case of women of reproductive age group

Johnson et al[20] *and Miller et al*[21] were the initial ones to suggest a correlation between Sepsis and hyperbilirubinemia

Asfar et al[22] in his study found that a normal pre-operative serum CRP measurement in patients with suspected acute appendicitis is most

likely associated with a normal appendix. Deferring surgery in this group of patients would probably reduce the rate of unnecessary appendectomies.

Michael sand et al[23] by his retrospective review found that Patients with hyperbilirubinemia and clinical symptoms of appendicitis should be identified as having a higher probability of appendiceal perforation than those with normal bilirubin levels.

Burcharth et al[24] in his review concluded that elevated serum bilirubin can be used as a supplemental diagnostic tool in acute appendicitis

Farooqi and colleagues[24] by their prospective study found that WBC count and bilirubin, CRP, and ALAT levels are useful biomarkers in predicting appendicitis and appendiceal perforation. Combining the biomarkers increases the predictive values.

Numerous studies have been made explaining pathophysiology of Hyperbilirubinemia in severe appendicitis

*Utili et a*l through his studies on rat liver has shown that in vitro infusion of endotoxin leads to dose-dependent decrease in bile salt excretion from the liver

and that it is could be possible that Escherichia coli produces endotoxin which exerts damage at the cholangiolar level.

Sisson et al[26] in 1971 demonstrated that in appendicitis mucosal ulceration occurs early in the course of disease and this facilitates bacterial invasion into the muscularis propria of the appendix which results in classical acute suppurative appendicitis.

Estrada et al[27] also found that in patients with gangrenous/perforated appendicitis the peritoneal culture was more positive for anaerobic organism than in upper G.I perforation

Dieulafoy et al[28] gave indirect evidence of translocation of bacteria from inflamed gastrointestinal tract or from peritonitis to the liver via the portal vein and subsequent development liver abscess.

Estrada et al[27], *Bennion et al*[29], *Thomson et al*[29] all by their separate studies found that isolated hyperbilirubinemia without elevation of other liver enzymes is a significant predictor of perforated appendicitis.

Chaudhry et al[30] also concluded by his study that except Serum bilirubin and CRP none among the said criteria of age, duration of symptoms, Modified Alvarado score, total leukocyte count or ultrasonography were significant in predicting perforation in appendicitis

Combining CRP with Serum bilirubin is found to increase the specificity of the tests and also the predictive values. This was established by studies done by *Sand et al, Khan et al and Albu et al*[31]

HISTORY

1492- Appendix depicted in drawings of Leonardo Da Vinci

1522- The first description of Appendix by Jacopo Berengario da Carpi[32]

1561- Gabrielle Fallopio compared appendix to a worm and hence termed it appendix vermiformis

1579- Casper Bauhin proposed theory that Appendix serves as a reservoir for feces in intra uterine life.

1711- Lorenz Heister first described classic appendicitis

1735- First successful appendectomy done by Amyand in London. He operated on an 11-year-oldboy with a scrotal hernia and a fecal fistula. Within the hernia sac, Amyand found a perforated appendix surrounded by omentum.The appendix and omentum were amputated. The patient was discharged a month later in good condition

1767- Darlymple describes gangrenous appendicitis post autopsy

1812- Parkinson gave a good detail of mortality following appendectomy

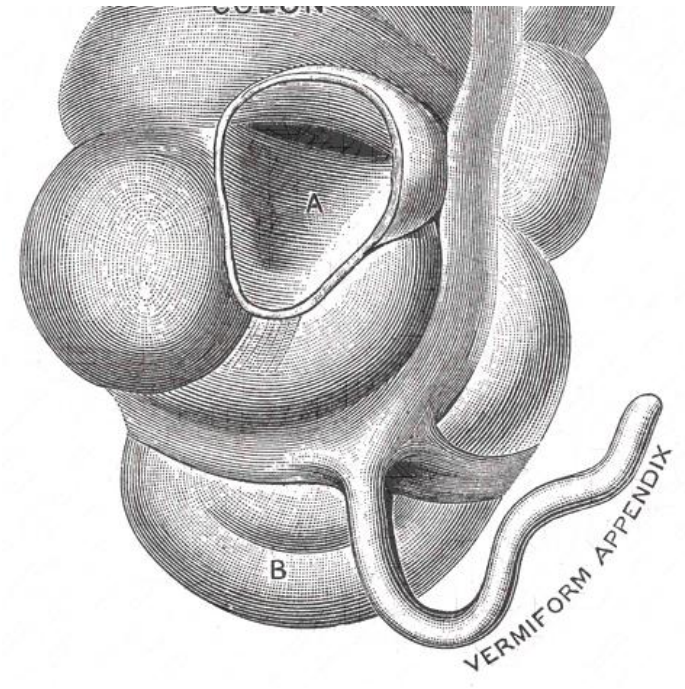
1843- William Parker published a paper about drainage as treatment for Appendicular Abscess

1880- Robert first to make a pre operative diagnosis of Appendicitis

1886- Reginald H Fitz recommended surgery as main treatment option for appendicitis and published a paper on it[32]

1893- Charles McBurney advocated his muscle splitting incision for appendectomy in his landmark paper in the *New York State MedicalJournal*[33] and described indications for early laparotomy in treatment of appendicitis

1981- First laparoscopic appendectomy done by Kurt Semm



APPENDICITIS -

AN

OVERVIEW

Acute appendicitis is the most common emergency abdominal surgical condition, which affects approximately 5% of the population[34]. Most patients are between the ages of 5 and 40 and present in the first 24 to 48 hours of illness typically to the hospital. In children and in adult population, especially females there are an increased risk of atypical mode of presentation or delay in diagnosis. Hence the chance of perforation or negative appendectomy is more in these patients.

Anatomy

The Appendix or vermiform appendix or the Abdominal Tonsil is a lymphoid organ that is present in the right iliac fossa. The base of appendix is fixed and could be found by tracing the taenia coli and found at their confluence. The location of tip is varied and could be in any position in relation to the caecum namely, pre ileal, post ileal, retrocaecal, pelvic or sub hepatic. The lumen of appendix is wide in children but narrows as age progresses. The location of the tip determines the location of tenderness in Acute appendicitis. The appendix has its own mesentery and it is called mesoappendix. It is formed by prolongation of mesentery of terminal ileum and contains the appendicular artery. The appendiceal artery arisesfrom the ileocolic artery and is present along the free cresentic edge

entering the mesoappendix near its base. The appendix opens into the caecum posterior to ileocaecal opening. Sometimes the appendicular orifice has a valve called as the Valve of Gerlach[35]. The lining epithelium of appendix is columnarepithelium. The lymphoid follicles present in appendix are maximal in the age group of 10-30. This is the reason that appendicitis is more common in this age group than other age groups.

Pathophysiology

Obstruction of the lumen of Appendix is the main cause for Acute appendicitis and its associated symptoms. In around 60% of patients with luminal obstruction, the main reason is found to Lymphoid hyperplasia. The second most common cause found in around 25% of people is Fecal accumulation called fecolith.

In children a viral prodrome[36] may cause lymphoid hyperplasia and cause appendicitis. As the appendiceal lumen becomes narrowed, mucus secretion by the epithelium causes distension of the appendix distal to the narrowed lumen. This causes venous outflow obstruction and the organ becomes increasingly turgid and ultimately ischemic Necrosis and bacterial proliferation may supervene in the

ischemic environment. Bacterial toxins may cause further mucosal damage. As the disease progress, they may become transmural and lead to gangrene and perforation. Once the appendix perforates,the ensuing omental reaction walls off the spreading of peritonitis. Diffuse peritonitis occurs more often in younger people with underdeveloped omentum in which case localization of disease may be difficult. If the process is not controlled, infection spreads into the portal system via the venous efferents and may even cause septicemia

Clinical Signs and Symptoms

The above pathophysiology correlates well with the classic pattern of pain described by the patient with acute appendicitis. Initial complaint is due to luminal distension. This is perceived as vaguely localized, periumbilical pain, consistent with the midgut origin of the appendix. As the disease progresses transmural inflammation occurs which irritates adjacent parietal peritoneum. Parietal peritoneum is innervated somatically and so pain islocalized at the point of irritation, most commonly in the right iliac fossa at the Mc Burney`s point[37]. The pain may be associated withother symptoms like anorexia, nausea and some

vomiting. Low-grade fever and leucocytosis are common in case of a patient with Acute appendicitis

On examination, the patient will exhibit tenderness in the region of McBurney's point, located at one third – two third junction along spino umbilical line. If the appendix is retrocaecal, pain on digital rectal examination may be present. Peritoneal irritation may cause rebound tenderness and, in advanced state, involuntary guarding may set in.

The other signs that may be present are

- Pain in the right iliac fossa on palpation of the left lower quadrant - Rovsing's sign
- Pain on extending the right hip - psoas sign seen in retrocaecal appendix
- Pain on passive rotation of right hip on flexion -obturator sign seen in pelvic appendix.

Once the appendix perforates, the turgidity decompresses and pain may reduce, but increasing peritonitis soon follows. Prolongation of symptom increases risk of peritonitis spreading which may cause Leucocytosis

Differential Diagnosis

Many enteric, urologic, musculoskeletal, and gynecologic conditions may cause symptoms mimicking appendicitis[36]. A few of those are

1. Meckel's diverticulitis
2. Twisted ovarian cyst
3. pelvic inflammatory disease
4. pyelonephritis or Ureteric colic
5. gastroenteritis
6. inflammatory bowel disease
7. endometriosis
8. ovulatory pain (Mittelschmerz)
9. Sigmoid diverticulitis
10. acute ileitis
11. cholecystitis and
12. perforated peptic ulcer

The operating surgeon must keep these diagnoses in mind and in particular rule out all those conditions which may require non operative management. When in doubt periodic evaluation is necessary so that removing a normal appendix or

not operating and allowing complications to occur, neither of these to disasters occur.

To minimize risk of perforation, a negative appendectomy rate of 10-20% has been accepted. Ct has reduced the negative appendectomy rate drastically.A good history and a detailed examination and survey of urologiacal and gynaecological systems may help a surgeon in minimizing diagnostic errorsLab investigations like CBC , Urinalysis, X-rays and ultra sound or CT may help in ruling out other conditions than in diagnosing appendicitis exactly.

Treatment[38]

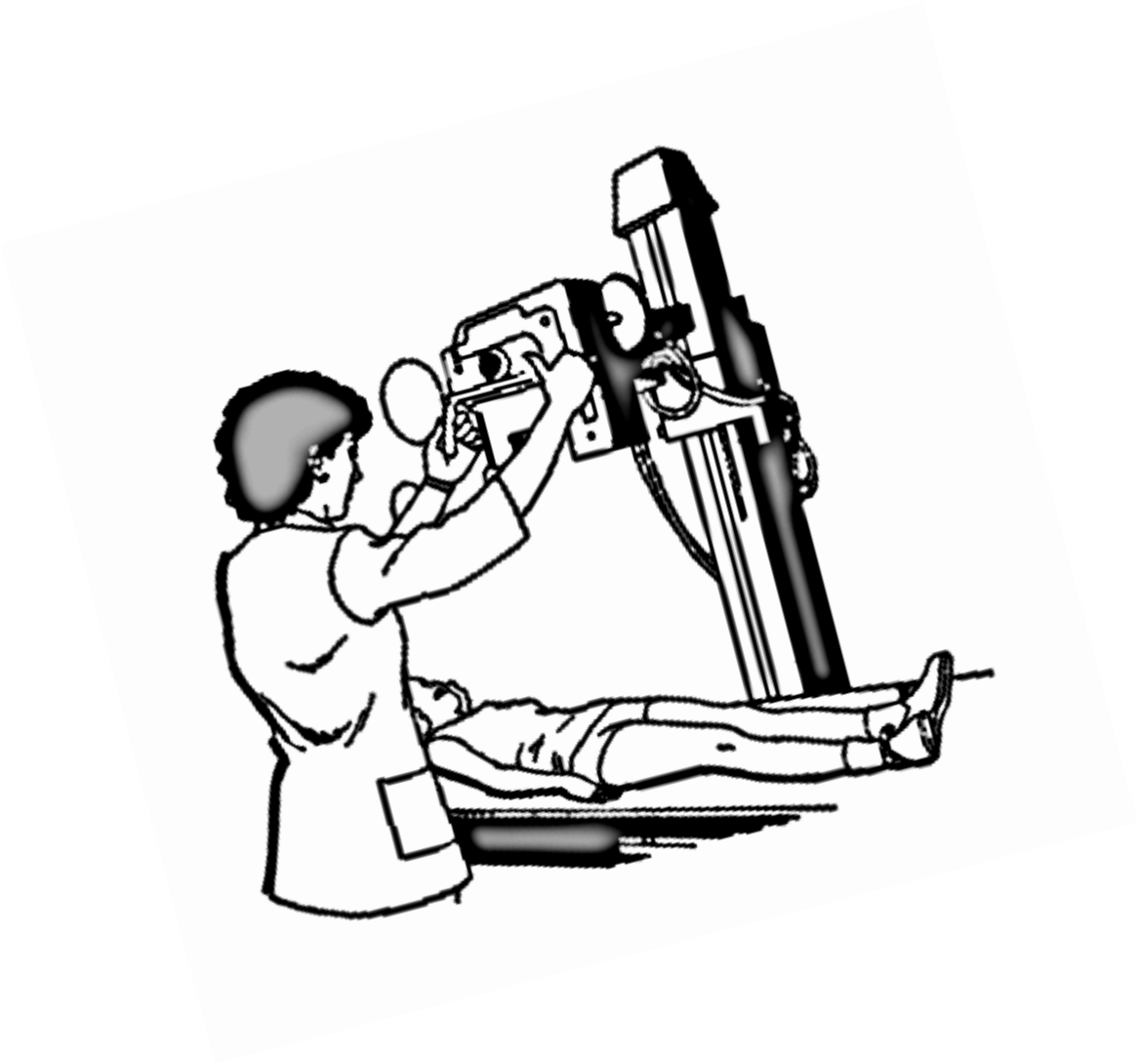
The treatment of choice for Appendicitis is Appendectomy. Recent studies have however shown that catarrhal appendicitis may be managed by antibiotics alone and the chances of recurrence is low if the etiology is not persistent. So the trend is shifting towards non operative management in case of early appendicitis.

A second-generation cephalosporinor broad-spectrum penicillin and anaerobic coverage with metronidazole are advocated. If the appendix has no perforation or gangrene, antibiotics may be stoppedafter first 24 hours

postoperatively. If perforationand contamination or abscess is found during surgery, antibiotics are continued until the patient has a normal whiteblood cell count, resumes bowel activity and there is no fever. Once the diagnosis of appendicitis has been made there should be no delay in surgery as in case of confirmed case of appendicitis the chance of perforation increases after 24-36 hours. Appendectomy is done through anopen or laparoscopic approach. Open appendectomy may be done through a muscle splitting incision or a cosmetic Lanz incision centered over McBurney`s point. The appendix is brought into the woundand the mesoappendix serially clamped and ligated,skeletonizing the appendix and isolating the base of the appendix where it joins the cecum. Base is ligated and appendix removed. Invertion of stump done if there is doubt regarding viability of base. In case of diagnostic uncertainty or if patient has generalized peritonitis, a lower midlineincision may be needed to allow wider access to the pelvic peritoneal cavity.

Ever since advent of laparoscopy, it has been considered the preferred option for appendectomy thereby preventing removal of normal appendix. Though post operative complications are less with laparoscopic method, if there is presence of abscess or perforation the chances of residual infection is more with Laparoscopic appendectomy. Laparoscopy is an attractive option when there is diagnostic

uncertainty, since itallows inspection of the peritoneal cavity before continuing with appendectomy. If the appendix is normal then the surgeon should seek to find the possible confoundingpathology. Typically this would include inspecting the ovaries, look for Meckel's diverticulum, and inspecting or palpating the mesentery for nodes for pathology that would explain right-sided abdominal complaints. Sometimes, the patient at presentation may be found to have a palpable mass on abdominal examination. In such cases if there is no evidence of abscess the patient may be managed by Ochsner Sherren regimen. Appendectomy in case of early mass formation is not advised and may be difficult. Also there is a high risk injuring adjacent bowel. If the mass is associated with a localized abscess on CT or ultrasound, the patient may be treated non-operatively with percutaneous drainage of the abscess and antibiotic support. The subject of subsequent interval appendectomy after 6-8 weeks is controversial[37], as recent evaluations of this strategy have documented that most patients do not have recurrent acute appendicitis, and so, interval appendectomy may not be necessary.



IMAGING

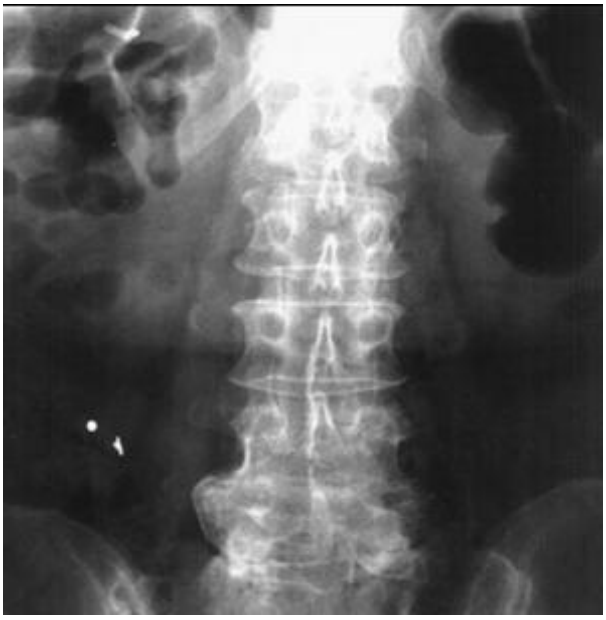
IN

APPENDICITIS

Plain Radiography

No radiological sign is pathognomonic for diagnosis of acute appendicitis, yet X-raysof abdomen has been done for this purpose since 1906[39]. Plain X ray Abdomen serves no diagnostic purpose in case of diagnosing or deciding the subsequent management in case of acute appendicitis. It may demonstrate one of the above signs- faecolith of the appendix, gas in the appendix, dilated ileum or caecum and sometimes multiple air fluid levels(i.e. signs of localized paralytic ileus), deformity orobliteration of the caecal shadow, haziness of the right psoas muscle[40], lumbar spine scoliosis, obliteration of the properitoneal fat line in the right iliac fossa,density over the right sacroiliac joint and rarely in case of perforation may reveal freeintraperitoneal or retroperitoneal gas.

Plain X ray abdomen showing a fecolith



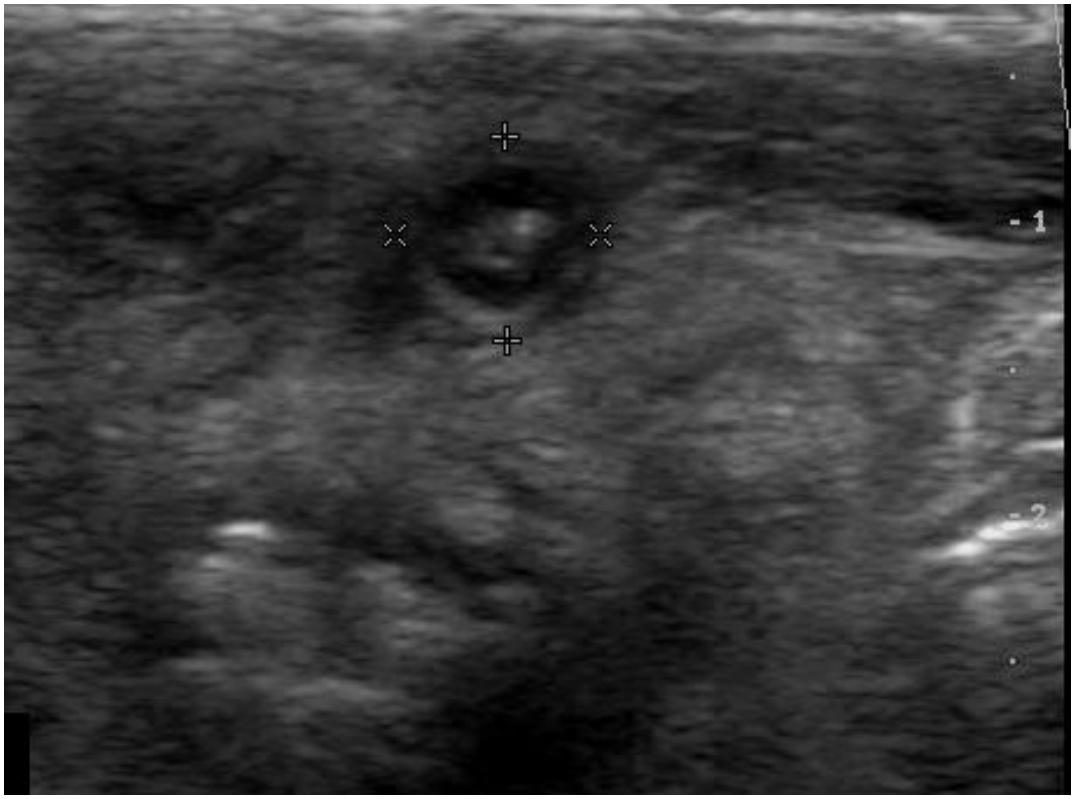
Not one of these signs is sensitive or specific for acute appendicitis.They may be present in other conditions causing right lower quadrant pain or a few may be seen in even normal individuals.The presence of one of these signs does not dictate the further course of action except in cases of air under diaphragm which may warrant a definite surgery. Degree of inflammation and expertise of the radiologist also add to specificity.

Around 60 per cent of patients with positive radiographs did not have appendicitis during surgery and at least 38 per cent of 'normal' subjects had a minimum of one of the above signs[41]. Other more recent studies have also found plain radiographs to be unreliable. Incidence of a positive finding varied between 8-75% in various studies. Also around 10% had other pathologies which required surgery like perforated ulcers or colonic diverticula,torsion of ovarian cyst and Acute intestinal obstruction. The low sensitivity and specificity make this investigation of lowdiagnostic yield especially unattractive.

Ultra sonogram

If the appendix is visualized on ultrasound examination that indicates the presence of acute appendicitis. Nowadays even probe tenderness in RIF with non-visualization of organ gives the suspicion of acuteappendicitis. The appendix is seenas a tubular, immobile, non-compressible structure having a blind-ending tip in longitudinal view with a diameter of >6 mm, not being displaced on pressure with the ultrasound probe[42].

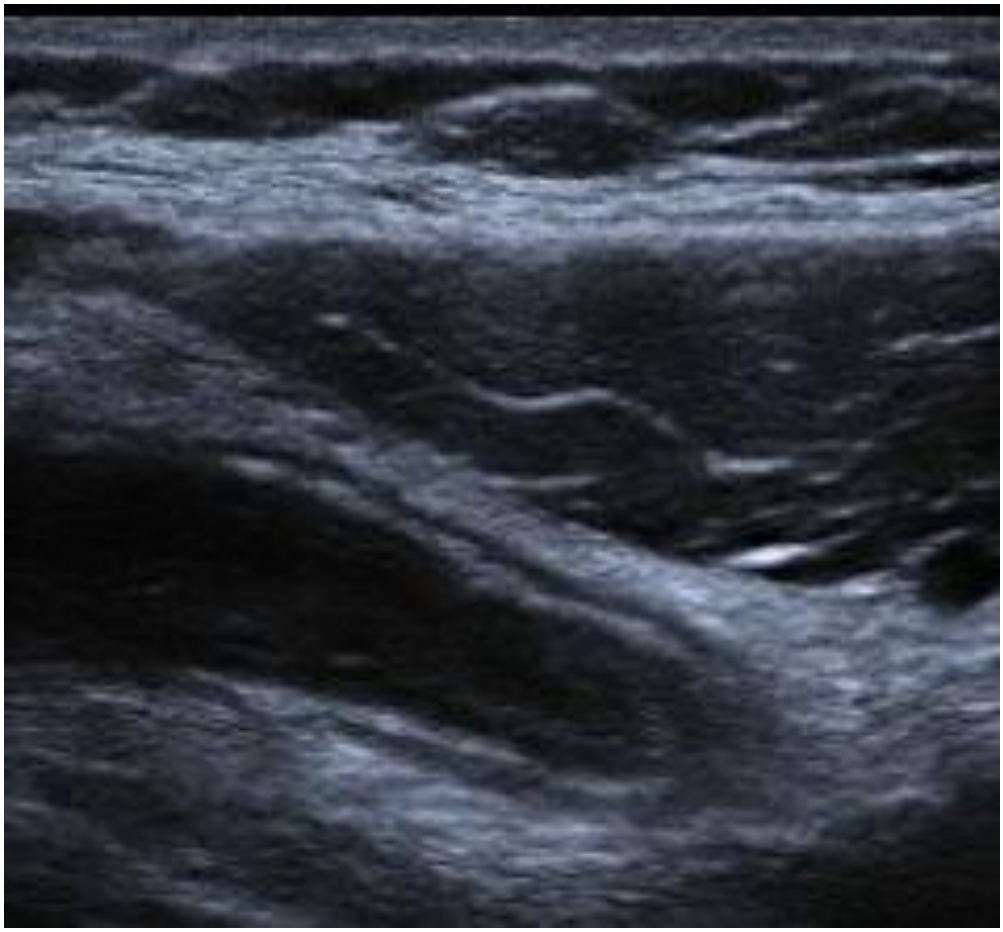
Due to the varying echo density of the lumen, mucosa and thickened wall of the inflamed appendix, it usually gives a characteristic sonographic appearance, referred to as a 'bull's eye' or 'target sign '[43]. A faecolith in the lumen of appendix or peri-appendiceal fluid collection are considered significant indicators of appendicitis.



USG abdomen in a patient with appendicitis showing target sign

Due to pain ,guarding, obesity or overlying gas around the organ, USG will be non-diagnostic in 3-11per cent of cases .Several studies show that the sensitivity ranges from 75 to89 per cent and the specificity from 86 to 100 percent[44]. Retrocaecal appendicitis, early appendicitis and perforated appendicitis are difficult to detect in USG. In expert hands it has high specificity and is also accurate in excluding diseases that do not need surgical intervention (like mesenteric adenitis, terminal ileitis, calculi in the lower urinary tract and gynecological disorders) as well as for diagnosis of conditions other than

appendicitis which may require an operation (such as ectopic pregnancy) Ultrasound being non-invasive and devoid of any radiation hazard can be used in pregnancy. Its only disadvantage lies in the fact that it requires special equipment and expertise. Its low sensitivity and failure to detect in certain specific patient groups like obesity, retrocaecal appendix are the deterrents in using this as a tool in diagnosing acute appendicitis

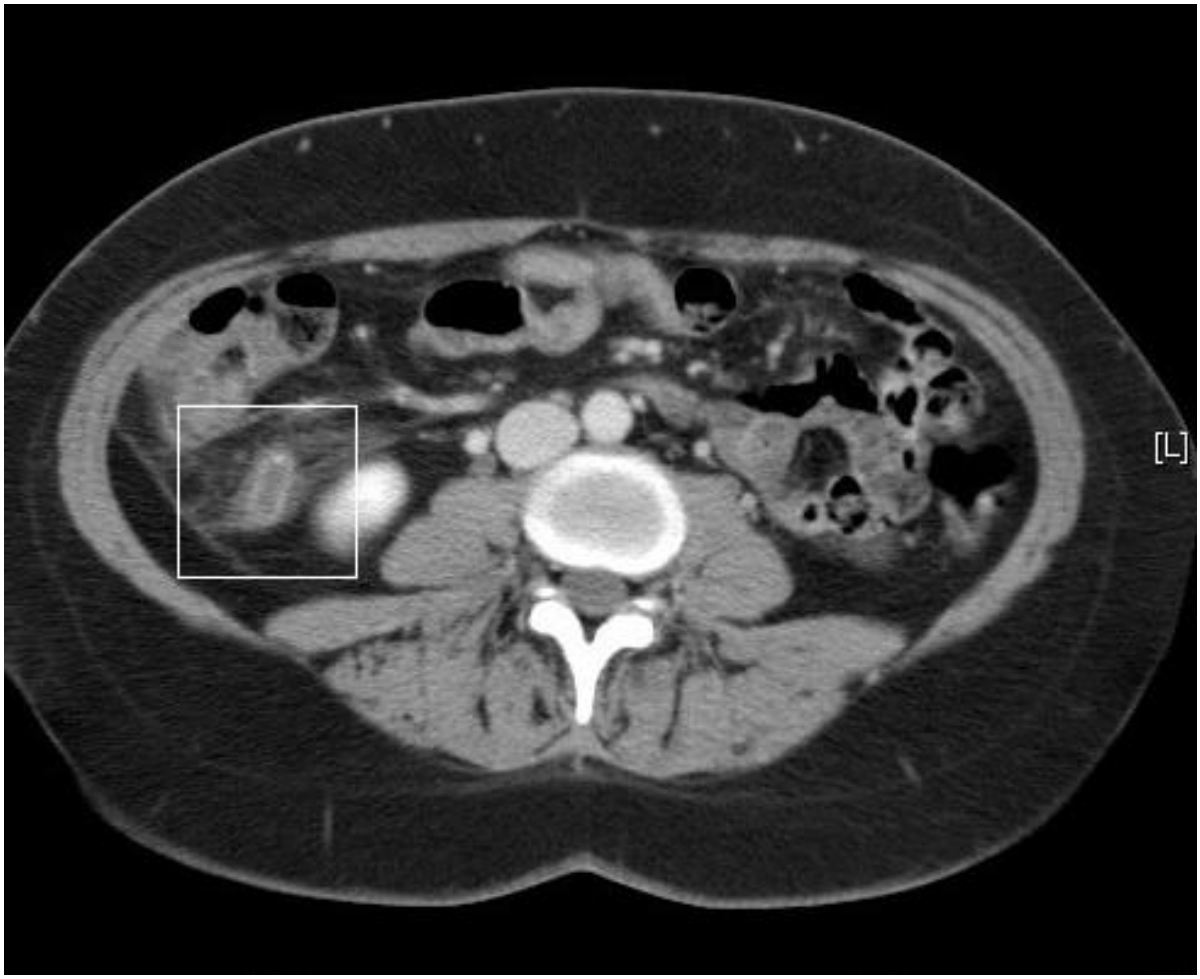


USG abdomen in a patient showing inflamed appendix

Computerized Tomography

The invent of ComputerizedTomography in evaluation patients suspected to have Acute appendicitis has caused a decrease in negative appendectomies. CT is used for confirmation of the clinical diagnosis, to pre operatively evaluate for the presence and degree of complications (abscess, peritonitis), and also for detecting alternative pathological conditions that may mimic the patient's symptoms. It is a widely available procedure, safe and fast to perform, and the ionizing radiation exposure is smaller than that of bariumfollow through examination. In patients with equivocal clinical findings suspected to have acute appendicitis the use of CT has obviousmedical and financial implications.

On the medical side, we can avoid a significant portion of negative appendectomies, thereby avoiding the morbidity of unwanted surgery. Certain studies show 0.14% mortality and 4.6% morbidity reported with a negative appendectomy[45]. CT also detects other medical conditions which may not require surgical intervention at all. On the financial side, the expense that a CT incurs is very much lower than that associated with surgeries and extended hospital stay.

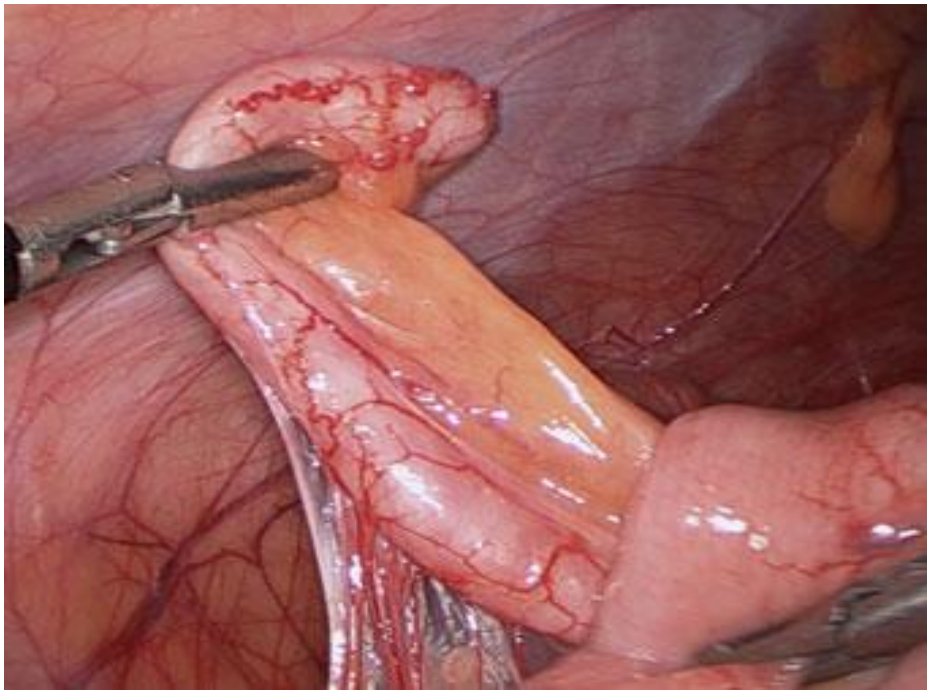


CECT abdomen in a patient showing inflamed appendix

In conclusion, CT must be used judiciously to improve diagnostic accuracyin patients suspected of appendicitis. CT is particularly more useful in children and in elder age groups, in women of menstrual age group and in cases where the findings are equivocal. CT should not be the first or the preferred investigation in case of acute appendicitis but should be used judiciously when in doubt.

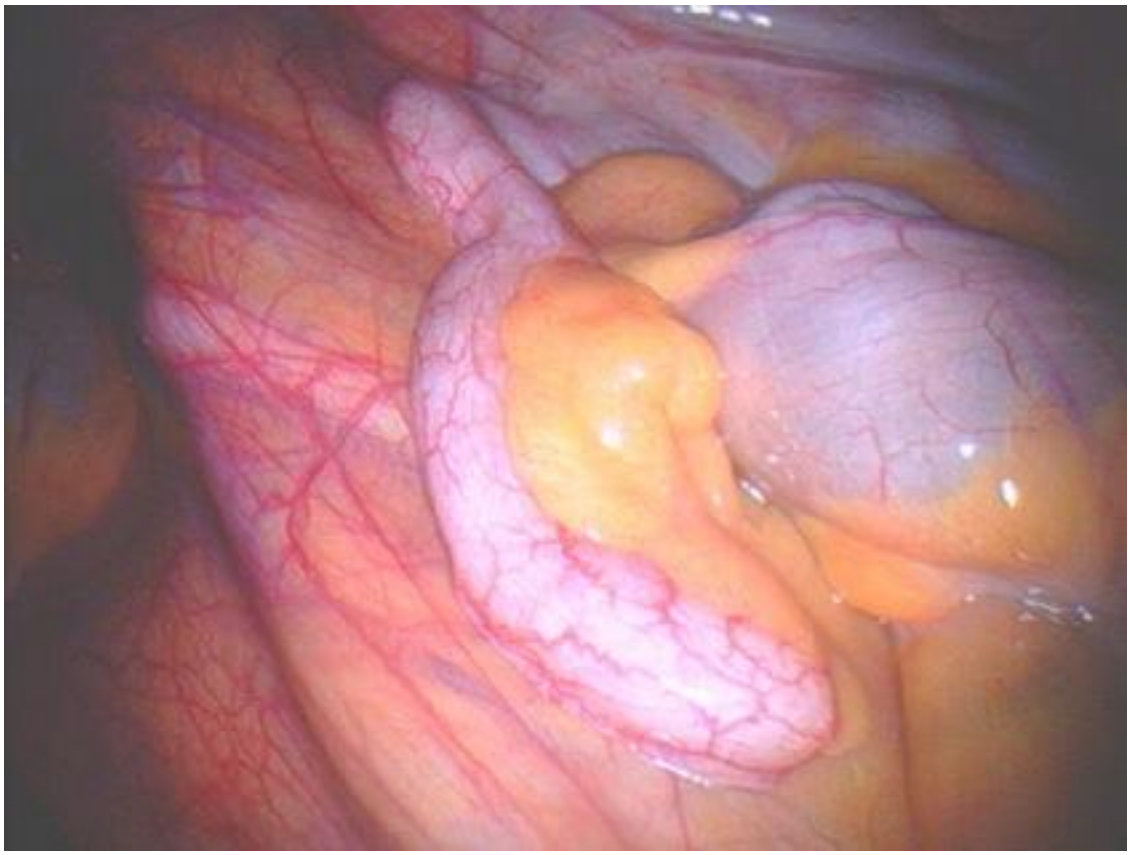
Laparoscopy

Advent of Laparoscopy revolutionized the field of surgery. The direct visualization of the intra abdominal organs helped in avoiding a lot of unwanted surgeries. With respect to appendicitis laparoscopy helped to bring down the negative appendectomy rates.For diagnosing acute appendicitis the criteria are, the identification of aninflamed appendix or the presence of inflammation inthe right iliac fossa when there is no other pathology toaccount for this. Appendicitis is excluded if laparoscopy[46] reveals a normal appendix or if some other intra-abdominal pathology is detected to explain the clinical picture. Previous laparotomiesand morbid obesity are generally considered as relative contra indications to laparoscopy.



Diagnostic Laparoscopy in a patient showing inflamed appendix

The sensitivity of Laparoscopy in detecting appendicitis is said to be 100%[47] in certain studies but nevertheless there are studies which contradict the same. In certain studies it was found that an appendix thoughtmacroscopically to be inflamed at laparoscopy turned out to be normal on histopathological analysis.



Diagnostic Laparoscopy in a patient showing normal appendix

There can be simultaneous inflammation of appendix and Fallopian tube. The appendix is not completely seen in its length during laparoscopy. Even if another explanation for the clinical signs is revealed on laparoscopy, the patient may nevertheless have appendicitis. Still negative laparotomy can be avoided

inaround 50% of patients by using laparoscopy[48]. This is because laparoscopy accurately diagnoses gynecological conditions. Also other causes of acute abdominal pain which may require surgery like perforated peptic ulcer or ectopic pregnancy is picked up on laparoscopy. It can be used in pregnant women too as laparoscopy is not contra indicated**.**

The only major disadvantage of laparoscopy[49] is its invasive nature.It may require generalanesthesia and is in fact a surgery by itself and maycause many of the complications of anyabdominal procedure. These complications are generally minimal, in the form of wound problems, but around 0.5% patients develop serious complications such as perforation of major blood vessels or even death[50]. The incidence of such complications is however found to be lower than that found to occur after negative appendectomy. Requirement of special equipment setup and the lack of expertise are the main drawbacks in case of routine use of laparoscopy in evaluation of acute appendicitis. Also when a complicated appendicitis is seen on laparoscopy, there may be a need to do open appendectomy because infection rates are higher in case of Laparoscopic appendectomy for perforated or gangrenous appendicitis.

SCORING SYSTEMS

The initial management decision for patients with suspectedappendicitis is still based on the diseasehistory, physical signs and symptoms and basic laboratory tests which reflect the inflammatory response. Surgeon`s knowledge along with these adjuncts play a role in decision making. To improve this scenario and to prognosticate patients with appendicitis a scoring system devised incorporating History, signs, symptoms and lab investigations are useful. A clinical scoring system is used to estimate the probability ofappendicitis in a patient compared with a large number ofsimilar patients from which the score was designed. Thisinformation is useful for decisionmaking and could be used as a standard for comparison and review to see for improvement or deterioration.

A clinical scoring system helps in structured management of patients with suspected appendicitis. Today CT or USG is routinely done in all patients suspected to have appendicitis. However, imaging does have its own limitations and is not 100% or specific[54]. Also CT should be used selectively to reduce ionizing radiation exposure. Indiscriminate use of CT may lead to the detection oflow-grade appendicitis which in normal setting might have resolved spontaneously

A large number of scoring systems have been proposed.There are several diagnostic scoring systems such as the Alvarado score[51],the modified Alvarado score for use in pediatric patients,PAS (Pediatric Appendicitis Score)[55],RIPASA (RajaIsteriPengiran Anak Saleha Appendicitis) score for use in Asian patients And a more recent Appendicitis Inflammatory Response (AIR) score.Most often these scoring systems combine symptoms (duration ofpain, migration of pain, nausea, vomiting), signs (tenderness, fever)and/or laboratory measurements (leucocytosis, CRP)[52]. Most scores have been proven useful in predicting suspected acute appendicitis inpatients presenting with pain in the lower right fossa, but none ofthem evaluates the risk of appendiceal perforation nor uses hyperbilirubinemia as a predictor

Of them, The Alvarado score is the best performing and has been validated by several studies. The Alvarado score described in 1986[51]. The score took into account three symptoms (Migration of pain right iliac fossa, Anorexia and Nausea / Vomiting), three signs (Tenderness in right iliac fossa , Temp. >37.5 and Rebound tenderness) and two laboratory investigations (Leukocytosis andShift to the left of neutrophils). Of these two were given scores of two (RIF tenderness and Leucocytosis) thereby making up a total of 10[53,54].

Migration of pain right iliac fossa	1
Anorexia	1
Nausea / Vomiting	1
Tenderness in right iliac fossa	2
Rebound tenderness	1
Elevated Temp. >37.5C	1
Leukocytosis	2
Shift to the left of neutrophils	1
Total	10

A score of 5 or 6	compatible with the diagnosis of acute appendicitis.
A score of 7 or 8	probable appendicitis
A score of 9 or 10	Very probable appendicitis.

Alvarado limitation[56]

The Alvarado score can be improved because it has many weaknesses. There was no consideration for age or sex of patients or for duration of symptoms. In extremes of age, even if score is low, surgery should be performed. There should have been a separate Alvarado score for males and females because of the greater chances of erroneous diagnosis of acute appendicitisin females when compared to males

The score was based on a retrospective review of patients who had been operated on for appendicitis, whereas the score is supposed to be used onpatients prospectively. Because of varied spectrum of disease between these groupsof patients, the scoring weights could be biased[56]. The variables were chosen without proper mathematical value and also of relevance. Also uncommon presentations have not been accounted into

Appendicitis inflammatory response score[57]

A more recent appendicitis inflammatory response score has been devised and is found to be more sensitive than Alvarado score. This score gives weightage for severity of symptoms and more values being given for increase in signs

Vomiting		1
Pain in right inferior fossa		1
Rebound tenderness or muscular defense	Light	1
	Medium	2
	Strong	3
Body temperature>38.5		1
Polymorphonuclear leukocytes	70–84%	1
	>85%	2
WBC count	10.0–14.9 9 10^9/L	1
	>15.0 9 10^9/L	2
CRP concentration	10–49 g/L	1
	>50 g/L	2
Total		12

Sum 0–4 = Low probability. Outpatient follow-up if unaltered generalcondition

Sum 5–8 = Indeterminate group. In-hospital active observation withrescoring/imaging or diagnostic laparoscopy

Sum 9–12 = High probability. Surgical exploration is proposed

The above scoreis similar to the Alvarado score in many ways, but there are important differences that may explain why this test performs better. The Alvarado score was based retrospective material and univariate analysis, whereas this score is a prospective one. Subjective and nonspecific variables like ‘‘anorexia,’’ ‘‘nausea,’’ were removed and more specific and objective variables like ‘‘vomiting,’’ CRP,’’ and ‘‘guarding’’ were included[53,57]. Instead of dichotomization, grading is used and hence more reliable. It must be noted that CRP has been incorporated in this newer scoring system.

PATHOLOGICAL SPECTRUM OF THE DISEASE

Inflammatory changes in appendicitis may affect the entire length of the appendix or only a part of it.In the latter case, the tip of appendix is more prone to be involved than base. Lack of luster of smooth serosa or dilated serosal vessels are the initial gross pathology noted. As the disease progresses, there is luminal obstruction with subsequent edema and also luminal enlargement. The mesoappendix may not be involved in earlier stages but in case of ischemic/ gangrenous appendicitis the mesoappendix may show signs of necrosis. Gangrenous appendicitis is identified as afriable appendix withblackish discoloration. Perforationfollows in untreated cases.

A dilated appendix may sometimes give the appearance of a mucocele of appendix."[58] Such a scenario needs the surgeon to have a pathological examination done and to rule out a mucinous neoplasm of appendix which may mimic the same. A faecolith may also a dilated appendix

Acute inflammation of the appendix may fall into one of the following category. Each of these could be considered as separate entities or a part of continuing spectrum of a single disease. The early stages are diagnosed pathologically whereas the late stages have distinct gross appearance

a) Acute catarrhal appendicitis[59]

In this condition, the inflammation may be present only in the appendiceal mucosa and may be noted when the specimen is cut open after appendectomy. Gross changes are generally not specific and a pathological examination showing neutrophilic infiltrate into the mucosa and sub mucosa may suggest and confirm the diagnosis of catarrhal appendicitis. In various studies , where appendix was removed in case of elective abdominal surgeries for other cause was performed it was noted that around 10% of these appendix showed features which would suggest a catarrhal or early appendicitis. None of the patient had symptoms suggestive of the disease at the time of presentation.

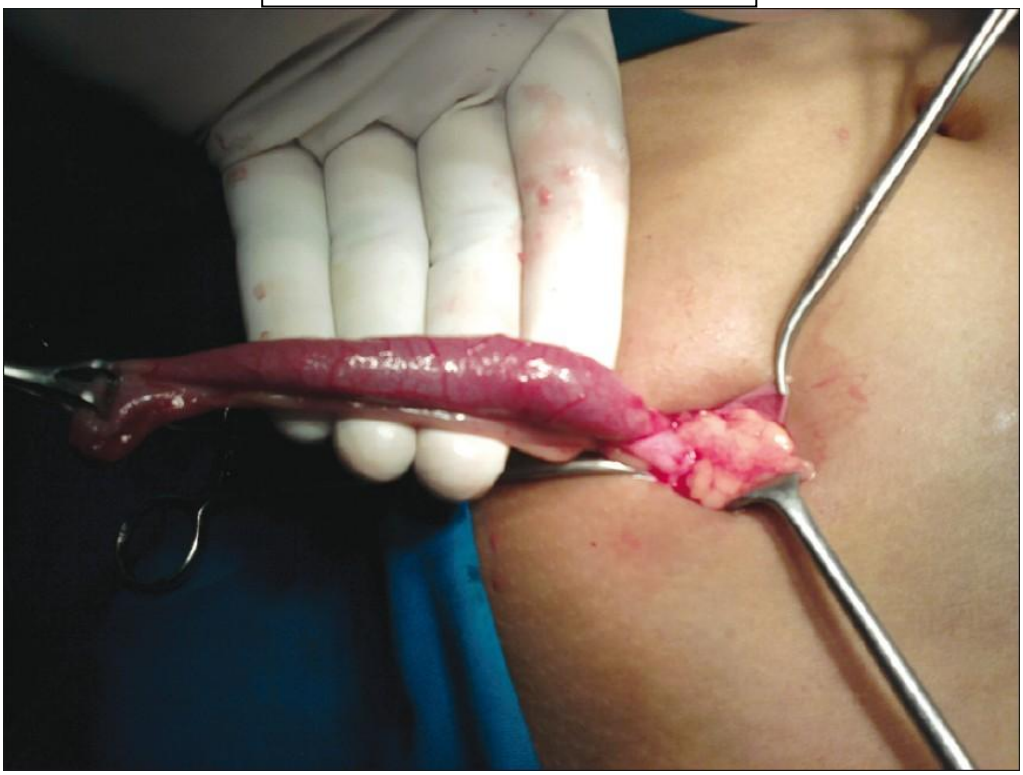
Also it was noted that non-specific enteritis may cause neutrophilic infiltration of appendiceal mucosa.This resulted in the opinion that most of the time; this may not be the cause for the patients' symptoms. Studies have also suggested that acute catarrhal appendicitis may be managed by conservative methods by antibiotics. If the aetiology is persistent the disease may progress or else the disease may subside.

b) Acute phlegmonous appendicitis

It is also called Suppurative appendicitis[59], and is characterized by transmural inflammation, extensive ulceration, and intramural abscesses formation. The serosa is not involved but it may be lusterless; vascular involvement in the form of thrombi is seen mostly. The involvement is circumferential. If such a finding is seen the symptoms may be attributed to the appendicealpathology. It has been found that eosinophilic infiltrate in muscularis is a routine finding in case of appendicitis and in case of suppurative appendicitis this will be seen.

Mucin may sometimes extravasate into the wall causing a foreign body kind of reaction.

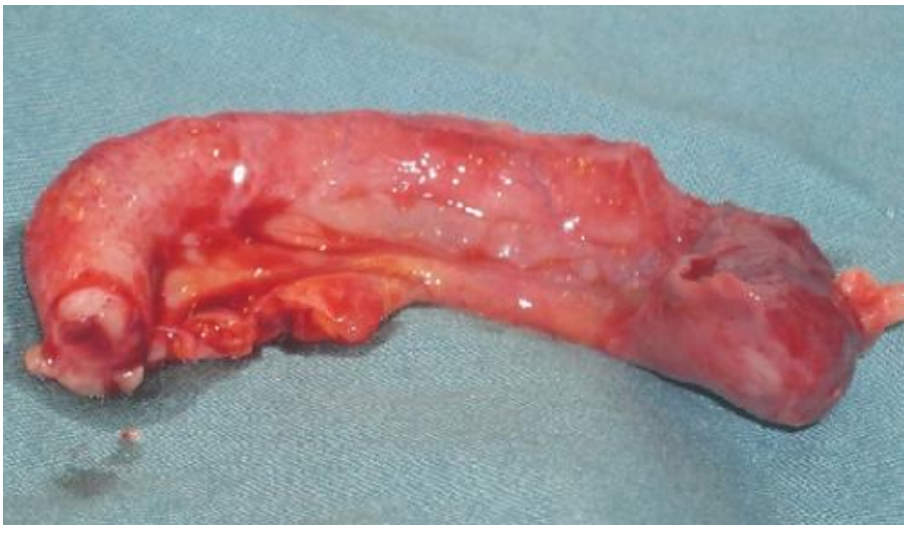
Acute phlegmonous appendicitis



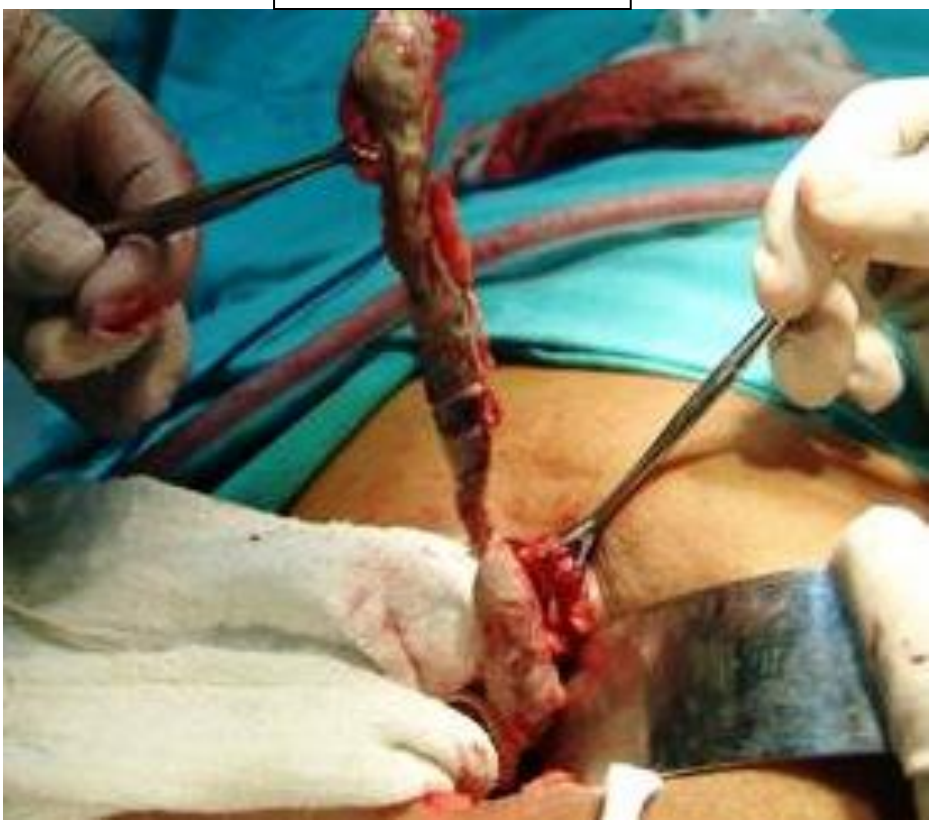
c) Gangrenous and Perforated Appendicitis

The main feature of gangrenous appendicitis is the involvement of serosa and mesoappendix along with gross features of necrosis which may be seen. A gangrenous appendix may progress to perforation[59]. But there are instances where even in the absence of gangrenous change in the appendix the tip of the appendix, the most common area prone for ischemia may undergo perforation. A diagnosis of perforation is macroscopic finding and in most cases the pathologist may not be able to report the same unless multiple sections are studied. The vascular compromise seen in phlegmonous appendicitis worsens and may lead to complete obstruction of blood supply and the subsequent ischemia may cause gangrene/perforation. The high rate of perforation in case of acute appendicitis in patients with sickle cell anemia could be explained based upon this theory of micro vascular thrombi[61]

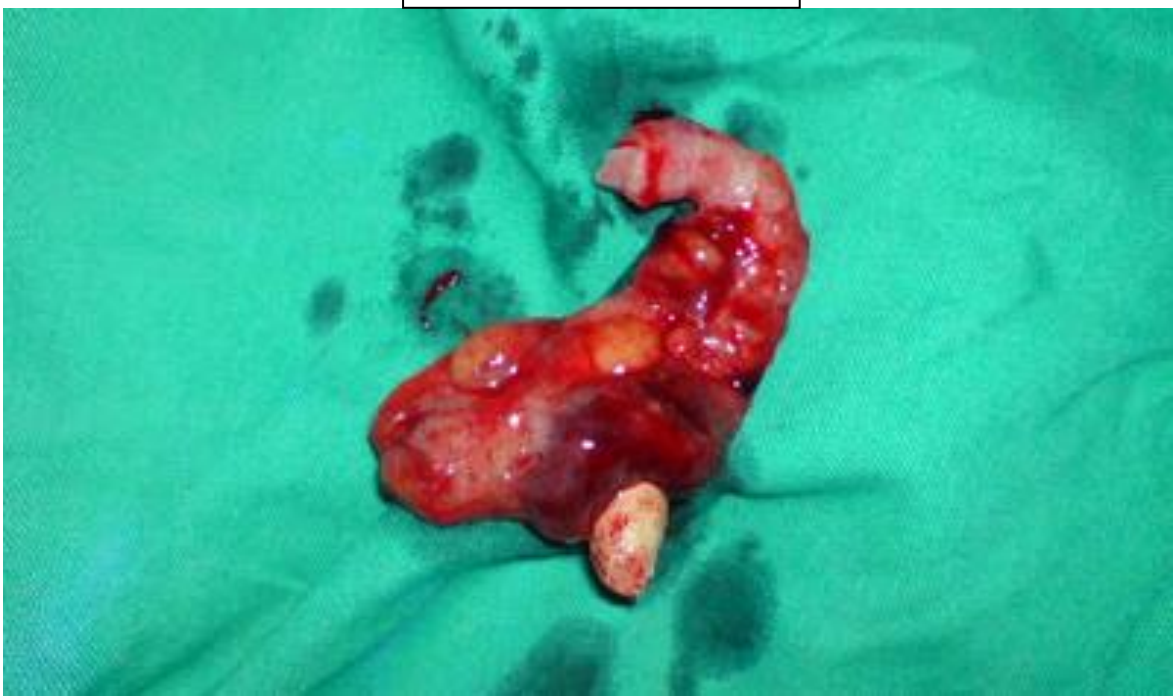
A perforated appendix



Gangrenous appendicitis



Appendix showing a fecolith



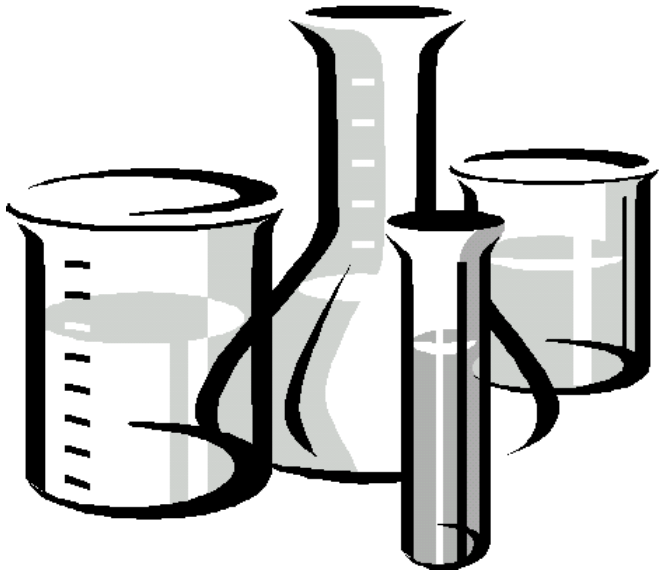
d) Appendicular mass

In case of early stages of phlegmonous appendicitis, the inflammatory reaction is not restricted to the appendix alone and the inflammatory mediators may cause peri appendiceal changes and may be associated with the appendix being engulfed with the surrounding omentum and may cause appendicular mass formation. The adhesions may be between the appendix and the nearby caecum. The delineation of appendix might be difficult at the time of surgery in such cases and in general it is advised that surgery need not be done in case of appendicular mass as the appendix has been be sealed by natural means and the chance of spread of disease to cause complications is less. Nevertheless patient needs to be watched to look out if there is progression or worsening of symptoms which may indicate that the disease is not localized and may sometimes require explorative laparotomy.[60]

e) Appendicular abscess

In case of a perforated or gangrenous appendicitis, the inflammatory exudates may spill out into the peri appendiceal space[59] and this may lead to a mass formation. Sometimes the inflammation is not contained and the ensuing reaction may cause a peri appendiceal collection of neutrophils causing a formation of abscess. In case of loculated abscess the signs may be minimal. The abscess may

expand and may spread and may cause peritonitis. The formation of abscess warrants immediate intervention. Patients with appendicular abscess are said to have increased morbidity and mortality when compared to catarrhal/ phlegmonous appendicitis. Ultrasound guided aspiration may be sufficient in a few but most of them require a lower midline laparotomy and abscess drainage



INFLAMMATORY

MARKERS IN

ACUTE

APPENDICITIS

Due to lack of a specific biomarker for Acute appendicitis and because the presentation is sometimes non specific, making a correct diagnosis remains a challenge. Commonly used laboratory tests for the diagnosis of appendicitis are white blood cell count(WBC), Serum bilirubin and C-reactive protein (CRP)[24].

In many surgical centers surgical procedures performed during the night are avoided , and it is a common thinking that delaying appendectomy for 12- 24 h does not increase complication rates.The current line of thought is that for early uncomplicated appendicitis antibiotic treatment may be sufficient. Appendicitis is also more and more being managed by antibiotics like diverticulitis. But Appendiceal perforation presenting with peritonitis always requires an immediate emergency operation or percutaneous drainage if there is abscess. Thus,there is a demand for accurate markers to specifically separate patients with complicated perforated appendicitis requiring surgery from those with uncomplicated acute appendicitis who may be observed.

Leucocytosis appears in around 70% to 90% of the patients with acute appendicitis. However, because few other acute abdominal complaints are

associated with leucocytosis, it has a low specificity. Due to the relation between Leucocytosis and appendicitis, it has been incorporated in Alvarado scoring system[51]. But still degree of leucocytosis does not correlate with the severity of acute appendicitis. Hence there is a need for an inflammatory marker which can predict the severity of Acute appendicitis

Elevated CRP and hyperbilirubinemia are found to have linear relation with severity of Acute appendicitis.Numerous studies have found that CRP levels are helpful in detecting perforation and abscess in patients with suspected appendicitis Two other markers that have shown to be helpful in diagnosing appendicitis. They are calprotectin(CP) and serum amyloid A (SAA) protein[67].The pathophysiology of appendicitisinvolves an increase in mucosal barrier`s permeability. This leads to influx of activated neutrophils which release Lactoferrin and calprotectin which can be detected in the systemiccirculation. Calprotectin, a cytosolicprotein constitutes around 60% of proteins inhuman neutrophil granulocytes and is helpful to differentiate appendicitis from normal individuals[63].

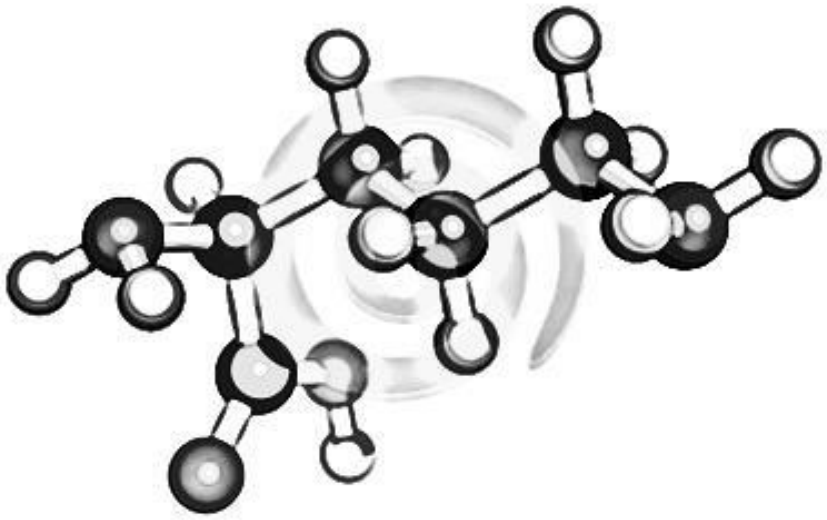
SAA protein is a family of proteins produced inresponse to inflammation-related cytokines such asinterleukin (IL)-1, IL-6, and TNF alpha.There are several isoforms of SAAof which SAA 1 which peaks within 2 to 3 hours after

activationof the immune system and returns to normal levelsat 5 to 7 days is highly specificto indicate disease process and was found to be a reliable marker in children than leucocytosis and CRP.[64]

Serum bilirubin is a breakdown product of hemoglobin. Hyperbilirubinemia maybe conjugated or unconjugated. Hyperbilirubinemia may be due to pre hepatic (hemolysis) intrahepatic (liver parenchymal disease) or post hepatic cause (obstructive jaundice). Hyperbilirubinemia is seen in certain congenital disorder like Gilbert syndrome.Many researchers have proposed thatHyperbilirubinemia could be used to support the diagnosis of perforated appendicitis[68]. The levels elevated bilirubin is directly related to the pathogenesis of appendicitis and in cases of perforated or gangrenous appendicitis, the rise in bilirubin was found to be higher than that seen in cases of catarrhal or phlegmonous appendicitis.

This raise in serum bilirubin has been attributed to sepsis induced cholestasis[69]. Hence for Hyperbilirubinemia to occur in case of acute appendicitis the degree of disease needs to be severe with signs of sepsis evident. Also it is been found in many studies that Hyperbilirubinemia is a sensitive marker only in cases of Severe appendicitis and not a good marker in early stages of appendicitis. All laboratory investigations including CRP, Leucocytosis, and Serum Bilirubin have

been found to be increased in other inflammatory diseases and also in certain other medical conditions. They are still pretty good markers in pre operative evaluation in suspected cases of acute appendicitis when used together than alone



CRP IN

ACUTE APPENDICITIS

CRP is the best known among the acute phase proteins, a group of proteins whose concentration increasers in blood in response to inflammatory disorders.C-reactive protein (CRP), an acute phase protein was first discoveredby W.S. Tillet and T. Francis at the Avery laboratory of theRockefeller institute in 1930.[70] It is used routinely in many centersto aid in the diagnosisof patients with an acute abdomen. It is an acute phase protein produced in the liver. Normally in healthy individuals serum concentration is less than 5 mg/l. It increases after 6-12 hours after an acute inflammatory process and returns to normal within 72 hours after the cause is removed.

It is increased in conditions likeinfections, inflammatory arthritis, post-operative states, neoplasia, pregnancy, and aging. CRPproduction is controlled by Interleukin-6 and in a few minutes' increases from 10 to 1,000 times.Many reports have investigated the value of the raisedserum CRP measurement in improving the diagnosis ofacute appendicitis. It is more sensitive than leucocyte count or Erythrocyte sedimentation rate as the increase occurs earlier and after healing it returns back to normal range[71]

The positive CRP is more accurate than the Leucocyte count and neutrophil count in predicting severity of suspected appendicitis. When combined together with the

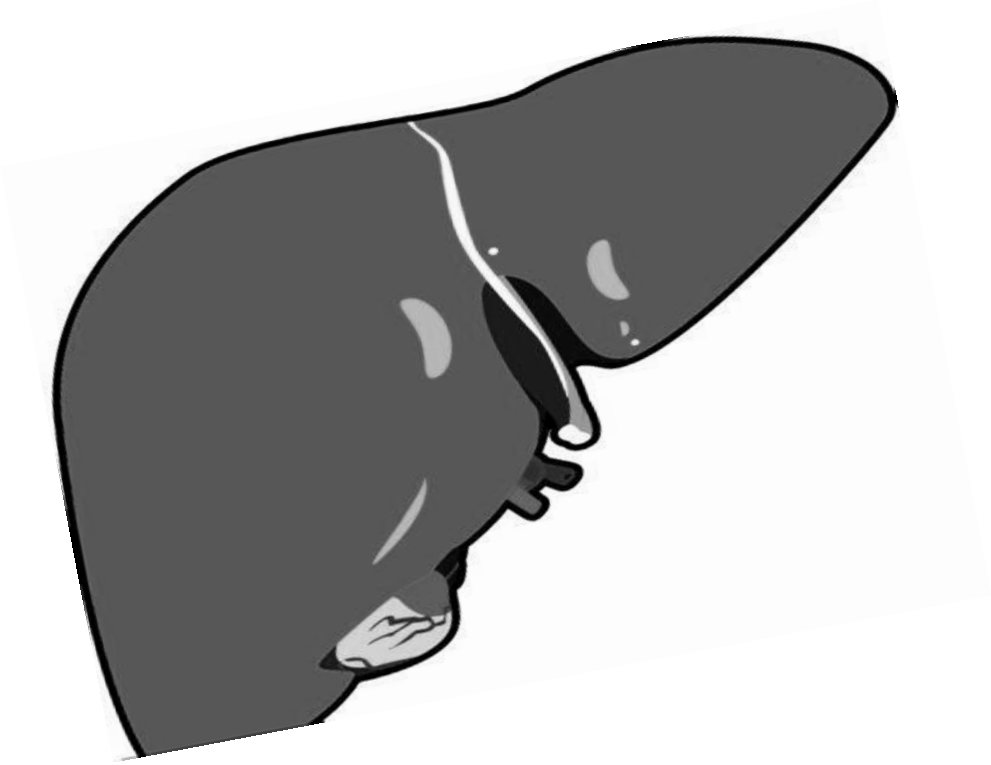
above two tests, it further improves diagnostic accuracy. The sensitivity and specificityof CRP is reported as 86.6% and 93.6%, respectively[72]. Numerous studies showed that a normal CRP value probably indicates anormal non-inflamed appendix. In case of perforated or gangrenous appendicitis the increase in CRP may be five to ten folds[72] and so the test is more specific in severe cases of acute appendicitis than in initial phases. Also in cases of catarrhal or phlegmonous appendicitis, CRP values are very useful in the diagnosis, but it is not highly sensitive and doesn`t replace the clinical judgment of a surgeon.

Because there are many inflammatory disorders which may cause a raise in CRP levels the test can`t be used alone as a severity predictor of acute appendicitis. Nevertheless its positive linear correlation is proved in many prospective and retrospective studies. This lead to CRP values greater than 5 mg/l being included as a criterion in the recent Appendicitis inflammatory response score for evaluation of patients with suspected acute appendicitis. The sensitivity and positive predictive value of CRP can be increased if it is used along with other tests

When only patients with acute appendicitis were considered, CRP, WBC and granulocyte count were found to be increased[74]. But, CRP levels showed a progressive increase with increase in severity, whereas WBC and granulocytes did

not increase in a linear manner but even decreased in perforated cases as compared with gangrenous appendicitis. Multiple studies have shown that CRP was the only single significant predictor of perforation among the laboratory data.

Also it has been studied that CRP is less accurate in the first hours after the onset of pain but its sensitivity raises to 100 percent after about 12 hours; So, it could be told with near certainty that a raised CRP values after 12 hours nearly always suggests acute appendicitisIn one particular study, accuracy was 77.9 percent in patients with less than 12 hours after onset of pain and increased to 89.6 percent after 12 hours[74]. Therefore, in the initial 12 hours after onset of pain it is specially indicated to consider CRP along with other tests; if one of them is normal and the other is elevated, clinical imaging and further tests may be helpful.



HYPERBILIRUBINEMIA

IN

ACUTE APPENDICITIS

Elevated Serum bilirubin is found in a number of cases of acute appendicitis. This hyperbilirubinemia seems to be not due to either Hepatic dysfunction or obstruction to biliary flow. A raise in serum bilirubin is a useful marker especially in case of perforated appendicitis. It should be mentioned that, hyperbilirubinemia is seen in various other disease states, like general peritonitis (e.g., alimentary tract perforation), sepsis and in cases such as post major surgeries. The major pathogenetic mechanism for this increase not associated with hepatic dysfunction is said to involve enhanced bilirubin production incited by oxidative stress due to various invasions. It has also been suggested that Bilirubin by itself possesses antioxidant activity[27], and that excessive reactive oxygen species produced are scavenged by enhanced bilirubin production in the body.

Regarding bacterial inflammation, it is seen that severalbacterial infections are prone to induce cholestasis. The two most common primary causative organisms found in of acute appendicitis are Escherichia coli and Bacteroides fragilis. These two species are said to inhibit the microcirculation and cause damage to hepatic sinusoids in rats. E. coli produces an endotoxin which produces dose-dependent cholestatic disorder. Also, hemolysis of erythrocytes is causedby E. coli infection[24,25]. These mechanisms may explain the reason for hyperbilirubinemia in cases of acute appendicitis. In thecase of gastrointestinal

perforation, upper gastrointestinal trephination is accompanied by acute pain, but the bacteria-positive rate due to peritoneal irritation is generally low. In addition, perforation of the upper gastrointestinal tract is more commonly an aseptic chemical peritonitis Bacterial peritonitis by secondary infection occurs only 6–8 hours after perforation[30]. So hyperbilirubinemia is seldom noticed more often in such cases. In contrast, the bacteria positive rate is increased following appendicealperforation, because the area of perforation lies in the lower part of the gastrointestinal tract. The frequency of separation of E. coli and B. fragilis is higher following the perforation of the appendix and the large intestine than due to gastrointestinal tract perforations[68].

In appendicitis, compromised appendix wall integrity leads to translocation of bacteria and endotoxins from the lumen of appendix into the portal system. Inflammatory cytokines may then travel tothe liver, inducing intrahepatic cholestasis. Research has revealed that E. coli endotoxin causes dose dependent cholestasis. Higher percentage of patients with gangrenous appendicitis are found to have an elevated preoperative serum bilirubin[69] , providing further evidence of the more pronounced inflammation in such patients. Postoperative complications occur more commonly in the patients who were hyperbilirubinemic prior to the operation. The pathogens involved in SSIs in appendectomized patients are mainly

gram negative bacilli and anaerobes. Gram-negative bacilli produce endotoxins, stimulate cytokine production andalso promote the generation of free radicals. The risk of developing a SSI depends on the amount of contaminant organisms present. It is suggested that postoperative SSI was more frequently encountered in thehyperbilirubinemic patients due to the greater quantity of contaminant microbial pathogens, and therefore, the more pronounced inflammation. So in patients with severe acute appendicitis heavier bacterial load is present, and consequently, more severe inflammation occurs which would in turn cause greater generation of reactive oxygen species and to scavenge these hyperbilirubinemia develops. Furthermore, studies show that the elevated bilirubin returns to normalcy after the operation in around 90% of the patients, which may be to be attributable to the elimination of excessive reactive oxygen species; the bacterial infection.

The length of hospital stay and complication rates are found to be more in case of patients who have increased pre-operative Serum bilirubin than those with normal bilirubin. Multiple studies have found that Increased pre-operative serum bilirubin is found to be a risk factor by itself in case of gangrenous appendicitis Patients with preoperative hyperbilirubinemia are said to be in a clinically and pathologically more severe state and can be an indication for surgery for acute appendicitis. In patients with elevated serum bilirubinlevel prior to surgery for

acute appendicitis, there is a higher probability of disease progression to a severe condition.Therefore, all patients with elevated serum bilirubin must be suspected to have severe form of acute appendicitis and are said to be candidates for emergency surgery[75].

MATERIALS AND METHODS

PERIOD OF STUDY

Data was collected from September 2013 to August 2014 – 1 year

PLACE OF STUDY

Department of Surgery, Govt Kilpauk Medical College.

INCLUSION CRITERIA

- Patients admitted with abdominal pain with signs and symptoms of acute appendicitis who are clinically diagnosed to have acute appendicitis are included in this study
- Patient of both sexes
- Age from 18 years to 60 years
- Patients who are willing to give consent for study were included.

EXCLUSION CRITERIA

- Pregnant women
- Patients on Long term steroids/immunosuppressant.

- Patients on treatment for Chronic Inflammatory diseases.
- Known CAHD patient
- Patients with Chronic liver disease

SAMPLE SIZE

100 patients

STUDY METHODOLOGY

Patients who got admitted to emergency department , Department of General Surgery, Government Kilpauk Medical College Hospital with complaints of acute abdominal pain and who were clinically diagnosed to have acute appendicitis were included in the study. All who satisfied the inclusion criteria were retained in the study group and those who did not were excluded from the study. Consent was obtained from the patient regarding inclusion in study.History and clinical examination was done. Patient`s age sex, symptoms and their duration were recorded. Also recorded were relevant gynaecological and urological history and also history of previous surgeries. Tenderness in McBurney's point and other signs which may indicate presence of Acute appendicitis was elicited and documented.

Arriving at a diagnosis and deciding to operate was made by the Operating surgeon alone based on clinical evaluation.

Routine blood investigations and Imaging studies were done pre operatively and documented. Blood samples were collected from 100 patients who satisfied the inclusion criteria for Serum Bilirubin and C Reactive Protein levels estimation. All those who were diagnosed to have Acute appendicitis were taken up for Emergency Open appendectomy. If the patient had normal appendix at the time of surgery a search was made for any other pathology which would explain the clinical presentation and if found treated accordingly.

Serum bilirubin and CRP estimation was done by kits from Diasys Private limited.

CRP ESTIMATION

CRP was estimated from the serum of the patient and mixed two reagents.

R1- HEPES containing polyclonal (goat) and monoclonal (mouse) anti human CRP antibodies bound to carboxylated polystyrene particles to Polyethylene glycol - 10 mmol/l

R2- Borate buffer - 4.6 mmol/L

Analysis was by Hitachi 911 analyzer and the technique used for quantitative analysis of CRP was by particle enhanced immunoturbidometric test.

It was based on the principle of fixed time determination of the concentration of CRP by photometric measurement of antigen antibody reaction of antibodies to human CRP bound to polystyrene with CRP present in the sample. The CRP concentration of an unknown sample was found using comparison to calibration curve provided with the analyzer.

BILIRUBIN ESTIMATION

Bilirubin estimation was done by a photometric test using 2, 4-dichloroaniline provided by Diasys Pvt Ltd. It was based on the principle that, in an acidic solution, direct bilirubin forms a red coloured azo compound with diazotized 2, 4- dichloroaniline. The test can be used to detect total bilirubin levels also. Unconjugated bilirubin levels are estimated by estimating the difference between the two.

R1- Phosphate buffer - 50 mmol/l

R2- 2, 4 – Dichlorophenyl diazonium salt – 5 mmol/l.

The values were documented and tabulated.

All patients underwent appendectomy by Lanz incision as was the Institution standard. In certain cases, there was a preoperative diagnosis of abscess by imaging modality (Ultra sonogram or ComputerizedTomography). The intra operative findings were noted and the patients were classified into one of the following study groups. The classification of the patient into the groups was by the Study person alone based upon the findings.

The groups were

1. Acute Appendicitis- Those who had inflamed appendix at the time of surgery , with no perforation/gangrene and with no other abdominal pathology which could explain patient`s symptoms
2. Appendicular perforation- Those who had inflamed appendix during surgery and appendix was perforated at the time of surgery
3. Gangrenous Appendicitis – Appendix which was ischemic (necrotic), with doubtful vascularity or found to be showing blackish discoloration
4. Appendicular Abscess – An inflamed appendix with peri appendiceal pus collection.

5. Appendicular mass – Appendix covered with omentum and not separately visualised with signs of inflammation present.
6. Normal Appendix – Appendix showing no signs of inflammation and/or some other intra abdominal pathology is found which explains patient`s symptoms

The specimen was sent for Histopathology study and the results noted. The comparison of pre-operative Bilirubin and C reactive protein levels were done with the intra operative finding and results tabulated.

PROFORMA

PROFORMA

1. Patient name
2. IP No:
3. Department:
4. Hospital:
5. Age:
6. Sex:
7. Chief complaints:
8. Past history:
9. General examination

   Vitals

   a. Pulse rate:

   b.Blood pressure:

   c.Temperature:

10. Abdominal examination

    Inspection

    Palpation

    Percussion

    Auscultation

11. per Rectal Examination

12. Cardiovascular and respiratory system examination

Pre-operative Diagnosis

- **Investigations**
  - Complete hemogram
  - Urine routine
  - Blood sugar
  - Blood urea
  - Serum creatinine

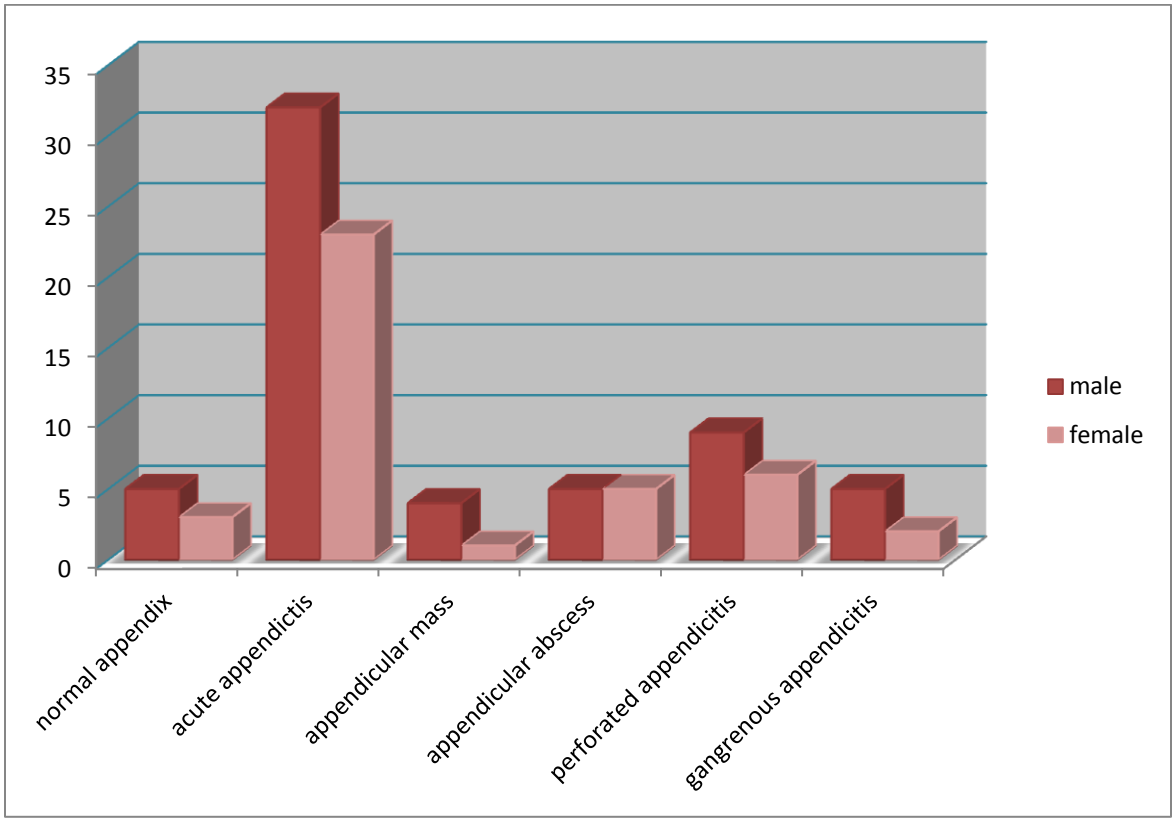
- Serum electrolytes
- **Liver Function Test including Serum Bilirubin**
- **C reactive protein**
- USG abdomen
- Plain X ray abdomen erect AP view

- Macroscopic peroperative finding

- Biopsy result

DATA ANALYSIS AND DISCUSSION

INCIDENCE OF DISEASE

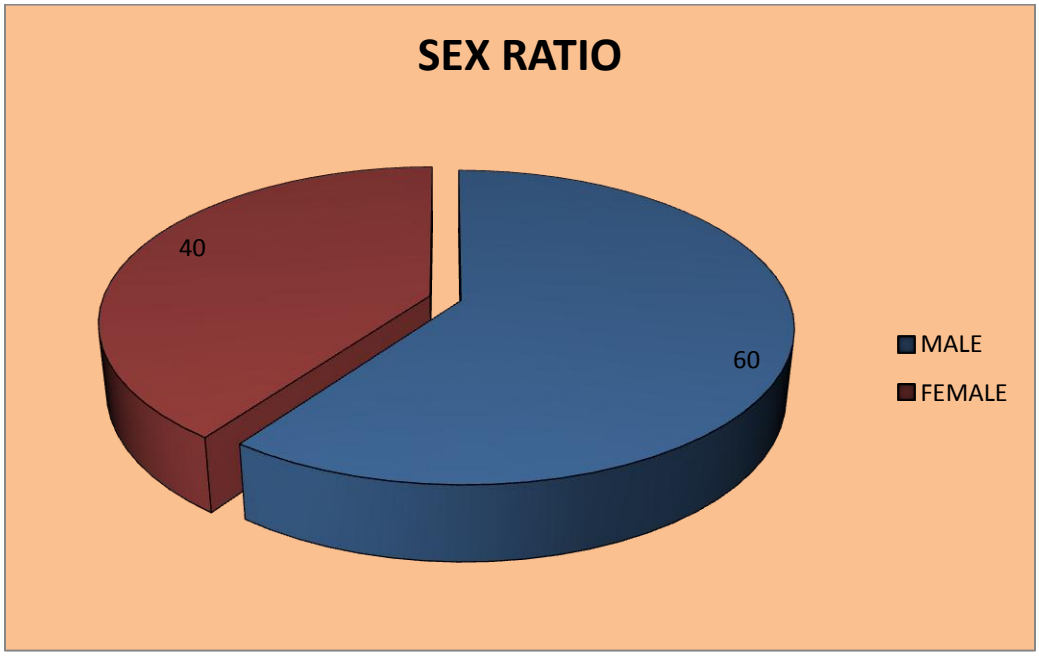


	MALE	FEMALE
Normal appendix	**5**	**3**
Acute appendicitis	**32**	**23**
Appendicular mass	**4**	**1**
Appendicular abscess	**5**	**5**
Perforated appendicitis	**9**	**6**
Gangrenous appendicitis	**5**	**2**

- The above chart and table shows the distribution of disease and varied presentation among the study population
- More than 50% of the study population was found to have uncomplicated appendicitis among the study group
- 8 of the 100 patients included in the study were found to have normal appendix at the time of operation. The negative appendectomy rate for this study is 8%
- The number of patients who had either perforation/gangrene at the time of surgery was 22. So perforation rate for this study is 22%
- It is seen that more male patients had normal appendix than females. But as the male: female ratio of this study itself was more; this is not a significant finding.
- Around 5% of patients had an early mass formation at the time of surgery. Appendectomy was not done in these patients and biopsy was done from the mass

SEX DISTRIBUTION:

CHART-2



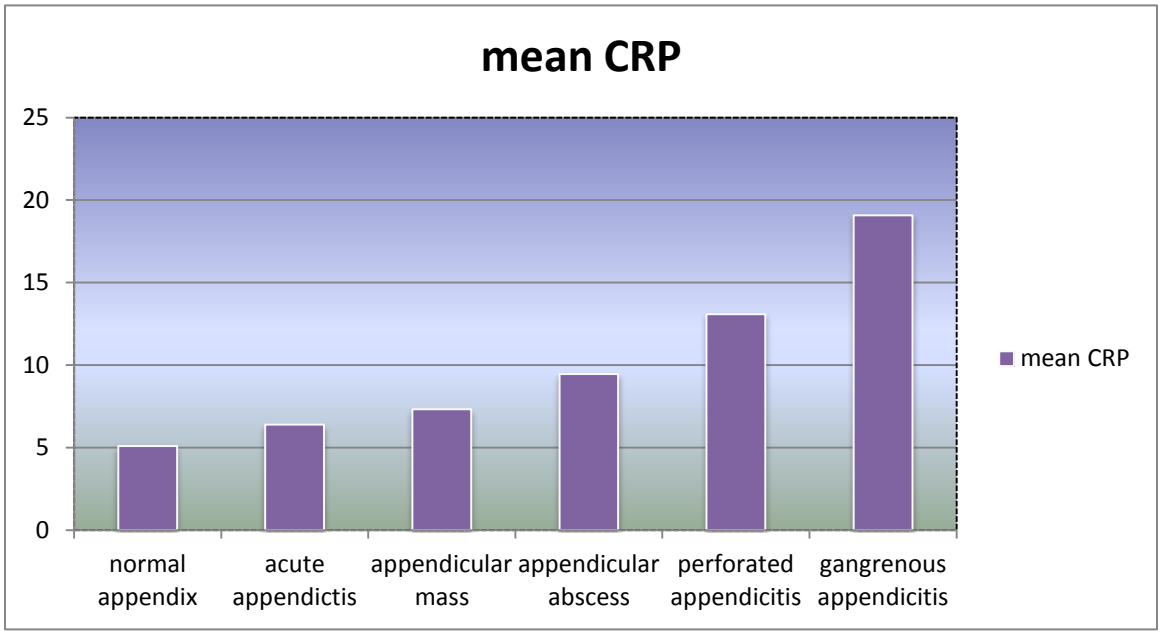
SEX	PERCENTAGE
MALE	**60**
FEMALE	**40**

Appendicitis	Yes	No	Total
Male	55	5	60
Female	37	3	40
Total	92	8	100

P Value
0.880384101

- This is a pie chart shows the male female ratio in this study.
- This study shows out of 100 patients, 60% of the male patients had suspected appendicitis and 40% of the females had appendicitis.
- The male: female ratio in this study is 1.5:1.
- There seems to be a slight male predominance in case of appendicitis but this was found to be statistically not significant (p=0.88)
- This could probably also due to the fact that the females included in the study itself were lesser due to the inclusion and exclusion criteria

CRP IN ACUTE APPENDICITIS



Pathological diagnosis	Mean C Reactive protein level
Normal appendix	5.1
Acute appendicitis	6.39
Appendicular mass	7.32
Appendicular abscess	9.45
Perforated appendicitis	13.09
Gangrenous appendicitis	19.08

- The above bar diagram shows the relation between pre-operative C reactive protein values and the severity of disease at the time of surgery

- The mean CRP value given in literature is found to be 5mg/l. In our study the mean value in our study was found to be 5.1mg/l which is closely related to the universal normal values

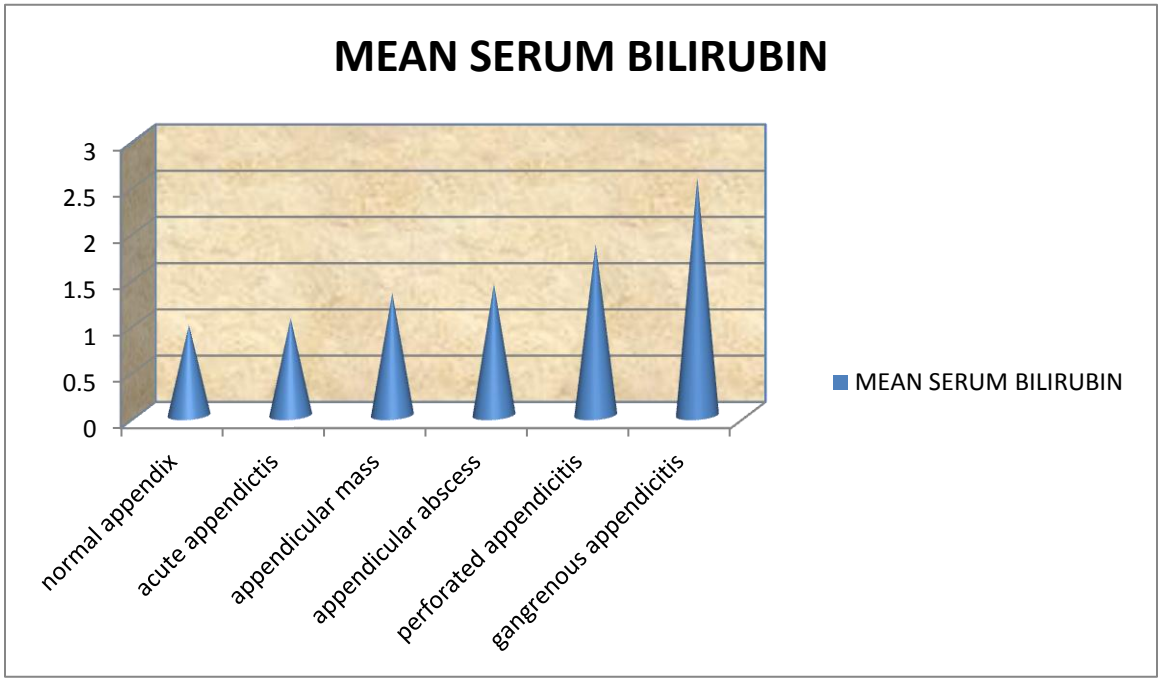
- CRP is an acute phase reactant. In our study group, patients who had normal appendix at the time of surgery had some other pathology eg.Meckel`sdiverticulitis which might even cause an increase in CRP levels.

- It is seen that the CRP levels increase with increase in severity of disease. The increase in CRP is found to be more pronounced with respected to perforated or gangrenous appendix as seen in the above bar graph.

- In case of mass/ abscess, the raise in CRP is not that much pronounced.

- Also notable is the fact that the C reactive protein levels are more in case of Gangrenous group than in perforated group.

SERUM BILIRUBIN IN ACUTE APPENDICITIS



Pathological diagnosis	Mean Serum bilirubin levels (mg/dl)
Normal appendix	0.975
Acute appendicitis	1.047
Appendicular mass	1.32
Appendicular abscess	1.42
Perforated appendicitis	1.8
Gangrenous appendicitis	2.8

- The above charts show the relation between Serum bilirubin levels and severity of appendicitis

- The normal range for Serum bilirubin is said to be between 0.8-1.2mg/dl.

- The mean serum bilirubin in our study is found to be 0.975 mg/dl

- From above bar graph it is seen that even in acute appendicitis the mean serum bilirubin is found to be within the universal normal range only.

- Serum bilirubin elevation occurs only in cases of perforated and gangrenous appendicitis

- The elevation in serum bilirubin is marked with gangrenous appendicitis (2.8 mg/dl) than perforated appendicitis (1.8 mg/dl)

- It is seen that in case of mass and abscess the serum bilirubin elevation is not very much.

- Also it is seen that Serum bilirubin in contrast to CRP is an indicator of perforation/ Gangrenous appendix and not a mere marker of inflammation alone

Sensitivity and Specificity of CRP in predicting appendicitis

		Appendicitis	
		Y	**N**
CRP	**>5**	76	4
	<=5	16	4

SENSITIVITY	0.826087
SPECIFICITY	0.5
PPV	0.95
NPV	0.80

Sensitivity and Specificity of CRP in predicting appendicitis

- The above chart shows the sensitivity specificity positive and negative predictive values for CRP in predicting acute appendicitis
- The cut off was kept as 5 mg/l, which is the universal normal value
- It is found that in the current study the specificity was found to be 50% and the sensitivity is 82.60%
- CRP has a very high positive predictive value (95%). This means an increase in CRP values correlates well with the presence or absence of appendicitis.
- CRP is found to have less negative predictive value (80%). This means absence of an elevated CRP value doesn't always rule out appendicitis.
- So CRP can be used as a test to diagnose if a patient has appendicitis or not because it has high sensitivity

Sensitivity and Specificity of Serum bilirubin in predicting appendicitis

Disease		**Appendicitis**			
Test	**Present**	**n**	**Absent**	**n**	**Total**
Serum Bilirubin					
Positive>1.2	True Positive	a= 39	False Positive	b= 0	a + b = **39**
Negative ≤ 1.2	False Negative	c= 53	True Negative	d= 8	c + d = **61**
Total		a + c = **92**		b + d = **8**	

Sensitivity	$\frac{a}{a+c}$	= **42.39 %**	95% CI: **32.15 %** to **53.14 %**
Specificity	$\frac{d}{b+d}$	= **100.00 %**	95% CI: **62.91 %** to **100.00 %**
Positive Predictive Value	$\frac{a}{a+b}$	= **100.00 %** (*)	95% CI: **90.89 %** to **100.00 %**
Negative Predictive Value	$\frac{d}{c+d}$	= **13.11 %** (*)	95% CI: **5.85 %** to **24.22 %**

- The above charts show the sensitivity and specificity of Serum bilirubin in predicting appendicitis

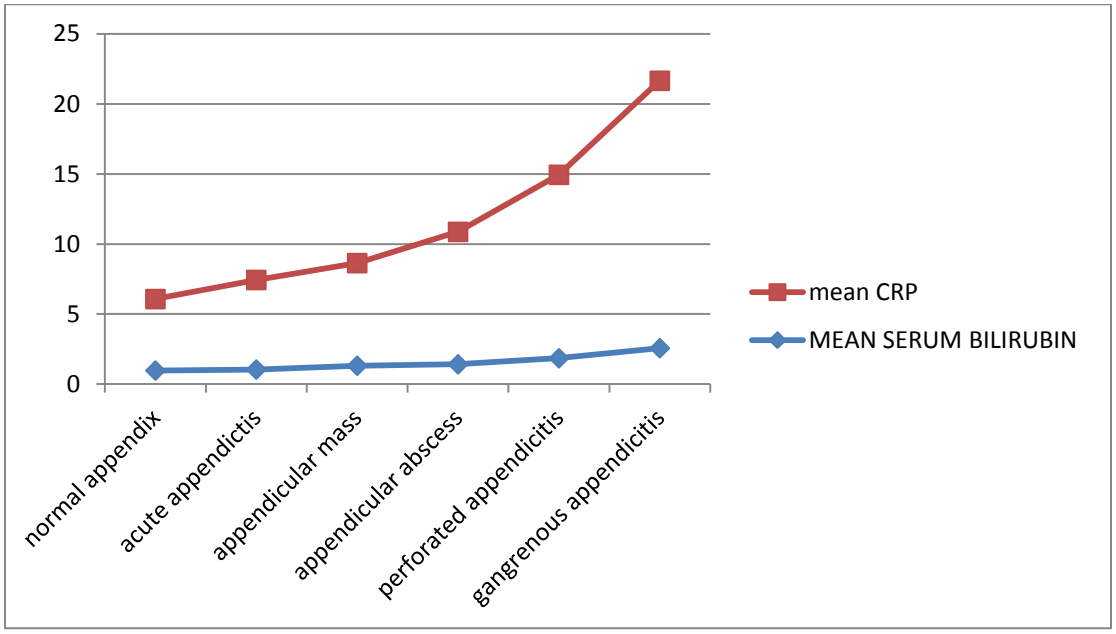
- It is seen that serum bilirubin is a low sensitivity test in assessing appendicitis.

- It has been seen through numerous studies that in early phases of disease marked rise in serum bilirubin does not occur. Our study also supports the same view.

- Though the specificity is very high (100%), the test could be used to only rule out absence of disease but may not be helpful in diagnosing early suspicious cases.

- The false negatives are high in case of serum bilirubin. So even in many cases of appendicitis the serum bilirubin might be normal

Mean CRP and Bilirubin in Acute appendicitis



Pathological diagnosis	Mean Serum bilirubin levels (mg/dl)	Mean C Reactive protein level
Normal appendix	0.975	5.1
Acute appendicitis	1.047	6.39
Appendicular mass	1.32	7.32
Appendicular abscess	1.42	9.45
Perforated appendicitis	1.8	13.09
Gangrenous appendicitis	2.8	19.08

- The above stacked line diagram compares the mean values of CRP and Bilirubin in acute appendicitis.
- It is seen that the increase in CRP is very significant when compared to Serum bilirubin.
- The increase in CRP in cases of gangrene or perforation is comparable to that of Raise in Bilirubin (3-4 fold raise).
- In case of Acute appendicitis or appendicular mass/abscess, Serum bilirubin was not a better marker than CRP in predicting severity of disease.

CRP in perforated/gangrenous appendicitis

		Perforated/Gangrenous		Total
		yes	no	
CRP values	> 5mg/l	22	56	78
	≤5mg/l	0	22	22
Total		22	78	100

P Value
0.004794696

SENSITIVITY	1
SPECIFICITY	0.282051
PPV	0.282051
NPV	0

- The above chart shows the sensitivity and specificity of CRP in case of perforated appendix.

- In this study, it was found that none of the patients who had perforation had a CRP value below 5 mg/l. So the sensitivity of CRP in case of perforated appendix is found to be 100%

- But it was also noted that the specificity was very low. (28.2%). But this should be viewed considering the fact that in most cases where CRP was elevated but appendix was not perforated , appendix showed either phlegmonous appendicitis or abscess was present

- Only in 2 patients with elevated CRP was the appendix found to be normal. 41 of them had appendicitis (without perforation), 9 had abscess and 4 had mass at the time of surgery

Bilirubin in perforated/gangrenous appendicitis

		perforation	
		Y	N
bilirubin	>1.2	19	9
	≤1.2	3	46

SENSITIVITY	0.863636
SPECIFICITY	0.836364
PPV	0.678571
NPV	0.061224

- The above chart compares the specificity,sensitivity of serum bilirubin in predicting perforation/gangrene when compared to catarrhal/phlegmonous appendicitis.

- Patients with normal appendix and those with mass or abscess were not taken into consideration for comparison in the above table.

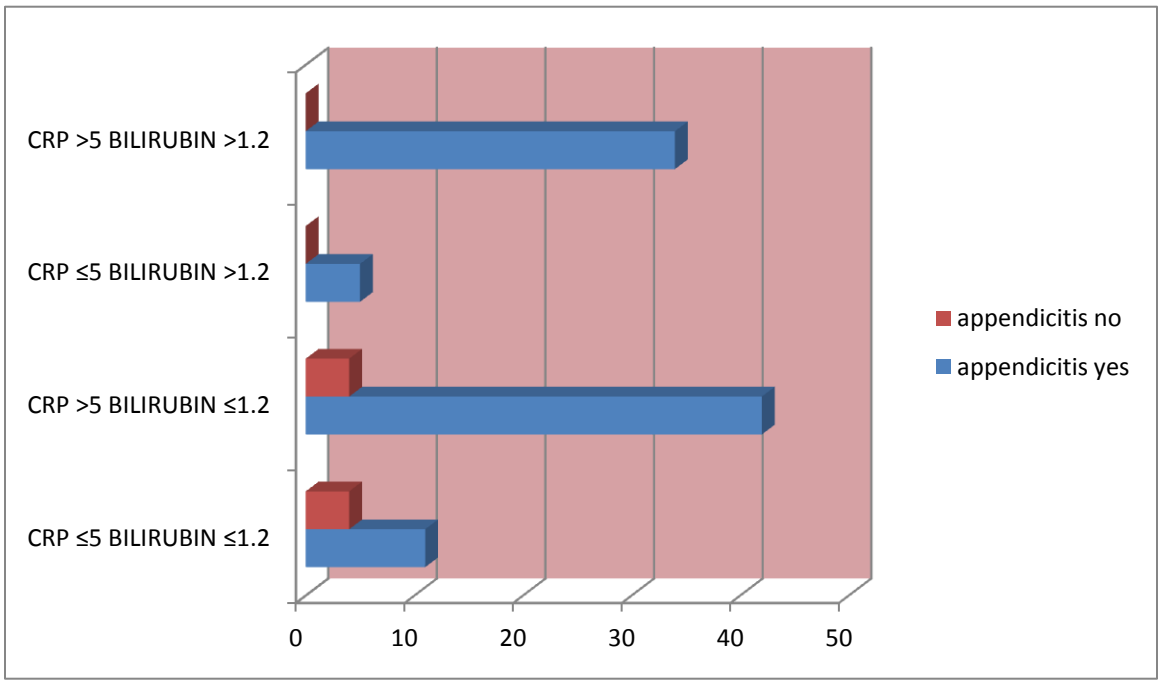
- It is found that the sensitivity (86.36%) and specificity (83.63%) of Serum bilirubin in predicting perforation/gangrene (complicated) when compared to uncomplicated appendicitis is very high.

- It was also found that none of the patient with normal appendix had an elevated serum bilirubin.

- Even in the 55 patients with uncomplicated appendicitis, only 9 had elevated serum bilirubin and 46 had bilirubin below 1.2mgs/dl only

CRP combined with Hyperbilirubinemia in predicting severity

APPENDICITIS	CRP ≤5 BILIRUBIN ≤1.2	CRP >5 BILIRUBIN ≤1.2	CRP ≤5 BILIRUBIN >1.2	CRP >5 BILIRUBIN >1.2
YES	11	42	5	34
NO	4	4	0	0
Total	15	44	5	34



P Value
0.014605687

- ✓ The above charts show the comparison between presence or absence of appendicitis compared in four groups

a) **CRP ≤5 BILIRUBIN ≤1.2**

b) **CRP >5 BILIRUBIN ≤1.2**

c) **CRP ≤5 BILIRUBIN >1.2**

d) **CRP >5 BILIRUBIN >1.2**

- ✓ It is seen that appendicitis is seen more commonly in groups with elevated CRP and also in groups with elevated CRP and bilirubin
- ✓ But this raise seen in those patients with elevated CRP is probably due to a large number of uncomplicated appendicitis in this study population.
- ✓ The graph shows number of patients with/without appendicitis in these four groups.
- ✓ The data is found to be statistically significant (p=0.014)

CONCLUSION

This study was done with the objective of finding markers which would be helpful to pre operatively predict severity of acute appendicitis and also to predict if a patient has acute appendicitis or not, when a patient presents with symptoms suggestive of the same. The existing setup helps in aiding a surgeon in validating his clinical suspicion in case of a patient with suspected acute appendicitis. The current scoring systems or imaging modalities help in diagnosing acute appendicitis but none help in grading severity and none is specific enough to bring the negative appendectomy rate to minimal levels

From this study, it is seen that C Reactive protein and Elevated serum bilirubin values may be used in pre operative assessment of patients with suspected appendicitis. C reactive protein maybe used as a rule out test and maybe helpful in reducing the negative appendectomy rates. But, Serum bilirubin, based on this study, is found to be a precise indicator of severity of disease than just diagnosing if a patient has acute appendicitis or not. An elevated serum bilirubin in a patient with suspected acute appendicitis is a warning sign and warrants surgery and could be helpful in reducing the morbidity and mortality seen in association with complicated appendicitis.

Whereas, C Reactive protein is a marker of inflammation and if a patient with suspected appendicitis has a normal CRP level, the patient may be considered for observation if the surgeon decides. With one of the tests having high sensitivity and one having good specificity, combining both can be useful in creating an ideal screening platform which is both sensitive and specific. So by combining both Serum Bilirubin values and CRP levels, negative appendectomy rate and perforation related complications in a case of acute appendicitis may be brought down. CRP has already made its way into diagnostic scores meant for appendicitis and Serum Bilirubin will be a helping hand to it. Larger prospective studies with more sample size are needed. The conclusion is, for any case of Acute abdomen, (including acute appendicitis), the clinician and his skills are the main deciding factors in arriving at a diagnosis and all other aids are supplementary.

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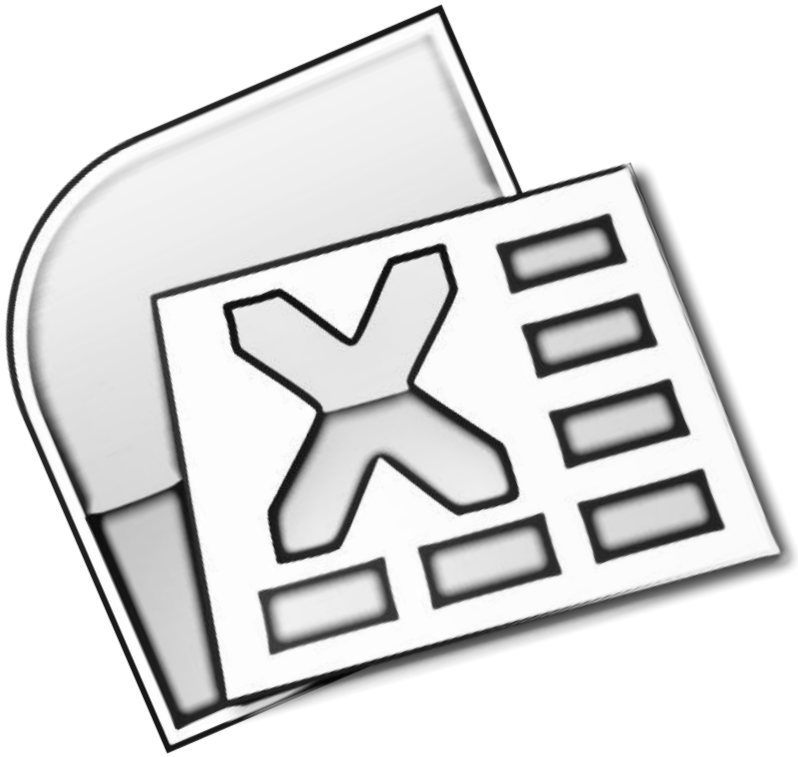

MASTER CHART

S. NO	NAME	AGE	SEX	IP NO.	COMPLAINTS			DURATION	DIAGNOSIS	SR. BILIRUBIN	CRP	HPE REPORT
1	Kanniyammal	18	F	1327570	Rif pain	Vomitting	Fever	1 day	Perforated appendicitis	1.3	10.6	Perforated appendix
2	Valarmathy	19	F	1327612	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	0.9	4.5	Acute appendicitis
3	Anjalai	27	F	1327695	Rif pain	Nausea	Fever	1 day	Perforated appendicitis	1.8	13.2	Perforated appendix
4	Chidambaram	30	M	1328077	Rif pain	Vomitting	Fever	1 day	Normal appendix	1.1	5	Normal appendix
5	Duraimurugan	24	M	1328341	Rif pain	Vomitting	Fever	10 days	Acute appendicitis	1.2	7.3	Acute appendicitis
6	Victor	29	M	1328319	Rif pain	Distention	Fever	3 days	Appendicular mass	1.6	8.2	Chronic inflammatory change
7	Veerammal	55	F	1328323	Rif pain	Vomitting	Fever	2 days	Perforated appendicitis	2	8.7	Perforated appendix
8	Nagomi	35	F	1328210	Rif pain	……..	Fever	2 months	Acute appendicitis	1.1	3.6	Acute appendicitis
9	Purushothaman	17	M	1329493	Rif pain	Distention	Fever	1 day	Perforated appendicitis	1.6	18.8	Perforated appendix
10	Saravanan	20	M	1329145	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	1	6.4	Acute appendicitis
11	Srilekha	19	F	1330383	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	0.9	3.4	Acute appendicitis
12	Karthikeyan	29	M	1330536	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.2	8.5	Acute appendicitis
13	Priya	18	F	1331259	Rif pain	Nausea	Fever	2 days	Appendicular abscess	1.3	6.2	No specimen
14	Ganesh	18	M	1331208	Rif pain	Nausea	……	1 day	Acute appendicitis	0.8	6.2	Acute appendicitis
15	Hariharan	35	M	1331137	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	0.8	7.4	Acute appendicitis

16	Ramya	29	F	1331864	Rif pain	Vomitting	…….	1 day	Normal appendix	1	5.1	Normal appendix
17	Devi	28	F	1333358	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	1.3	6	Acute appendicitis
18	Tamilselvan	18	M	1333914	Rif pain	Vomitting	Fever	2 days	Perforated appendicitis	1	22.6	Perforated appendix
19	Selvakumar	26	M	1335454	Rif pain	Nausea	Fever	3 days	Acute appendicitis	1.2	8.2	Acute appendicitis
20	Amutha	35	F	1332407	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	0.9	3.9	Acute appendicitis
21	Venkatesan	25	M	1332510	Rif pain	Vomitting	Fever	1 day	Appendicular mass	1.1	6.4	Chronic inflammatory change
22	Prakash	38	M	1332811	Rif pain	Distention	Fever	3 days	Perforated appendicitis	2.6	10.9	Perforated appendix
23	Parthiban	21	M	1334906	Rif pain	Nausea	……	2 days	Acute appendicitis	1	2.8	Acute appendicitis
24	Bharathi	23	M	1334258	Rif pain	Vomitting	Fever	1 day	Normal appendix	0.9	4.2	Normal appendix
25	Ramani	45	F	1418875	Rif pain	Vomitting	Fever	5 days	Gangrenous appendicitis	2.4	24.3	Gangrenous appendicitis
26	Raja	38	M	1334332	Rif pain	Vomitting	Fever	3 days	Appendicular abscess	1.3	15.4	No specimen
27	Elumalai	38	M	1335224	Rif pain	Nausea	Fever	1 day	Perforated appendicitis	1.7	8.8	Perforated appendix
28	Sadham hussain	21	M	1337583	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	1.3	4.2	Acute appendicitis
29	Sathya prakashi	18	F	1337083	Rif pain	Obstipation	Fever	2 days	Perforated appendicitis	1.5	6.2	Perforated appendix
30	Nithyanandham	18	M	1337408	Rif pain	Vomitting	Fever	2 months	Acute appendicitis	1	5.8	Acute appendicitis
31	Srinivasan	32	M	1337512	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	0.9	4.4	Acute appendicitis
32	Eraiyah	63	M	1337318	Rif pain	Vomitting	Obstipation	2 days	Gangrenous appendicitis	4	12.3	Gangrenous appendix

33	Abeltisen	18	M	1333235	Rif pain	Nausea	Fever	1 day	Acute appendicitis	1.1	6.4	Acute appendicitis
34	Vijay babu	38	M	1336333	Rif pain	Nausea	Fever	2 days	Perforated appendicitis	2.6	14.3	Perforated appendix
35	Venkatesh	29	M	1332510	Rif pain	Nausea	Fever	1 day	Acute appendicitis	1	8.4	Acute appendicitis
36	Velu	44	M	1336239	Rif pain	……..	……	3 days	Normal appendix	0.9	4.7	Normal appendix
37	Ashok kumar	29	M	1335950	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	0.8	5.3	Acute appendicitis
38	Sasikumar	28	M	1337621	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	0.9	6.2	Acute appendicitis
39	Anbarasu	18	M	1337848	Rif pain	Vomitting	Fever	2 days	Gangrenous appendicitis	2.2	22.6	Gangrenous appendix
40	Vilvabharathi	18	M	1338445	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1	7.8	Acute appendicitis
41	Govindhasamy	25	M	1339492	Rif pain	Nausea	…….	1 day	Acute appendicitis	1.3	6.4	Acute appendicitis
42	Simon	18	M	1400060	Rif pain	Nausea	Fever	2 days	Acute appendicitis	1.1	4.9	Acute appendicitis
43	Sumathy	26	F	1339019	Rif pain	Vomitting	Fever	1 day	Normal appendix	0.9	5	Normal appendix
44	Vinoth	18	M	1400231	Rif pain	Mass	Fever	1 day	Appendicular abscess	1.5	7.6	No specimen
45	Rajeswari	22	F	1400200	Rif pain	……..	Fever	2 days	Acute appendicitis	1	8	Acute appendicitis
46	Vasanthi	29	F	1400902	Rif pain	Vomitting	Fever	2 days	Perforated appendicitis	1	9.6	Perforated appendix
47	Pramila	20	F	1402006	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	0.9	5.5	Acute appendicitis
48	Suseela	24	F	1403365	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.1	8.2	Acute appendicitis
49	Sangeetha	29	F	1404923	Rif pain	Nausea	Fever	3 days	Appendicular abscess	1.5	13.8	No specimen

50	Neela	28	F	1404006	Rif pain	Diarrhoea	Fever	2 days	Acute appendicitis	1.3	4.6	Acute appendicitis
51	Srinivasan	29	M	1403982	Rif pain	Vomitting	Fever	1 week	Gangrenous appendicitis	1.7	34.5	Gangrenous appendix
52	Visali	18	F	1403606	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.2	5.7	Acute appendicitis
53	Rajasekaran	36	M	1403527	Rif pain	Nausea	Fever	3 days	Acute appendicitis	1	5.9	Acute appendicitis
54	Santhosh	23	M	1403565	Rif pain	Vomitting	Fever	1 week	Appendicular abscess	1.2	6.1	No specimen
55	Jaisankar	23	M	1403094	Rif pain	Vomitting	Fever	2 days	Perforated appendicitis	1.5	20.6	Perforated appendix
56	Prabhu	31	M	1403275	Rif pain	Diarrhoea	Nausea	1 day	Normal appendix	1	7.7	Normal appendix
57	Kalaivani	19	M	1403710	Rif pain	Nausea	Fever	3 days	Acute appendicitis	0.9	6	Acute appendicitis
58	Murugan	27	M	1403076	Rif pain	Burning micturition	Fever	2 days	Acute appendicitis	0.8	8.2	Acute appendicitis
59	Achudhan	20	M	1402183	Rif pain	Vomitting	Fever	4 days	Normal appendix	1	4.8	Normal appendix
60	Kalvidasan	24	M	1402987	Rif pain	Vomitting	Fever	10 day	Appendicular mass	1.1	7.3	Chronic inflammatory change
61	Bhavani	26	F	1402663	Rif pain	Diarrhoea	Fever	3 days	Acute appendicitis	1	5.2	Acute appendicitis
62	Samundeswari	22	F	1401962	Rif pain	Burning micturition	Fever	1 day	Acute appendicitis	0.8	6.8	Acute appendicitis
63	Anandhi	39	F	1401183	Rif pain	Vomitting	Fever	2 days	Acute appendicitis	1.3	7.3	Acute appendicitis
64	Shanthi	20	F	1401446	Rif pain	Vomitting	Fever	10 days	Appendicular abscess	1.2	8.3	No specimen
65	Ammu	26	F	1401385	Rif pain	Burning micturition	Fever	8 days	Appendicular abscess	1.6	10.5	No specimen

66	Glory	35	F	1406547	Rif pain	Nausea	Fever	2 days	Acute appendicitis	1	4.6	Acute appendicitis
67	Yasmin	18	F	1406547	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.2	8.1	Acute appendicitis
68	Mohan	50	M	1418804	Rif pain	Vomitting	Fever	7 days	Perforated appendicitis	3	16.2	Perforated appendix
69	Gopalakrishnan	38	M	1337721	Rif pain	Vomitting	Fever	3 day s	Acute appendicitis	1	9.3	Acute appendicitis
70	Kumar	21	M	1338230	Rif pain	Vomitting	Fever	4 days	Acute appendicitis	1.1	6.3	Acute appendicitis
71	Manikandan	28	M	1400573	Rif pain	Vomitting	Fever	7 days	Perforated appendicitis	2.6	5.5	Perforated appendix
72	Jeyanthi	40	F	1400863	Rif pain	Burning micturition	Fever	5 days	Acute appendicitis	0.8	5	Acute appendicitis
73	Prema	19	F	1400757	Rif pain	Distention	Fever	6 days	Appendicular mass	1.3	10.1	Chronic inflammatory change
74	Dilipkumar	22	M	1401138	Rif pain	Nausea	Fever	3 days	Acute appendicitis	0.9	8.2	Acute appendicitis
75	amruth	22	M	1402400	Rif pain	Burning micturition	Fever	1 week	Appendicular abscess	1.7	9.7	No specimen
76	Vaishalini	19	F	1404256	Rif pain	Vomitting	Fever	2 days	Acute appendicitis	1	4.9	Acute appendicitis
77	Neela	28	F	1403985	Rif pain	Vomitting	Fever	1 day	Acute appendicitis	1	6.3	Acute appendicitis
78	Sudha	18	F	1404285	Rif pain	Burning micturition	Fever	2 days	Normal appendix	1	4.3	Normal appendix
79	Sureshbabu	24	M	1404489	Rif pain	Nausea	Fever	1 day	Acute appendicitis	1.1	7	Acute appendicitis
80	Nandhakumar	20	M	1404633	Rif pain	Constipation	Fever	2 days	Gangrenous appendicitis	1.9	8.8	Gangrenous appendix
81	Duraisamy	22	M	1404690	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.6	4.3	Acute appendicitis

82	Banupriya	21	F	1404702	Rif pain	Vomitting	Fever	2 days	Acute appendicitis	1	7.8	Acute appendicitis
83	Gulam	21	M	1405409	Rif pain	Vomitting	Fever	4 days	Acute appendicitis	1.3	8	Acute appendicitis
84	Vendamirtham	28	F	1405679	Rif pain	Burning micturition	Fever	10 days	Appendicular abscess	1.5	11.9	No specimen
85	Ramesh	20	M	1405690	Rif pain	Mass	……	6 days	Appendicular mass	1.5	4.6	Chronic inflammatory change
86	Rajesh	27	M	1405781	Rif pain	Vomitting	Fever	1 week	Gangrenous appendicitis	3.3	13.6	Gangrenous appendix
87	Anwar	35	M	1407252	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1	10.3	Acute appendicitis
88	Dhinakaran	18	M	1407731	Rif pain	Vomitting	Fever	5 days	Perforated appendicitis	1.2	11.1	Perforated appendix
89	Sasikumar	33	M	1408067	Rif pain	Vomitting	Fever	2 days	Acute appendicitis	0.9	9	Acute appendicitis
90	Venkatesh	26	M	1407948	Rif pain	Burning micturition	Fever	2 days	Acute appendicitis	0.8	5.2	Acute appendicitis
91	Kumudha	22	F	1409045	Rif pain	Vomitting	Fever	3 days	Perforated appendicitis	2.4	16.8	Perforated appendix
92	Sathya	18	F	1409137	Rif pain	Vomitting	Fever	4 days	Acute appendicitis	1.1	4.9	Acute appendicitis
93	Alexander	18	M	1410265	Rif pain	Vomitting	Fever	3 days	Appendicular abscess	1.4	5	No specimen
94	Suryakumar	30	M	1410336	Rif pain	Burning micturition	Fever	2 days	Acute appendicitis	1.2	7	Acute appendicitis
95	Sasi	19	F	1410335	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.3	10.2	Acute appendicitis
96	Violet	48	F	1411479	Rif pain	Vomitting	Fever	5 days	Gangrenous appendicitis	2.5	17.5	Gangrenous appendix
97	Deepa	34	F	1410935	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	1.6	5.3	Acute appendicitis

98	Venkatesh	43	M	1411549	Rif pain	Burning micturition	Fever	2 days	Acute appendicitis	1	6.1	Acute appendicitis
99	Muniyammal	23	F	1411663	Rif pain	Vomitting	Fever	3 days	Acute appendicitis	0.9	5.5	Acute appendicitis
100	Arun	15	M	1412082	Rif pain	Vomitting	Fever	2 days	Acute appendicitis	0.8	9	Acute appendicitis