STUDY TO EVALUATE THE VALIDITY OF MANNHEIM PERITONITIS INDEX AS COMPARED TO APACHE II SCORING SYSTEM IN PREDICTING OUTCOME OF PATIENTS WITH PERITONITIS

A dissertation submitted to the M.G.R. Medical University, Tamil Nadu – in partial fulfillment of the requirements for the M.S. Branch I (General Surgery) examination held in April 2017.

BONAFIDE CERTIFICATE

This is to certify that the dissertation titled "A study to evaluate the validity of Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis" is a bonafide work of Dr. Paul Trinity Stephen. D, in partial fulfillment of the rules and regulations for the M. S. branch – I (General Surgery) examination to be held in April 2017.

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DECLARATION CERTIFICATE

This is to certify that this dissertation entitled "A study to evaluate the validity of Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis" is a bonafide work done by Dr. Paul Trinity Stephen. D under our guidance and supervision in the Department of Surgery, Christian Medical College, Vellore, submitted for the M.S., (General surgery) branch 1 examination to be held in April 2017, by the Tamil Nadu Dr. M. G. R. Medical University, Chennai.

The candidate has independently reviewed the literature, performed the data collection, analyzed the methodology and carried out the evaluation towards completion of the thesis.

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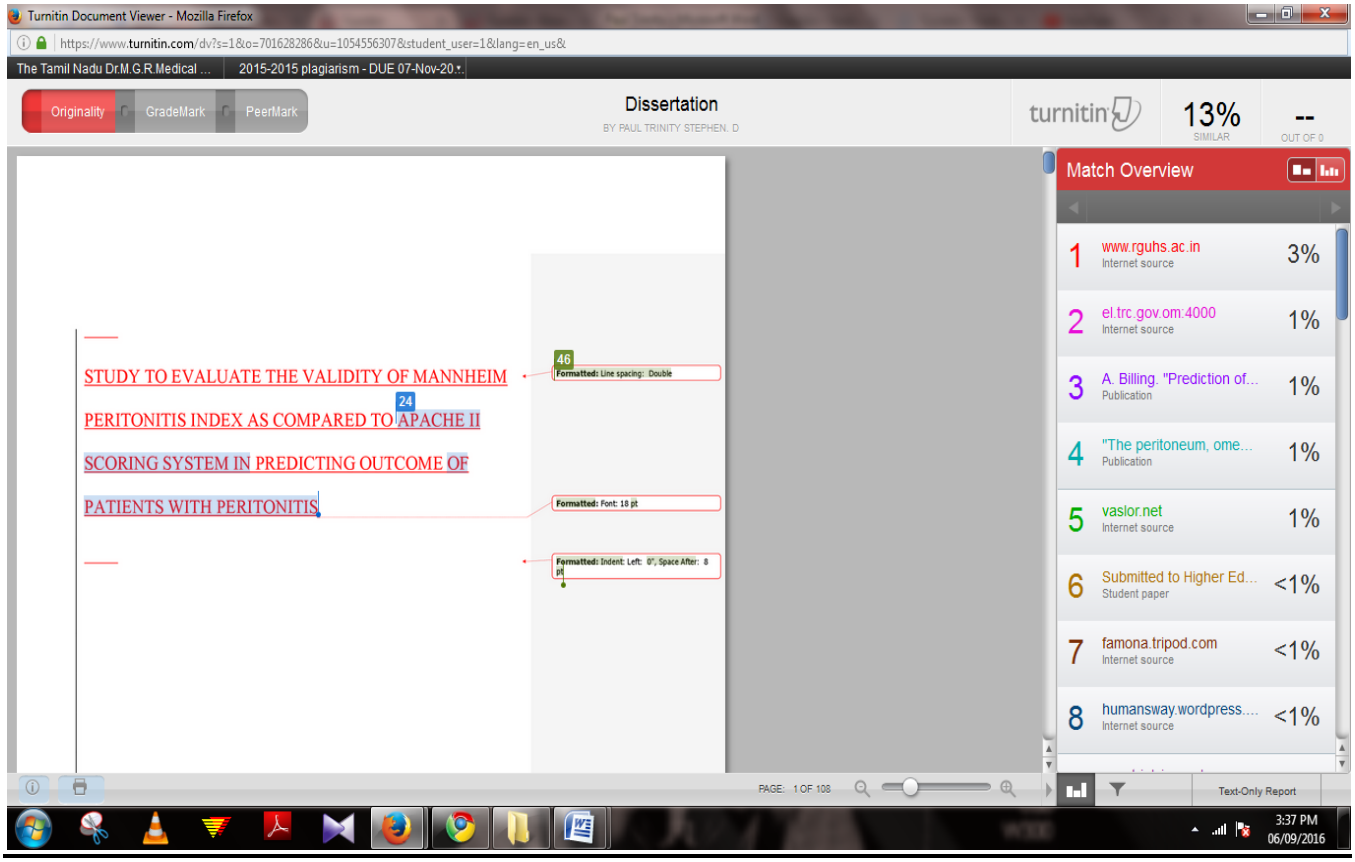
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TITLE OF STUDY: A study to evaluate the validity of Mannheim Peritonitis Index (MPI) as compared to APACHE II scoring system in predicting outcome of patients with peritonitis.

DEPARTMENT: General Surgery

NAME OF THE CANDIDATE: Paul Trinity Stephen. D

DEGREE AND SUBJECT: M.S General Surgery

NAME OF THE GUIDE: Dr. Vijay Abraham

ABSTRACT

Background

Peritonitis is one of the most common surgical emergencies with significant morbidity and mortality. Multiple scoring systems have been proposed and assessed in predicting the outcome in patients with peritonitis. Among them are APACHE II (clinical and laboratory parameters) and Mannheim peritonitis index(MPI) (clinical parameters only). This study was conducted to identify the predicting ability of both these scores and to compare MPI with APACHE II.

Study Design

Patients presenting to the emergency department or the surgical wards with clinical features of peritonitis either localized or generalized were prospectively studied from September 2014 to August 2016. A total of 77 patients were studied. Both

APACHE II and MPI were calculated for these patients and they were followed up to death or discharge from hospital (primary outcome). Morbidity was also studied in terms of local or systemic complications and whether the scores could predict the same. The sensitivity and specificity of the variables were calculated and assessed for their effectiveness in predicting outcome. Subgroup analysis was done using Bayesian methods.

Results

Of the77 patients studied during this period, there were 10(12.9%) non-survivors and 67 survivors (87%). The sensitivity and specificity of APACHE II score with cutoff of 10 were 40% and 78% respectively. The sensitivity and specificity of MPI with cutoff of 22 were 90% and 23% respectively. We did not find any statistically significant risk factor for increased mortality. MPI and APACHE II were both not good predictors of morbidity in patients with peritonitis, though MPI was slightly better among the two.

Conclusion

APACHE II was a better predictor of mortality in patients with peritonitis as compared to MPI though both had poor sensitivity and specificity than what was expected. Both the scores were poor predictors of morbidity in patients with peritonitis. Age>50 years, left shift of WBC and time elapsed between presentation and surgery were risk factors which showed some increased risk of mortality in patients with peritonitis though this was statistically insignificant.

Keywords

- APACHE II scoring system
- MPI (Mannheim peritonitis index)
- Peritonitis
- Mortality
- Morbidity
- Risk factors

INTRODUCTION

In India, the most common cause for surgical emergency is perforation peritonitis. Peritonitis continues to be one of the most challenging situations for a surgeon. Despite many advances in the anti-microbial therapy and supportive care, the mortality with peritonitis remains high.

The causes of peritonitis vary from one needing emergency surgical intervention to one which needs to be managed conservatively. Hence accuracy of diagnosis is paramount.

The complexity of surgical infections and increasingly complex management protocol of the ICU support has made therapeutic advances in this field difficult. Scoring systems that provide descriptions of patient's conditions at specific points in the disease process help to understand these problems.

The management of peritonitis has changed over time with better understanding of the pathophysiology, the concept of septic shock and multi-organ failure. The current trend is towards early recognition and aggressive therapy.

When the patient has progressed into multi-organ failure, prognosis looks dismal. In these situations questionoften arise whether this patient would really benefit from surgery or should he/she be managed differently?

This study attempts to answer some of these questions like:

1. Can the scores predict the outcome?
2. Can these help in deciding the prognosis of the patient?
3. Does delay in presentation matter?
4. Can these scores predict the complications seen in patients with peritonitis?

AIM AND OBJECTIVES OF THE STUDY

AIM:

The aim of the study was to evaluate the predicting ability and usefulness of Mannheim peritonitis index (MPI) as compared to APACHE II scoring systems on outcome of patients with peritonitis.

OBJECTIVES:

1. To assess the ability of MPI in predicting the outcome (death or discharge) in patients with peritonitis.
2. To re-evaluate the cut off points for MPI in our population.
3. To look at the factors that predict poor outcome in patients with peritonitis as assessed in previous studies.
4. To study complications occurring in the immediate post-operative period (Morbidity) and the ability of the scores to predict the same.

METHODOLOGY

The study was conducted at Christian Medical College, Vellore, Tamil Nadu, India. Patients admitted and diagnosed with secondary peritonitis during the period of September 2014 to August 2016 were recruited for the study. Patient data was used to score both the scoring systems at admission or within 24 hours post operatively and followed up till death or discharge from the hospital.

Inclusion Criteria:

All patients diagnosed with secondary peritonitis, admitted to the emergency department or surgical wards and who underwent emergency surgery. Pr-operative consent was sought for the same.

Exclusion criteria:

Patients with

1. Primary peritonitis
2. Peritonitis related to peritoneal dialysis.
3. Pancreatitis
4. Peritonitis secondary to trauma.

Primary outcome:

In hospital death or discharge.

Secondary outcome:

Morbidity was assessed in terms of hospital stay, ICU stay, Wound infection, wound dehiscence, need for re-operation, anastomotic leak, need for mechanical ventilation, need for dialysis. Special note was made of Glasgow coma scale (GCS) was< 8 for more than 48 hours post operatively.

Calculation of sample size:

From the available literature(1–8), sensitivity and specificity ranged from 85-95% and 16-78%respectively. The following table provides the sample size for various levels of precision with the sensitivity of 90%.

Single Proportion - Absolute Precision			
Expected Proportion Sensitivity for MPI as compared to APACHE	0.9	0.9	0.9
Precision (%)	10	15	20
Desired confidence level (1- alpha) %	95	95	95
Required sample size	35	15	9

To study sensitivity the number of deaths ranged from 10 to 35 with the precision of 10% to 20% respectively. However, we concluded to study 15 deaths to get a precision of 15%. In order to get 15 deaths, with the incidence of mortality being 20% (range of 2-30% from various studies), we need to study 75 patients prospectively. This meant that there would be nearly 15 deaths and 60 surviving. Thus the survival number will provide specificity of 70% (minimum) with the precision of 10 to 15%.

The outline of the study was as follows:

Patients presenting to the Emergency department or surgical ward with secondary peritonitis duringthe period September 2014- August 2016 in CMC, Vellore

Inclusion Criteria:

All patients diagnosed with secondary peritonitis and admitted to emergency department or surgical wards and who undergo emergency surgery.

Exclusion criteria:

-Pancreatitis

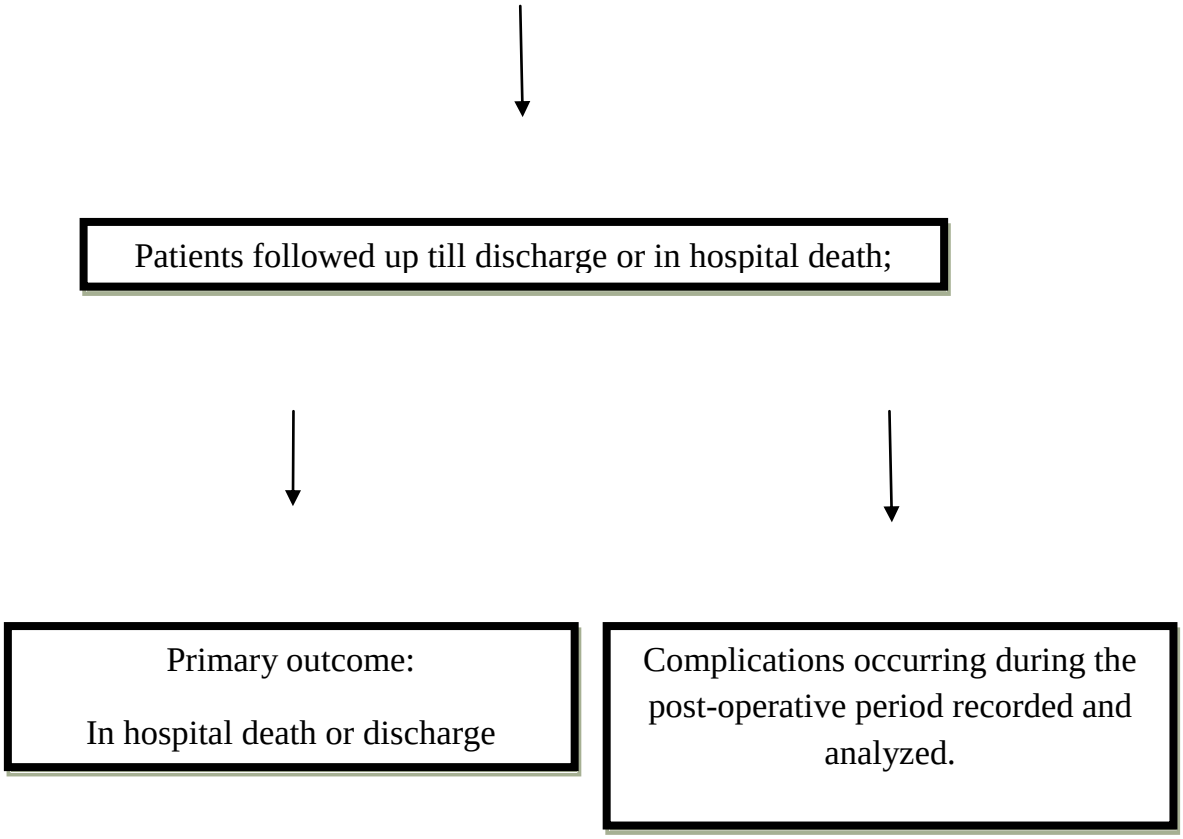
-Primary peritonitis

-Peritonitis secondary to dialysis

-Peritonitis secondary to trauma

Consent taken from the patient or close relatives.

Assessment using APACHE II and MPI scoring systems at admission or within 24 hours of the surgery.



The data was collected prospectively. The two scoring systems were used to score all patients.

Previous studies on APACHE II have suggested ranges of scores as less than 10; 11-20 and >20 (Patients with scores between 11-20 showed very good correlation with outcome prediction whereas scores of <10 and >20 showed poor correlation.

We kept a cut-off point of 11 for this study. ,

Mannheim Peritonitis Index (MPI)was the index test. The cut off points from various studies for this have been found to be 21. Studies have categorized patients into three groups namely<21; 21-29; >30.

We kept a cut-off point of 22 for this study.

Both scoring were done at the same time.

Data was entered in EPIDATA software. Data was screened for outliers etc using Histogram, Box-Cox plots and distributions. The best cut off value for MPI was found out using ROC curve. ROC software was used. The sensitivity, specificity and the likelihood ratios were calculated and presented with 95% confidence interval (CI). However, diagnostic odds ratio (OR) and agreement statistics were also calculated. A subgroup analysis was done for complications by repeating the above tests. However, careful interpretation was made using Bayesian methods.

REVIEW OF LITERATURE

HISTORY

Physicians in ancient times dreaded abdominal complications. Despite being the commonest surgical emergency, the outcome of peritonitis was slim before the past century. The comprehension of the physiology of peritoneum cavity is still evolving. Despite this, the mortality rates for patients with secondary peritonitis have fallen from 100 to <10% over the last century.

Hippocrates initial description of patient with peritonitis as translated by the Germans said, "The patient looks sick and wasted. The nose is pointed, temple sunken, the eyes lay deep, rimmed and dull. The face expresses fear, the tongue is furrowed, the skin shiny. The abdominal muscle wall is tense with muscular guarding; no bowel sounds can be heard. The pulse is quick and small. The hard, tender mass in the hypochondrium is a bad prognostic sign if it involves the whole area. The presence of such a mass at the beginning of fever indicates that death is imminent".

The above description has been called 'Hippocrates facies'.

In the second century A.D Galen, a physician to Roman emperor is reported to have performed suturing of lacerated bowel.

Peritonitis due to acute peptic ulcer perforation was first described by Littre in 1670 on Henrietta Anne, Duchess of Oreans. Hertein, in 1767, reported a cure for biliary peritonitis in dogs using irrigation of abdomen.

The three developments that increased the understanding of peritonitis included the foundation of experimental physiology by Francois Magendie and Claude Bernard, an understanding of cellular pathology and the advent of germ theory by Pasteur and Koch.

George Wegner first reported, a series of experiments attempting to elucidate the normal physiology of peritoneum in 1879. The modern era of the understanding of peritoneum was propounded by John B. Murphy. In 1908, he wrote "*There are no stomata or stigmata in the peritoneum. The endothelial lining is everywhere, continuous."*

EMBRYOLOGY OF PERITONEUM

Peritoneal cavity is derived from the two limbs of the horse-shoe shaped intraembryonic coelom, which is situated caudal to septum transversus; The 2 parts are at first separate, but later fuse to form one cavity. The attachment of mesentery of the primitive gut on the abdominal wall is initially in the midline. As a result of changes involving the rotation of the gut and as a result of some parts of the gut becoming retroperitoneal, the line of attachment of mesentery becomes

complicated. The peritoneal cavity therefore comes to be subdivided into number of pockets that are separated partially by folds of peritoneum.

Parietal peritoneum:

It lines the inner surface of the abdominal and pelvic walls and other lower surface of the diaphragm. It is pain sensitive because of somatic innervations.

Visceral peritoneum:

It lines the outer surface of the viscera, to which it is firmly adherant and cannot be stripped. Blood and nerve supply are same as the underlying viscera. It is pain insensitive as it is supplied by autonomic innervation.

Histologically, peritoneum consists of an outer fibrous tissue layer, which gives strength to the membrane and an inner mesothelial cell layer which secretes serous fluid.

The peritoneal cavity is the largest cavity of the body. It contains a main region, greater sac and a smaller, lesser sac. It is also divided into abdominal and pelvic portions. The abdominal portion has the supracolic and infracolic compartment divided by the transverse colon.

There are seven subphrenic spaces, four intraperitoneal and three extraperitoneal spaces. These spaces are divided by the falciform ligament into right and left spaces.

PHYSIOLOGY OF THE PERITONEUM

Mesothelial cells are organized into two discrete populations- cuboidal and flattened cells. Gaps(stomata) between neighboring cells of peritoneal membrane are found only among the cuboidal cells. Peritonitis increases the width of these stomata. Beneath mesothelial cells is a basement membrane of loose collagen fibers. The basement membrane overlies a complex connective tissue layer that includes collagen and other connective tissue proteins, elastic fibers, fibroblasts, adipose cells, mast cells, eosinophils, macrophages and lymphocytes and network of lymphatic and capillaries.

The mesothelial lining cells of the peritoneum secretes serous fluids that circulate within the peritoneal cavity. The peritoneal cavity has 50-100 ml of fluids with solute concentration. The protein content of the peritoneal fluids is less than the plasma.

Two primary forces govern the movements of fluids within the peritoneal cavity 1. Gravity, 2. Negative pressure created beneath the diaphragm with each normal respiratory cycle. Sub diaphragmatic collections occur frequently because a relative negative pressure is created beneath the diaphragm with each exhalation.

PERITONEAL RESPONSE TO INJURY:

An inflammatory event in the peritoneal cavity can result in the irritation of the peritoneum with loss of the regional mesothelial cells. Larger and smaller defects both heal in the same amount of time. It has been proven that within three days of injury, new layer of mesothelial start appearing. By the fifth day, the layer appears almost like the normal epithelium surrounding it. On the 8^{th} day, the regeneration is complete. The exact origin of cells responsible for mesothelial regeneration is unknown.

The mechanisms postulated include,

- Submesothelial cells producing the new ones.
- Surviving or floating mesothelial cells migrating into the wound.
- Peritoneal fluid monocytes and macrophages differentiating into mesothelial cells.

Normal peritoneal wound heals without formation of adhesions. Local tissue hypoxia or ischemia seems to be the most important factor responsible for development of adhesions. Others include subperitoneal surface injury, intra-abdominal infections and contamination of the peritoneal cavity by foreign material. Deposition of fibrin after peritonitis is necessary for adhesion formation. The formation of adhesions is both a protective response to localize the infection and an adoptive response to wound healing with the additional supply it provides.

PATHOPHYSIOLOGY OF PERITONITIS

General or local inflammation of peritoneum is designated as peritonitis. Every case of peritonitis initiates a sequence of responses involving the peritoneal membrane, the bowel and the body fluid compartments. These then produce secondary endocrine, respiratory, renal and metabolic responses.

PRIMARY RESPONSE IN PERITONITIS:

Membrane inflammation:

Peritoneum reacts to injury by hyperemia and transudation. Edema and vascular congestion occurs in the subperitoneal layer just outside the peritoneal layer. Absorption across the inflamed segment of peritoneum is initially increased and then decreases gradually. During the early phase of vascular and transudative phase of engorgement, the peritoneum acts as a two way street. There is secretion of toxins and other materials into the peritoneal cavity which is absorbed by the lymphatics and enters blood stream and thereby causing systemic toxicity. There is also exudation of excess fluid into the peritoneal cavity. This fluid contains excess fibrin which promotes formation of adhesions and localizes infection in the peritoneal cavity.

Bowel response:

Initial response in hyper mobility. Thereafter, the mobility decreases and near adynamic ileus follows. This causes bowel distension with air and fluid accumulation.

Hypovolaemia:

Peritoneum responds to injury by hyperemia and transudation of plasma like fluid from extra, intra cellular and interstitial compartments into the peritoneal surface. The loose connective tissue beneath the mesothelium of the viscera and mesentery trap extra cellular fluid as edema. The atonic bowel also accumulates the fluid derived from extra cellular space. This translocation of water, electrolytes and proteins into a sequestered "THIRD SPACE" functionally removes this volume temporarily from the body economy. With peritonitis, translocation of about 4-6 liters or more in 24 hours is not uncommon.

SECONDARY RESPONSES IN PERITONITIS:

Endocrine response:

There is an immediate adrenal medullary response, withrelease of epinephrine and nor-epinephrine resulting in systemic vasoconstriction, tachycardia and sweating. There is increased secretion of cortical hormones during the first two or three days following injury. Secretion of aldosterone and anti-diuretic hormone (ADH) also increases in response to hypovolemia resulting in increased water and sodium conservation. Water retention is more than sodium retention causing dilutional hyponatremia.

Cardiac response:

There is decrease in extra cellular fluid (ECF) volume and progression to acidosis. Volume deficit results in decreased venous return and diminished cardiac output. There is tachycardia to increase the cardiac output, but the compensation is incomplete. Progression of acidosis brings about secondary cardiac dysfunction and further decrease in cardiac output.

Respiratory response:

Abdominal distension secondary to adynamic ileus, along with restricted diaphragmatic and intercostal muscle movements because of pain, results in decrease in ventilator volume and basilar atelectasis.

Renal response:

Urine output is diminished and renal capacity to handle the excess of solute is impaired. Hypovolemia causes decreased cardiac output and increased secretion of ADH and aldosterone all synergistically acting on the kidney. Renal blood flow is decreased which results in decrease in glomerular filteration rate (GFR) and urine flow in the tubules. Reabsorption of water and sodium is increased often in imbalance and potassium is wasted.

Metabolic response:

The metabolic rate is increased with peripheral oxygen demand. The capacity of lungs and heart to deliver oxygen is reduced. Poor circulation leads to shift from aerobic

to anaerobic metabolism in muscle and other peripheral tissues. As a result, end products of carbohydrate metabolism accumulate and lactic acidosis begins to develop.

PATHOPHYSIOLOGY OF SEPSIS:

Peritoneal insult will be manifested generally as systemic inflammatory response syndrome (SIRS) which if not treated adequately will lead on to Multi-organ dysfunction syndrome (MODS).

BACTERIOLOGY OF PERITONITIS:

Peritonitis is characteristically polymicrobial in nature.

Paths of bacterial invasion of peritoneal space can be:

- Direct invasion
- Local extension from an inflamed organ.
- Bloodstream- part of general septicemia.

DIAGNOSIS OF PERITONITIS

CLINICAL FEATURES:

Generalized peritonitis may present in different ways depending on duration of infection.

Early phase:

Pain, which is made worse by the movement of breathing, is the most predominant symptom. It is first seen in the site of original lesion. The patient usually lies still as there

may be worsening with any movement. Tenderness and rigidity follows when inflammation involves the anterior abdominal wall. Patients with pelvic peritonitis may complain of urinary symptoms also.

Pyrexia is also present in most cases. Nausea is common and may be associated with vomiting. Fever is usually high grade in young adults than elderly. Hypothermia may occur in the severely ill patients.

A rising pulse rate and falling temperature may be of grave significance. On the other hand, a gradually rising temperature and slowly falling pulse rate suggest localization of infection.

Intermediate phase:

Peritonitis may resolve, the pain and tenderness diminish leaving a silent soft abdomen. It may result in an abscess which is localized.

Terminal phase:

If resolution or localization has not occurred, the abdomen remains silent, and distends increasingly. Circulatory failure sets in with cold, clammy extremities, sunken eyes, dry tongue, thready pulse, drawn and anxious face. The patient finally lapses into unconsciousness.

SIGNS OF PERITONITIS:

Inspection:

There is diminution or absence of abdominal respiratory movement. The patient lies still in bed with legs drawn up in an effort to relieve the tension on the abdominal muscles. There is uniform distension of the abdomen and in early cases there is marked retraction of the lower half of abdomen.

Palpation:

Tenderness and rigidity is noted. Tenderness is constant but not a reliable sign as rigidity. Tenderness is first situated over the causative focus, but spreads with a diffusion of peritoneal inflammation, which rapidly becomes generalized and extreme in degree.

There are two other signs that are constantly present:

1. Rebound tenderness
2. Pain experienced over the affected region by pressure on an uninvolved organ.

Of all the signs, rigidity of the abdominal muscles is the most important and reliable sign. Voluntary guarding following involvement of parietal peritoneum by inflammation is the usual cause for this. A reflex spasm may be initially present. As peritonitis advances, reflex spasm may become so severe that board like rigidity of the abdominal wall is produced.

Percussion: Abdomen is resonant everywhere and tympanic owing to the fact that the intestines are filled with gas. In certain conditions, like perforation of gastrointestinal tract (GIT), obliteration of liver dullness may be evident.

Auscultation: Bowel sounds are diminished from the onset and it may even cease.

INVESTIGATIONS OF PATIENT WITH PERITONITIS:

A number of findings may elucidate doubtful diagnosis, but while making a diagnosis, the clinician should rely on history and physical findings mainly. This should in tern guide the relevant investigations.

Routine investigations:

Hemoglobin and urine analysis are done. ESR may be raised, particularly in abdominal tuberculosis affecting the peritoneum. Leukocytosis is usually seen, with left shift in the differential counts.

Peritoneal diagnostic aspiration:

It may be useful when there is sufficient peritoneal fluid in the peritoneal cavity to be aspirated. First described by Solomon, it is done in four quadrants after infiltrating the skin with local anesthetic. When the aspiration fails, the introduction of small quantity of sterile physiological saline, followed by aspiration after a few minutes may produce fluid of diagnostic value. Microscopy of fluid may show neutrophils more than 250 cells/mm3

and bacteria. Fluid is also examined for cell counts, differential count, pH , Gram stain, aerobic and anaerobic culture.

X ray abdomen:

X ray should include the diaphragm, lower chest and pelvis. There may be pneumoperitoneum (air under diaphragm), ground glass appearance, obliteration of peritoneal pad of fat line and psoas shadow due to edema of peritoneum. There may be dilated gas filled loops of bowel (consistent with paralytic ileus). If the patient is too ill to stand then lateral decubitus posture can be used.

Biochemical investigations:

- Estimation of serum electrolytes.
- Serum amylase to exclude acute pancreatitis provided it is remembered that moderately raised values are frequently associated with other abdominal catastrophes and operations eg. Perforated peptic ulcer, Cholecystitis.
- Widal test in ileal perforations to rule out typhoid.
- Blood urea, serum creatinine to assess the renal function.
- Peritoneal fluid culture and sensitivity.

Ultrasound and CT scan of abdomen:

These investigations may be useful in some patients in identifying the cause of peritonitis.

MANAGEMENT OF PATIENTS WITH PERITONITIS:

Management of patients with peritonitis is mainly operative.

The goals of surgical therapy include:

- To correct the cause of peritonitis(source control)
- To remove any foreign material in the peritoneal cavity that might inhibit WBC function and promote bacterial growth.

PREOPERATIVE MANAGEMENT:

- Correct fluid and electrolyte abnormalities.
- Central venous pressure (CVP) monitoring is essential in critically ill patients and elderly where cardiac impairment may be exacerbated by large fluid loss.
- Administer broad spectrum systemic antibiotics early.
- Urinary catheterization to assess the urinary output and fluid replacement.
- Administration of analgesics in small boluses. Non steroidal anti inflammatory drugs (NSAIDS) are usually avoided.
- Nasogastric tube placement and frequent aspiration to decompress the bowel.

OPERATIVE MANAGEMENT:

The usual management includes identifying the source for peritonitis, correction/removal of the same/affected organ and restoration of normal anatomy.

In our setting the commonest cause for peritonitis was duodenal perforation. At our centre, duodenal perforation is managed with Modified Graham's omental patch closure technique. For large perforation, additional tube drainage along with feeding jejunostomy is performed.

Small bowel perforations were managed either with primary closure or resection and anastomosis as indicated.

Large bowel perforations were managed with primary closure, primary closure with proximal loop stoma, loop stoma at the site of perforation, or end stoma at the perforation site and closure of distal stump.

Gall bladder perforations were managed with subtotal cholecystectomy and drain placement.

DO WE NEED SCORING SYSTEMS?

The complex nature of the surgical infections, the multifaceted aspects of treatment and the complexity of the ICU support make evaluation of new diagnostic and therapeutic advances in this field very difficult. Scoring systems that provide objective descriptions of the patient's condition at specific points in the disease process aid our understanding of these problems. The commonly used scoring systems are

1. Mannheim Peritonitis index
2. Sepsis score of Elebute and Stoner
3. APACHE II

All of the above are mainly used to predict death in patients with surgical infections. Most scoring systems are inappropriate for use in therapeutic decisions concerning individual patients.

In a country like India, where advanced critical care measures are largely unavailable and unaffordable by average citizens, it is vital that a scoring system be evaluated which not only prognosticate the outcome accurately, but also be simple and cost-effective.

MANNHEIM PERITONITIS INDEX (MPI)

MPI, was originally derived from data collected from 1253 patients with peritonitis treated between 1963 and 1979, and was developed by discriminate analysis of 17 risk factors, by Wacha. Eight of these risk factors significantly contributed to the prognosis and is currently used widely for predicting mortality from peritonitis.

The original reports excluded post-operative peritonitis and appendicitis, but on further investigation extension to these groups did not reduce its predictive value.

A detailed study of MPI was done by A. Billing(7) in 7 different hospitals and their data was compared. They considered patients with bowel perforation or post-operative peritonitis, peritonitis caused by pancreatitis, appendicitis and mesenteric ischemia for their study.

- Each risk factor was given weightage to produce a score used for prognostic purposes.
- Maximum score was 47.
- The cutoff point taken was 26. Patients with higher values being classified as non-survivors.
- Patients were divided into 3 categories of severity – MPI< 21, 21-29 and >29.
- They found linear correlation between index score and mean mortality rate.

Advantage of MPI

- Ease of use.
- Determination of risk available during operation.
- Surgeon could know the possible outcome in the patient and change his plan of management accordingly.

Patients with fewer score can be treated with minimal risks, while patient with high score may need aggressive approach with critical care support. The concept of programmed re-laparotomy, zip technique surgery may need to be considered in these cases. It is peritonitis specific index and appears to be the best for statistical studies and for comparing clinical trials. Other scores like APACHE II are not specific for peritonitis.

Disadvantages:

1. This index does not include the possibility of eradicating the source of inflammation.
2. It is a one time score; hence post-operative complications which may alter the outcome are not accounted for.
3. This index assigns peritonitis originating from colon to be of low risk. Since most of the colonic performances are usually secondary to malignancy, this may not be applicable uniformly.

APACHE II SCORE (ACUTE PHYSIOLOGICAL AND CHRONIC HEALTH EVALUATION):

This includes 2 parts. First one deals with acute physiology while the second is concerned with chronic health evaluation. This was primarily designed for intensive care unit (ICU) patients. In 1984, Meakins and associates used this score to evaluate patients with peritonitis(9). They found striking correlation between mortality rate and increase in score. The APACHE II utilizes 12 values and determines the outcome based on this. This score even though correctly measures the severity of illness; it is cumbersome in surgical practice and does not give any indication regarding management modalities of patient.

Other scoring systems:

John Boey, in 1986 published a study of risk stratification in perforated duodenal ulcer(10). They included 3 criteria namely major medical illness, preoperative shock and long standing perforation (more than 24 hours). They assigned 0 if no risk factor were present and scores to 1 to3 depending on the number of risk factors present. They concluded that definitive surgery (vagotomy and drainage) can be safely performed if no risk factors are present. If any risk factors are present, it is preferable to do simple closure. If all 3 risk factors are present, the outcome they found was uniformly dismal whether patient was operated or treated conservatively. Hence, conservative treatment deserves re-evaluation in these patients.

Which scoring is best?

Though no major studies have been conducted to compare all the scoring system, as most of them require different clinical and laboratory parameters., Almost all researchers agree that there is need for a reliable, simple and easily reproducible scoring system which helps not only in decision making and prognosticating sepsis but also one that can be used for comparing data at different institutions.

A Billing et al(7) assessed the validity of the Mannheim peritonitis index and its predictive power in a study of 2003 patients and concluded the index provides an easy and reliable means of risk evaluation and classification for patients with peritoneal inflammation.

Demmel N et al(11) did a study to evaluate the prognostic value of simple clinical parameters and the Mannheim Peritonitis Index (MPI) in which 438 patients with abdominal infection were included in a prospective study. MPI had a strong association to mortality. It showed a sensitivity of 88% and a specificity of 78% at score of 26 points. The MPI is an easily documented prognostic index for peritonitis with high accuracy in individual prognosis.

Kulkarni et al (1)evaluated APACHE-II score in prediction of mortality risk in patients with peritonitis due to hollow viscous perforation. APACHE-II score between 11 and 20 was shown to be a better predictor of risk of mortality in patients with peritonitis due to

hollow viscous perforation. Predicted mortality did not correlate with observed mortality in patients with scores of 1 - 10 and greater than 20. The APACHE-II scoring system can be used to assess group outcomes in patients with peritonitis due to hollow viscous perforation. But it does not provide enough confidence for outcome prediction in individual patients.

Chiarugi M et al(12) evaluated the effectiveness of laparotomy and the risk factors for survival in patients presenting with severe secondary peritonitis. The severity of the disease was calculated by using APACHE II and Mannheim Peritonitis Index (MPI) scoring systems. APACHE II and MPI scores were significantly greater in the non-survivors group. On multivariate analysis only MPI was found to be a significant independent risk factor for survival.

Malik et al(5) attempted to evaluate the use of scoring systems such as Acute Physiological and Chronic Health Evaluation score (APACHE II) and (MPI) in patients with peritonitis. A prospective study was conducted using 101 consecutive patients having generalized peritonitis over a two-year period. They concluded that both scoring systems are accurate in predicting mortality; however, the APACHE II has certain advantages and is more useful.

As we learn from these studies, the scoring systems have been extensively evaluated to assess their predicting abilities and the studies from the West have indeed found them beneficial. Due to lack of many studies in our country it has still not gained popularity. There is only one Indian study which compares the two scoring systems.

RESULTS

There were 78 patients included in the study. One was not analyzed as there was Incomplete data available.

AGE:

There were two groups. One <50 years and another >50 years. Below is the table showing the number in each group and the percentages within the group with regards to outcome.

Variables	Outcome				p-value
	Death		Discharged		
	n	%	N	%	
Age:					
<50	1	10.0	37	55.2	0.08
>50	9	90.0	30	44.8	

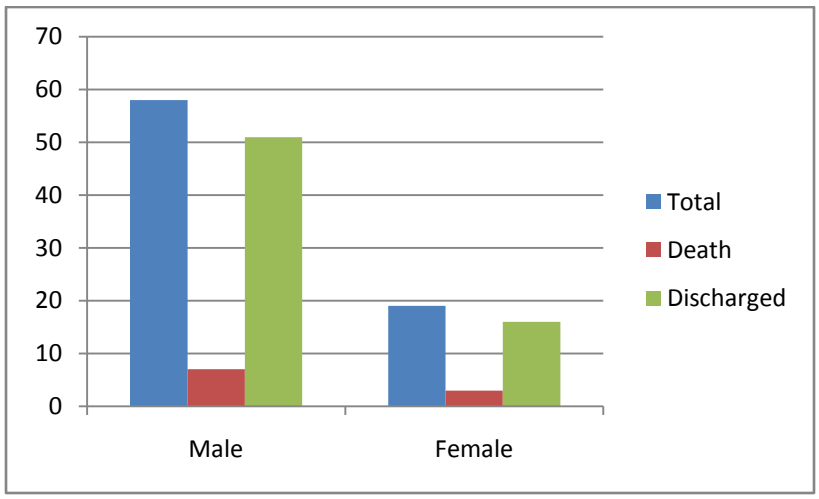
Among the patients who succumbed, 9 died in the age group > 50 years and 1 in <50years age group. This was same as mentioned in literature.

Bossche et al (13)studied multiple scoring systems in predicting mortality in 50 patients with peritonitis and found that age >60 and males gender signified risk for in-hospital death.

In this study, even though there was appreciable difference, no statistical significance could be found. This was attributed to the low total number.

GENDER:

Studying the gender ratios in this study, there was male predominance overall but there was no difference in the outcome comparing the two genders.



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Gender:					
Male	7	70.0	51	76.1	0.67
Female	3	30.0	16	23.9	

There were a total of 58 males and 19 females studied. As mentioned above, in previous studies an association has been identified between males and high risk for mortality in patients with peritonitis. But we did not find this in this study. Amongst the mortality, there were 7 males and 3 females. This study p-value was identified as 0.67 which was statistically not significant.

There were a few associations made in the past by other studies in regards to mortality in peritonitis. Studies mentioned male gender, patients with longer duration of symptoms, age >60 years, patients requiring ionotropic supports preoperatively, patients who have raised white cell counts, patients with left shift in differential white cell count, patients with preoperative organ failure etc were all associated with significant morbidity and mortality in patients with peritonitis.

Some of these associations were looked at in this study too. Association of age and gender has already been described above

Remaining risk factors associations are mentioned below:.

DURATION OF SYMPTOMS:

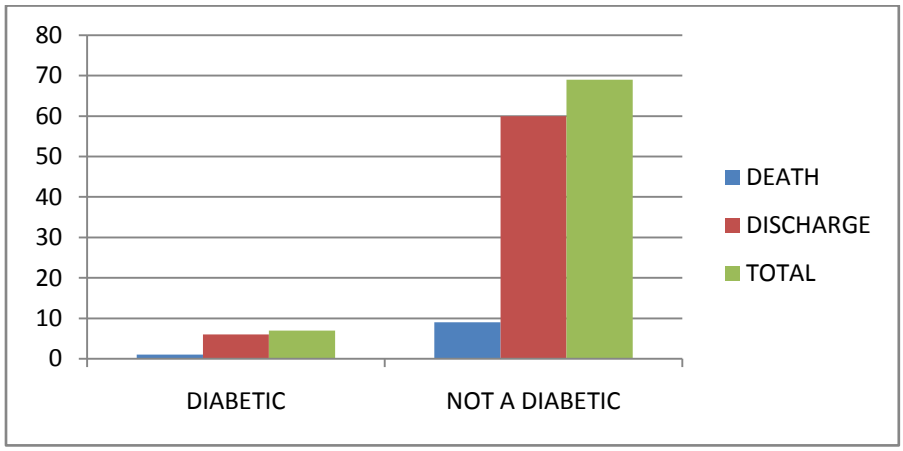
As anyone would expect, the longer the duration of symptoms, the worse the presentation of a patient would be and thereby we expect a worse prognosis in the patient. In the past, some studies have proved the same.

Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Duration of symptoms: (Mean ± SD)	2.3 ± 1.25		2.9 ± 2.68		0.45

In this study, mean duration of symptoms was around 3 days. Longer duration of symptoms in the patients who did well was noted. Though there was no statistical significance, patients with lesser durations of symptoms succumbed to their illness. Again the inverse results noted were attributed to the low total number. If there were more deaths or the total number of cases assessed was more, there might have been a comparable number and the results might have changed as per the expectation. Khan et al (14) observed duration of more than 48 hours to be associated with significant mortality in patients with peritonitis.

DIABETES MELLITUS:

Some studies(14–16)have proved an association between patients having diabetes mellitus and worse prognosis in peritonitis. This was also looked at in this study.

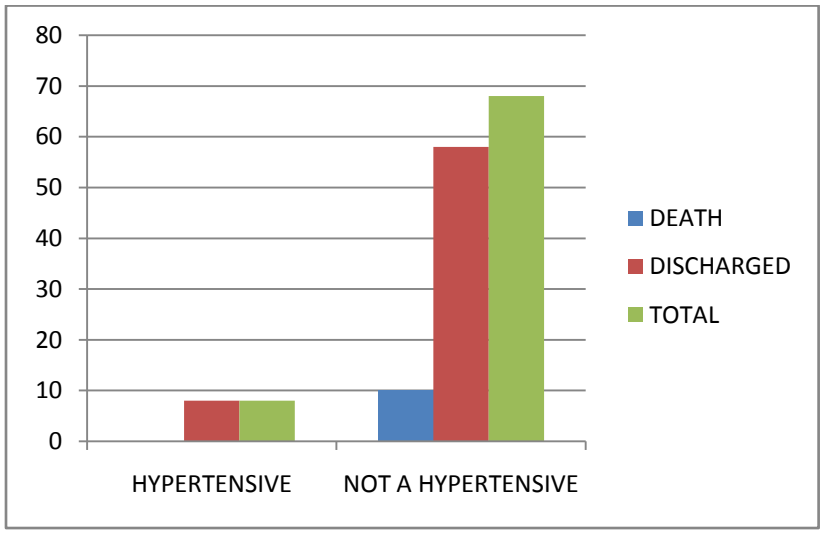


Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Diabetes mellitus:					
Yes	1	10	6	9.1	0.92
No	9	90	60	90.9	

In this study, there were a total of 7 diabetics. Among 10 people who succumbed to the disease, only one was diabetic. No significant association was found between diabetes and poor prognosis according to this study.

HYPERTENSION:

There were a few studies (14-15) which associated hypertensives to have poor outcome in peritonitis. This study data below shows:

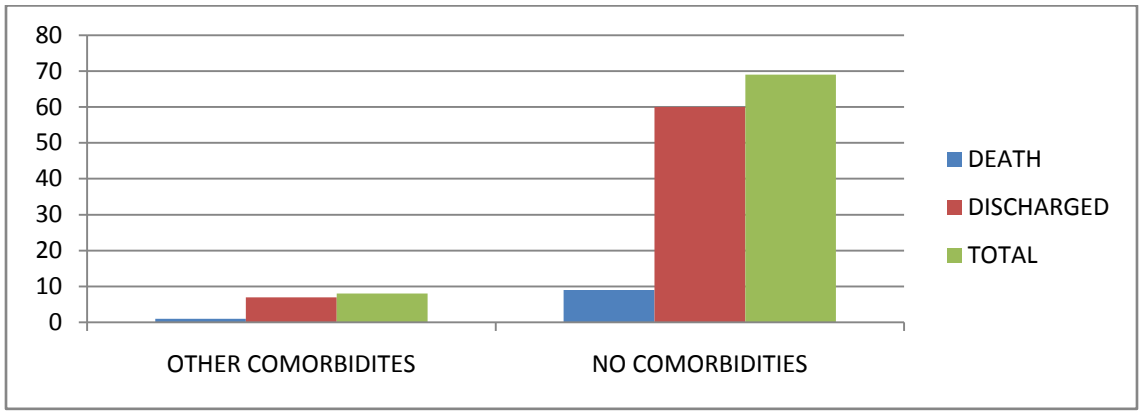


Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Hypertension:					
Yes	0	0	8	12.1	0.24
No	10	100	58	87.8	

A total of 8 hypertensives were there in this study population but none of them succumbed to the disease. There was no significant association between hypertension and poor prognosis of the disease.

OTHER CO-MORBIDITIES:

Few patients with hypothyroidism, seizure disorder and coronary artery disease were also found. These were classified as other co-morbidities and any association was looked at. There were no definite data from past regarding association of these co-morbidities with prognosis in patients with peritonitis. Except in case of patients with coronary artery disease where they were found to do poorly. This was attributed to poor recovery from the septic shock secondary to their coronary disease.



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Other co-morbidities					
Yes	1	10.0	7	10.4	0.965
No	9	90.0	60	89.6	

There were 8 patients with other co-morbidities but there was no significant association with poor prognosis. Seven of eight patients survived the disease well.

ASA SCORE:

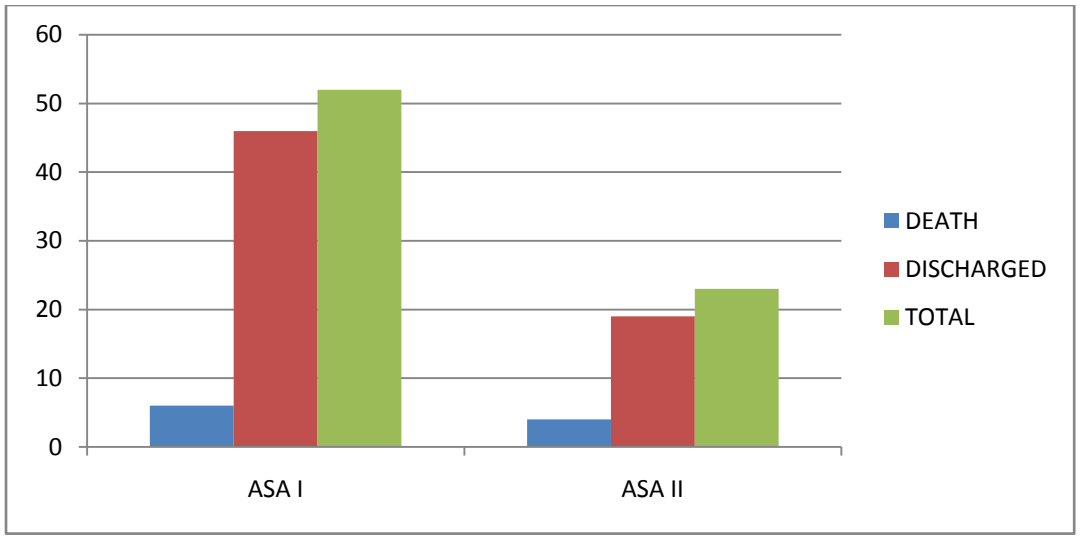
American Society of Anesthesiologists (ASA) adopted a classification based on patient's physical status. They are classified into 5 categories and a 6th category was recently added.

These are ASA grade:

1. A healthy individual.
2. Individual with mild systemic illness.
3. Individual with severe systemic illness.
4. Individual with severe systemic disease that is a constant threat to his/her life.
5. A moribund individual who is not expected to survive without the surgery.
6. A declared brain-dead individual whose organs are being removed for donor purposes.

In this study association of ASA score with regards to poor outcome was evaluated. As one would expect based on studies from the past, patient with a higher ASA grade did worse.

This study had only patients with ASA score of 1 and 2 that is patients with no systemic disease and patients with mild systemic disease.



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
ASA score:					
1	6	60.0	46	70.8	0.492
2	4	40.0	19	65	

There were a total of 23 patients with ASA score of 2, of which 4 died and the remaining were discharged. Among the 10 patients who died there was more number of ASA 1(six) patients which was not expected. This result was not statistically significant.

There was no statistically significant association between higher ASA score and poor outcome.

LEFT SHIFT:

Patients with peritonitis generally are found to have leukocytosis or leucopenia as as part of systemic inflammatory response syndrome. Studies(14) have shown association between leukocytosis and left shift of differential leucocyte count with poor outcome in patients with peritonitis.

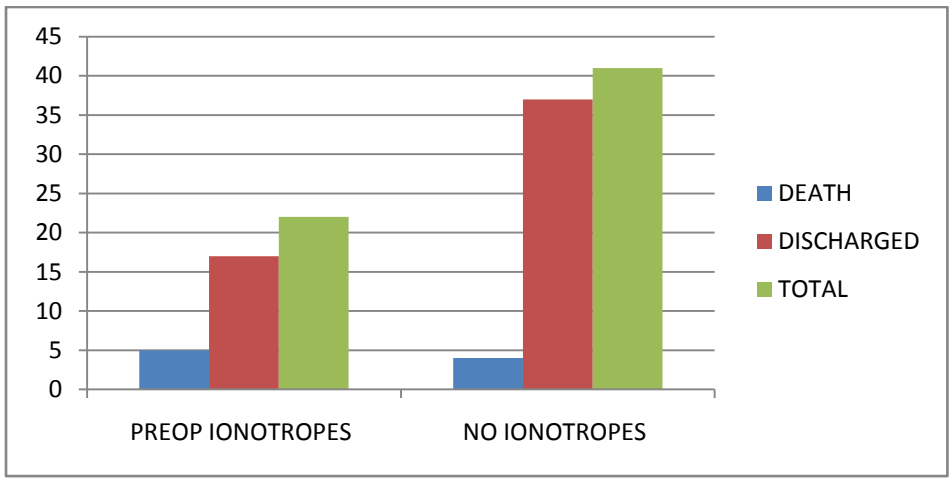
Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Left shift:					
Yes	8	80	57	86.4	0.59
No	2	20	9	13.6	

There were 65 patients who showed left shift with leukocytosis. Among them 8 died but the rest survived.

As expected, among 10 patients who died, 8 had left shift. Though more people with left shift died, there was no statistical significance..

PREOPERATIVE IONOTROPIC REQUIREMENT:

Patients with ionotropic requirement preoperatively had poorer outcome in peritonitis as in previous studies.



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
Preoperative ionotropes:					
Yes	5	55.6	17	31.5	0.16
No	4	44.4	37	68.5	

A total of 22 patients required ionotropes preoperatively. Among patients who died, there was no significant association between preoperative ionotropic requirement and their poor outcome.

TIME BETWEEN PRESENTATION TO EMERGENCY AND SURGERY:

The time elapsed between presentation of patient to the emergency department and time of actual surgery was studied. The delay in time as expected should cause worse prognosis. There is no definite data from past which studied this entity.

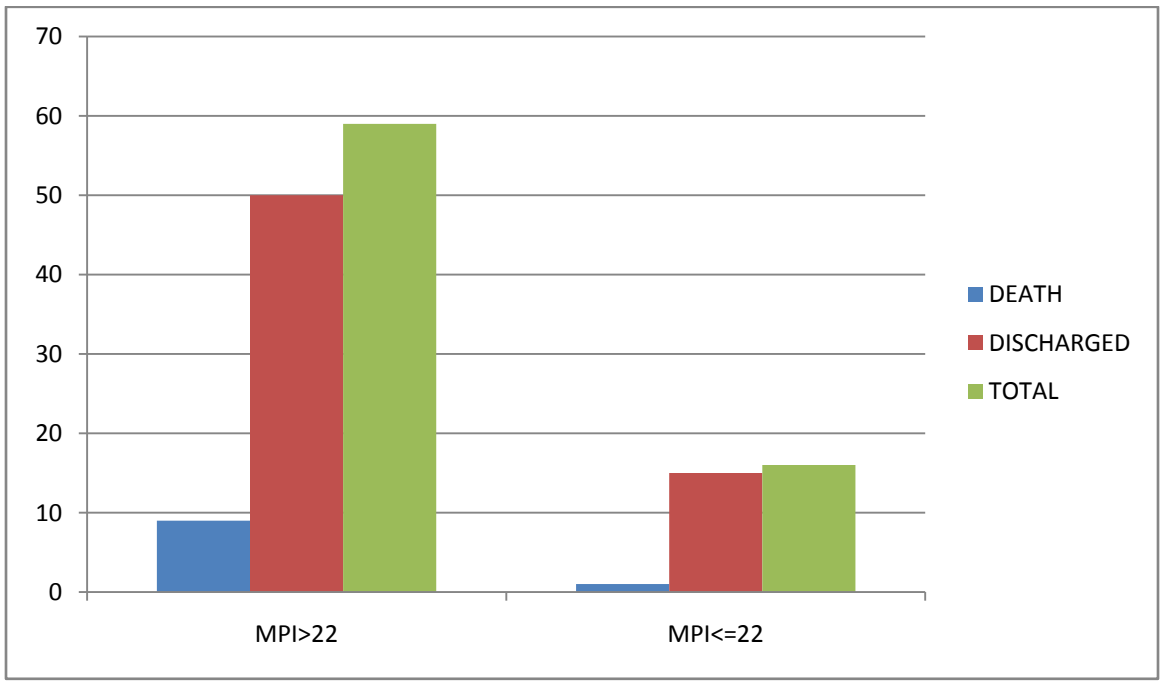
Variables	**Outcome**		**p-value**
	Death	**Discharged**	
	Mean time	**Mean time**	
Time between presentation and surgery	41 hours	36 hours	0.563

The mean time delay for patients who died was more than for those patients who survived. The time difference was 5 hours. Delay was more in the group of patients who succumbed to their disease. This was not statistically significant..

MANNHEIM PERITONITIS INDEX (MPI):

MPI has been used in many studies to successfully predict the outcome in patients with peritonitis. Different studies had different scores which predict the outcome well. For example, in Demmel et al(11), it was found to be a value of 26 with a high specificity and sensitivity to predict the outcome. In the initial validation study that was done for the score in 1988, score of 22 was kept as the cut off.

Similarly in this study an assumed cut off of 22was taken for assessment and for the prediction of outcome.,



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
MPI score:					
>22	9	90	50	76.9	0.347
<=22	1	10	15	23.1	

Among the 10 deaths, there were 9 patients who had a score of more than 22. As expected a higher score showed poor outcome.

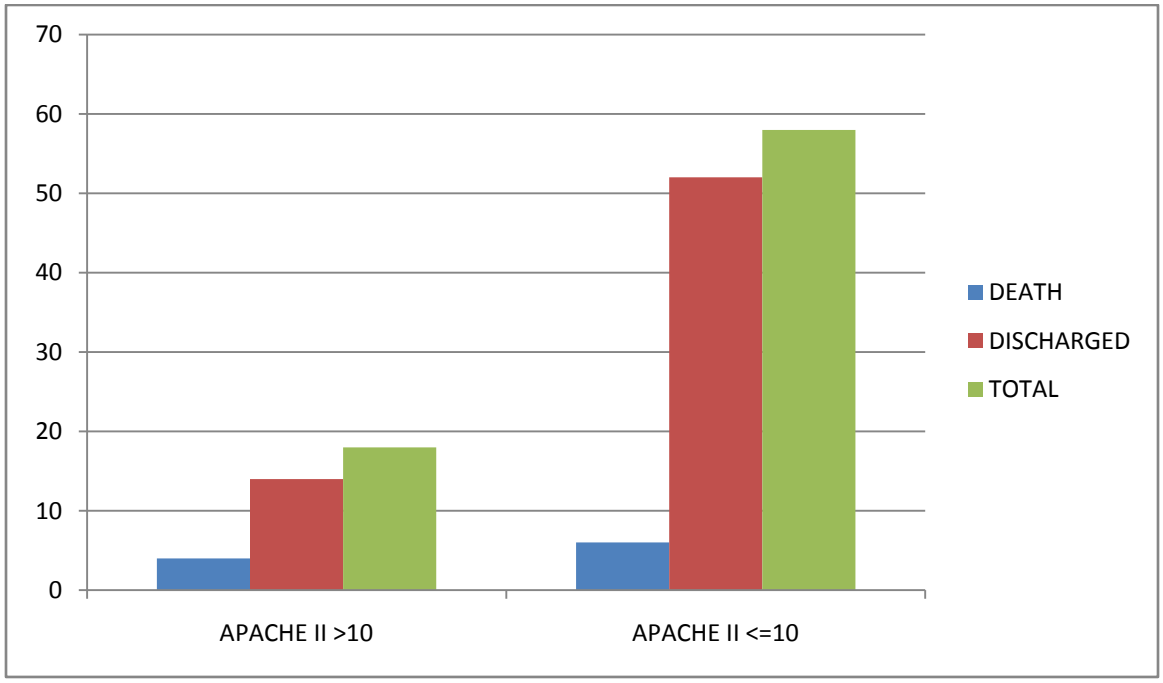
But the data was not statistically significant as there were very low number of deaths in comparison to the total number of patients. Among patients who had scores of more than 22, there were 50 in the group that were discharged and just 9 in the group which succumbed. Hence, giving a p value of 0.347.

With a cutoff point of 22, the sensitivity of MPI in predicting mortality in peritonitis was 90% and the specificity was 23.1%.

As was discussed earlier, one of the objective was to re-evaluate the cut-off point of MPI score which could predict the outcome best. According to the same, it was found that a cutoff point of 32 had the highest sensitivity and specificity in the study population.

APACHE II SCORE:

APACHE II was also calculated on all patients that presented to this hospital in peritonitis during the study period. Based on previous studies, the best cut off point for APACHE II to predict outcome in peritonitis was found to be 10. Hence sensitivity and specificity of the score with 10 as the cut off was calculated.



Variables	Outcome				p-value
	Death		Discharged		
	n	%	n	%	
APACHE II score:					
>10	4	40	14	21.2	0.193
<=10	6	60	52	78.8	

Out of the 76 patients, there were only 18 patients with scores more than 10.

Of the 10 who died, only 4 had score of >10 showing worse prognosis. There was no statistical significance of this..

The sensitivity of APACHE II score for a cut off of 10 in predicting mortality was found to be 40% and the specificity was found to be 78.8% in this study

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MORBIDITY:

Patients with peritonitis are noted to have multiple complications with regards to the surgery as well as septic shock. In this study morbidity in terms of local complications and systemic complications were looked at in detail.

Local complications were studied in terms of:

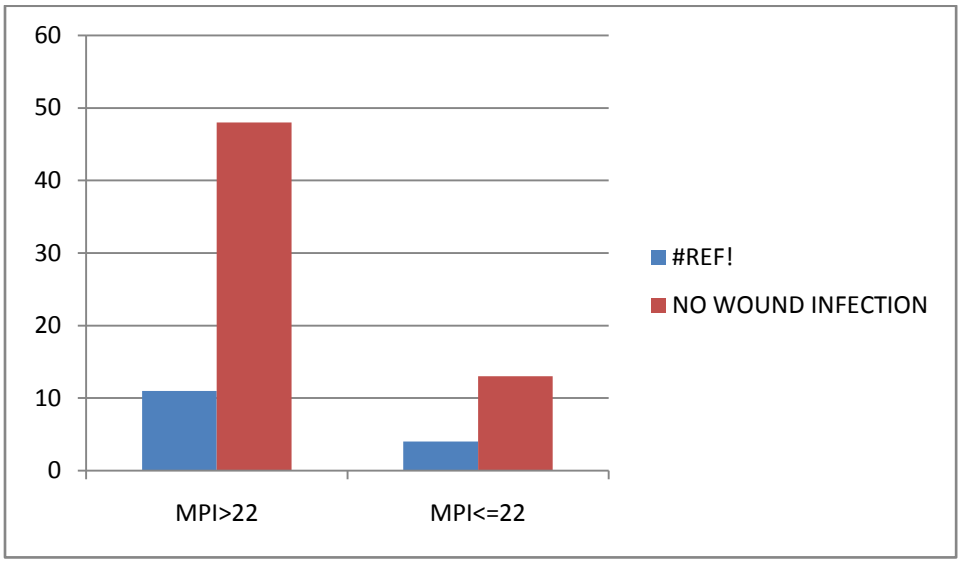
1. Wound infection
2. Wound dehiscence
3. Intra-abdominal collection
4. Anastomotic leak
5. Re-operation

Systemic complications were studied with following parameters:

1. Patients requiring dialysis for >48 hours post operatively.
2. Patients requiring mechanical ventilation >48 hours post operatively.
3. Patients with GCS score < 8 after stopping the sedation >48 hours.
4. Mean hospital stay.
5. Mean ICU stay.

All these aspects were studied in the patients till discharge or till death. Whether the two scoring systems could predict the outcome with regards to morbidity was assessed.

1. WOUND INFECTION:



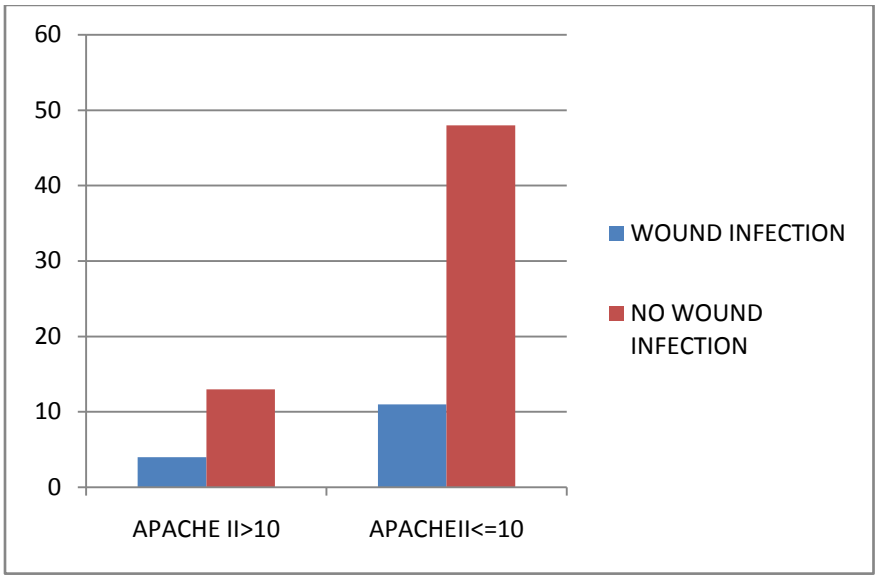
Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Wound infection:					
Yes	11	18.6	4	23.2	0.656
No	48	81.4	13	76.8	

In this study, fifteen patients had wound infection which was managed conservatively. Among these patients 11 had an MPI score of >22.

Patients with score >22 were 59 in number of which only 11 had wound infection. Hence there was no statistical correlation to the prediction and the p value was found to be 0.656.

The sensitivity of MPI in predicting wound infection in patients with peritonitis was 18% and the specificity was 76%.

In the APACHE group,



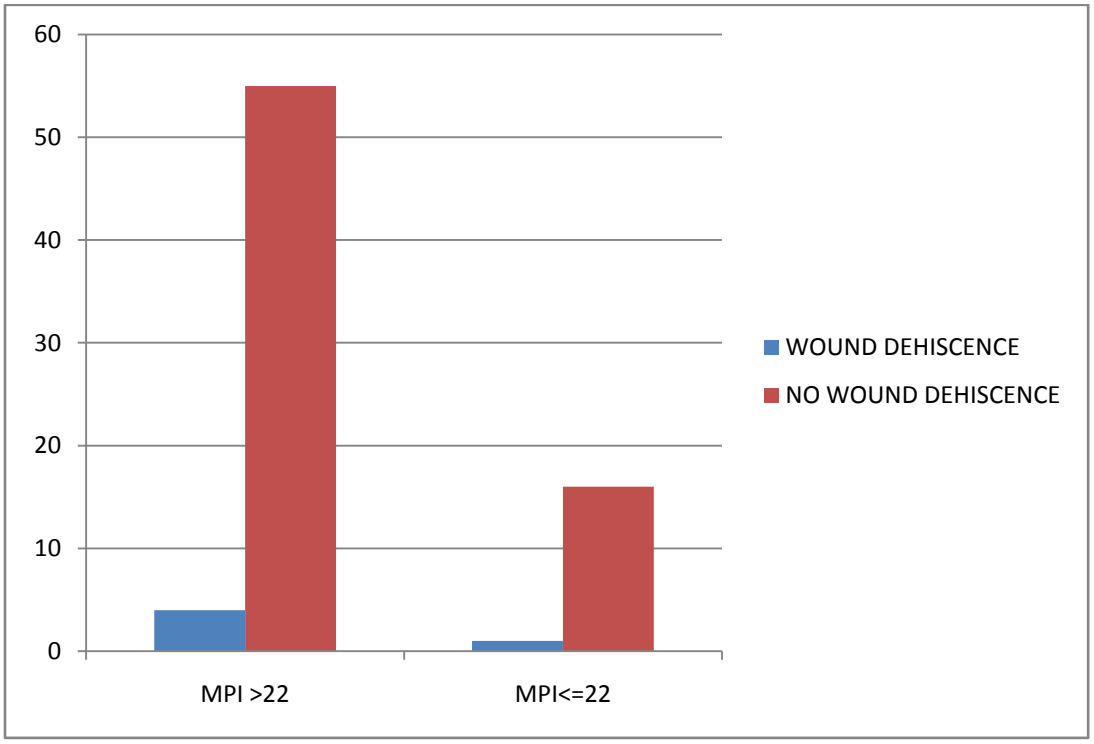
Variables	APACHE score				p-value
	>10		<=10		
	N	%	n	%	
Wound infection:					
Yes	4	27.8	11	18.6.	0.403
No	13	72.2	48	81.4	

There were 17 patients with APACHE II score of >10 among which only 4 had wound infection. There was again no statistical significance. The p value was 0.403.

The sensitivity of APACHE II score in predicting wound infection in patients with peritonitis was 27% and specificity was 81%.

2. WOUND DEHISCENCE:

Wound dehiscence is breakdown of wound along the suture line. This was studied with regards to MPI and APACHE II scores.

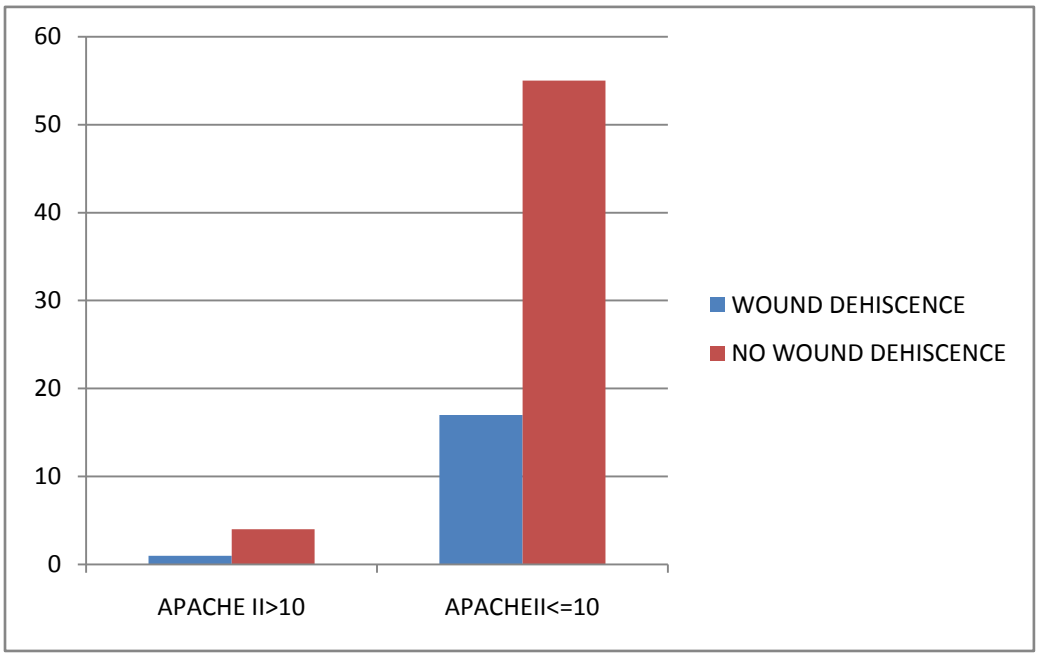


Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Wound dehiscence:					
Yes	4	6.8	1	5.9	0.895
No	55	93.2	16	94.1	

A total of 5 patients had wound dehiscence, of which 4 had a MPI score >22. This was not statistically significant as there were 59 patients with >22 MPI but only 4 had wound dehiscence. The p-value was 0.895.

Therefore, the sensitivity of MPI in predicting wound dehiscence in patients with peritonitis was 6% and specificity was 94%.

APACHE II AND WOUND DEHISCENCE

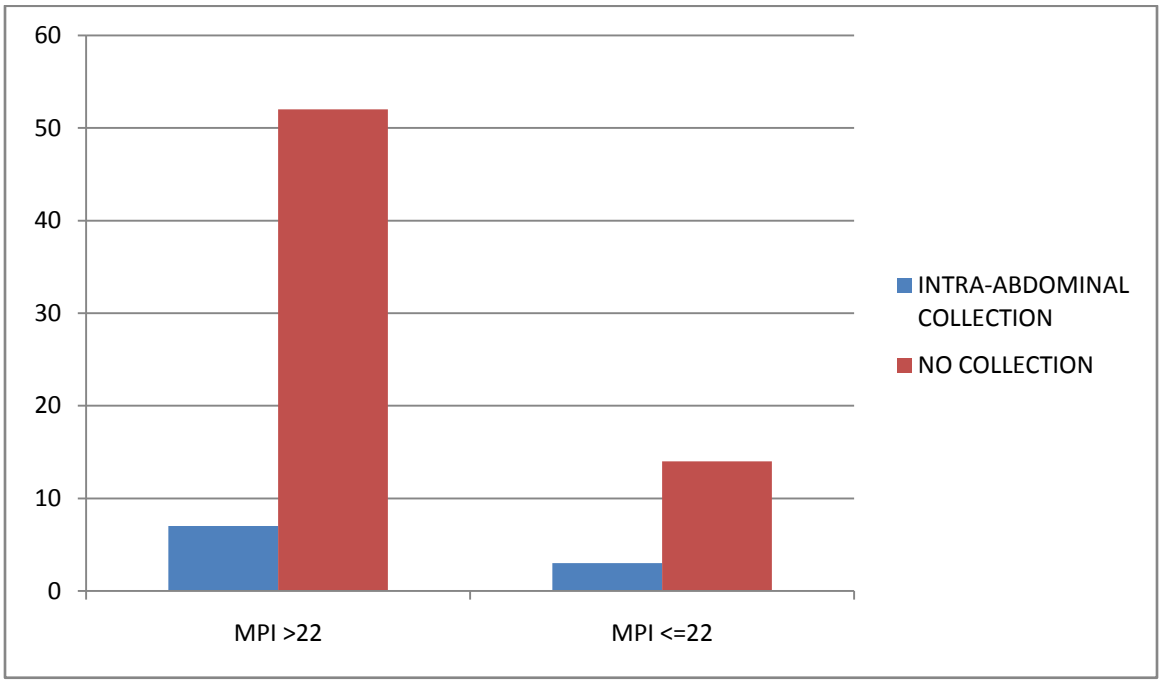


Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
Wound dehiscence:					
Yes	1	5.6	4	6.8	0.854
No	17	94.4	55	93.2	

There were 18 patients with more than 10 APACHE II score but only 1 had wound dehiscence. This was not statistically significant.

The sensitivity of APACHE II score in predicting wound dehiscence was 5.6% and specificity was 93%.

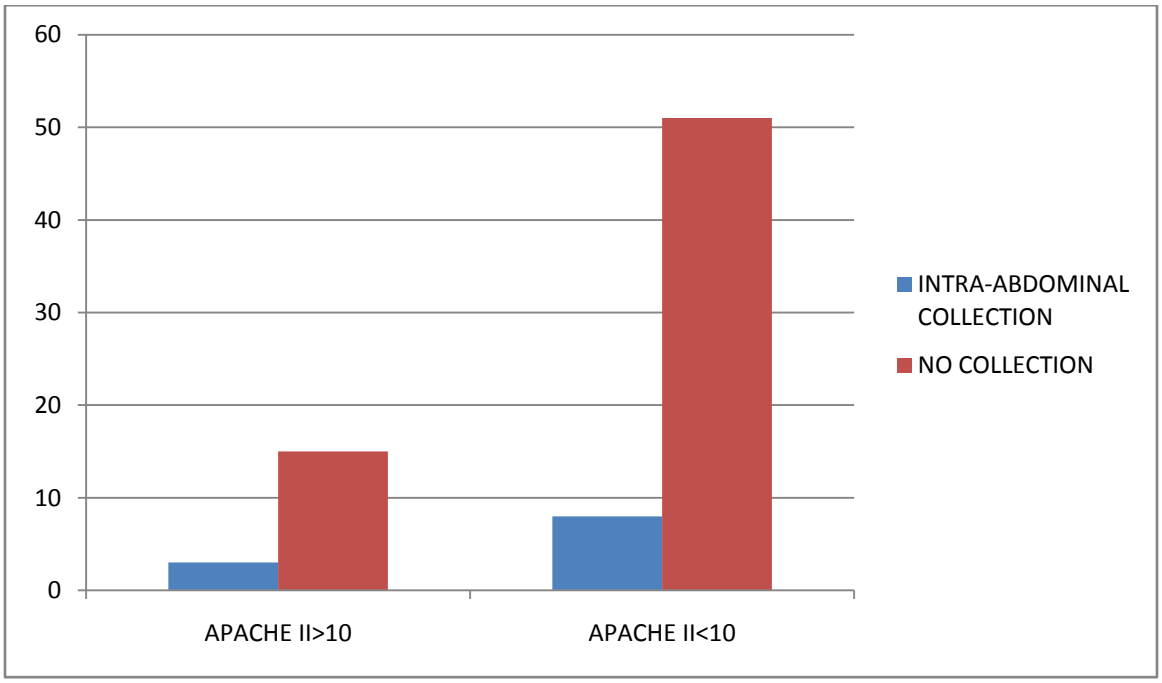
3. INTRA-ABDOMINAL COLLECTION:



Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Intra-abdominal collection:					
Yes	7	11.9	3	17.6	0.534
No	52	88.2	14	82.4	

Ten patients who had intra-abdominal collection, of which 7 had a MPI score of >22. Of 59 patients who had a total of MPI>22, only 7 had intra-abdominal collection.

Therefore, the sensitivity of MPI in predicting intra-abdominal collection in patients with peritonitis was 11% and specificity was 82.4%.



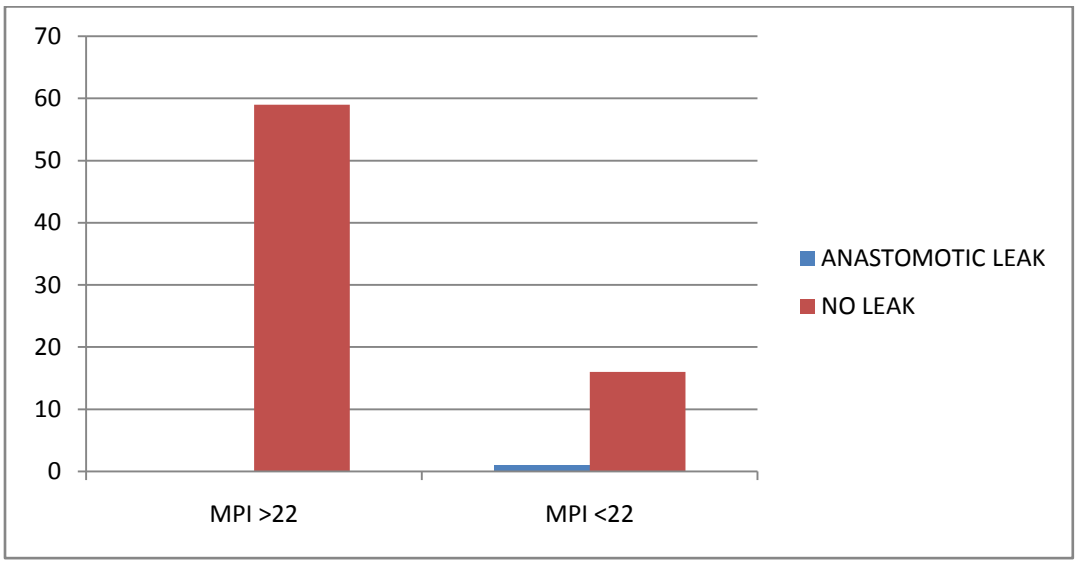
Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
Intra-abdominal collection:					
Yes	3	16.7	8	13.6	0.742
No	15	83.3	51	86.4	

Of 18 patients who had APACHE II score of >10, only 3 had intra-abdominal collection. Of 11 patients who had intra-abdominal collection, only 3 had score>10. The p-value was 0.742.

Therefore, the sensitivity of APACHE II in predicting intra-abdominal collection in patients with peritonitis was 16.7% and specificity was 86.4%.

4. ANASTOMOTIC LEAK:

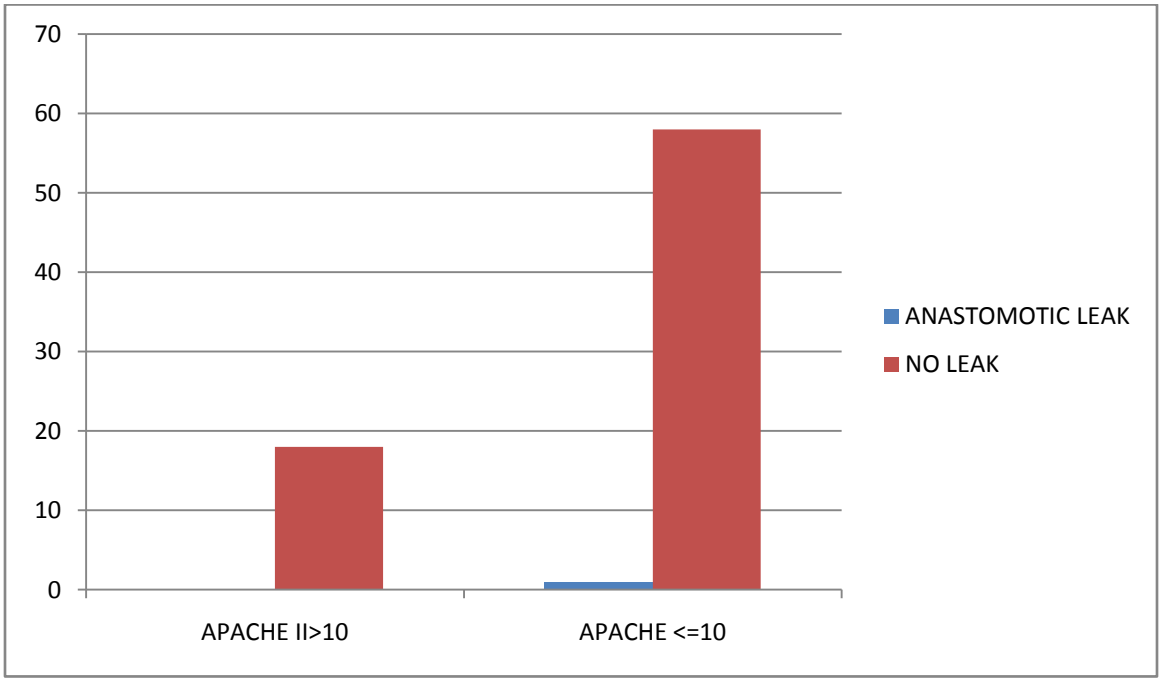
Anastomotic leak was identified either by reoperation or by imaging (CECT abdomen and pelvis).



Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Anastomotic leak:					
Yes	0	0	1	5.9	0.06
No	59	100	16	94.1	

There was only 1 patient who had leak but had MPI score of <22.

Therefore, the sensitivity of MPI in predicting anastomotic leak in patients with peritonitis was 0% and specificity was 94.1%.



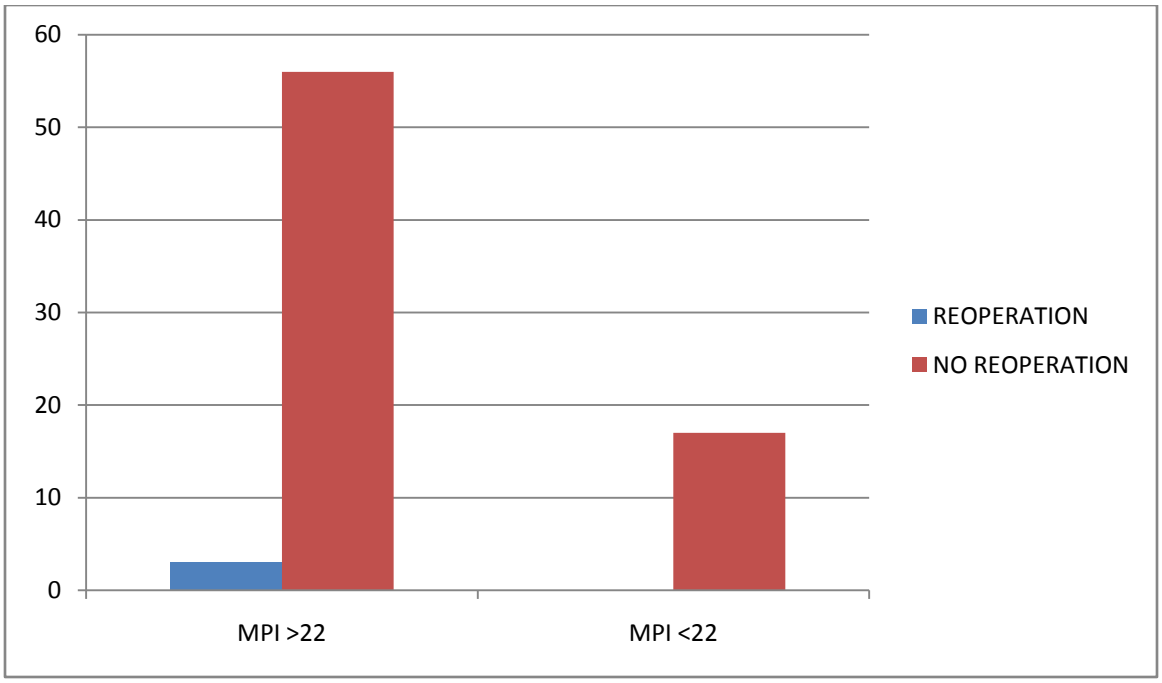
Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
Anastomotic leak:					
Yes	0	0	1	1.7	0.578
No	18	100	58	98.3	

This patient did not have APACHE II score more than 10.

Therefore, the sensitivity of APACHE II score in predicting anastomotic leak in patients with peritonitis was 0% and specificity was 98%.

5. REOPERATION:

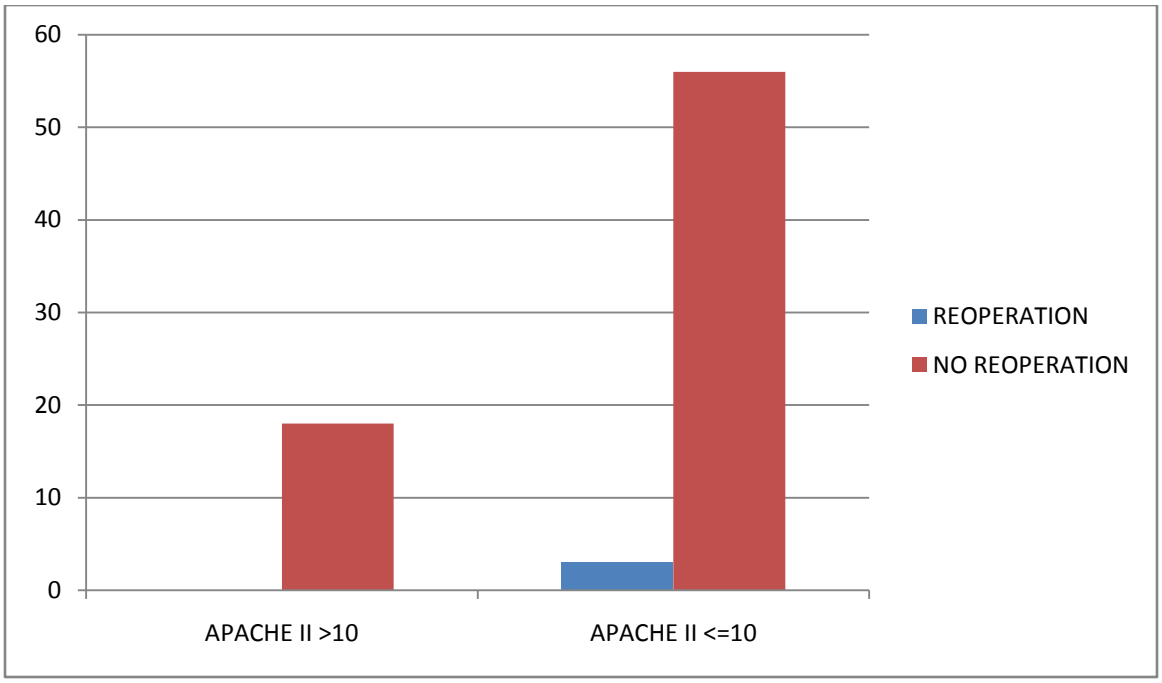
Reoperation due to local complication was considered as a morbidity. In this study, 3 patients had reoperation.



Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Reoperation:					
Yes	3	5.1	0	0	0.343
No	56	94.8	17	100	

All 3 patients had score>22. But this was not statistically significant, as the p-value was 0.343.

Therefore, the sensitivity of MPI in predicting reoperation in patients with peritonitis was 5.1% and specificity was 100%.



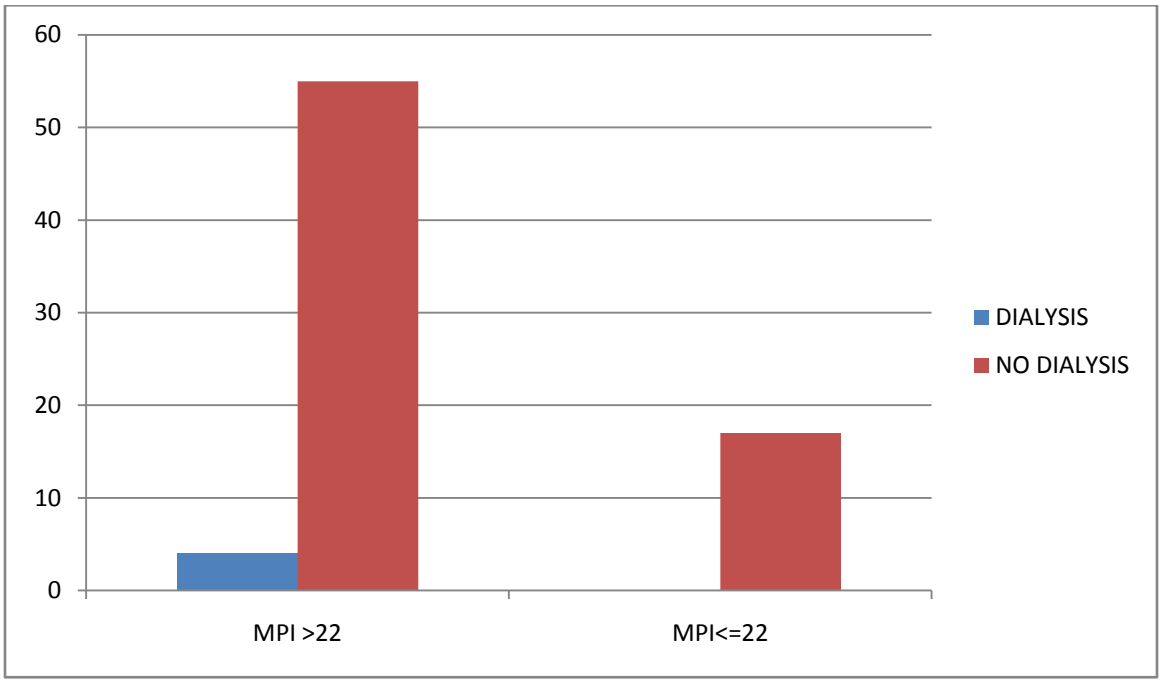
Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
Reoperation:					
Yes	0	0	3	5.1	0.329
No	18	100	56	94.9	

All 3 patients had APACHE II score <10.

Therefore, the sensitivity of APACHE II score in predicting reoperation in patients with peritonitis was 0% and specificity was 94.9%.

6. DIALYSIS:

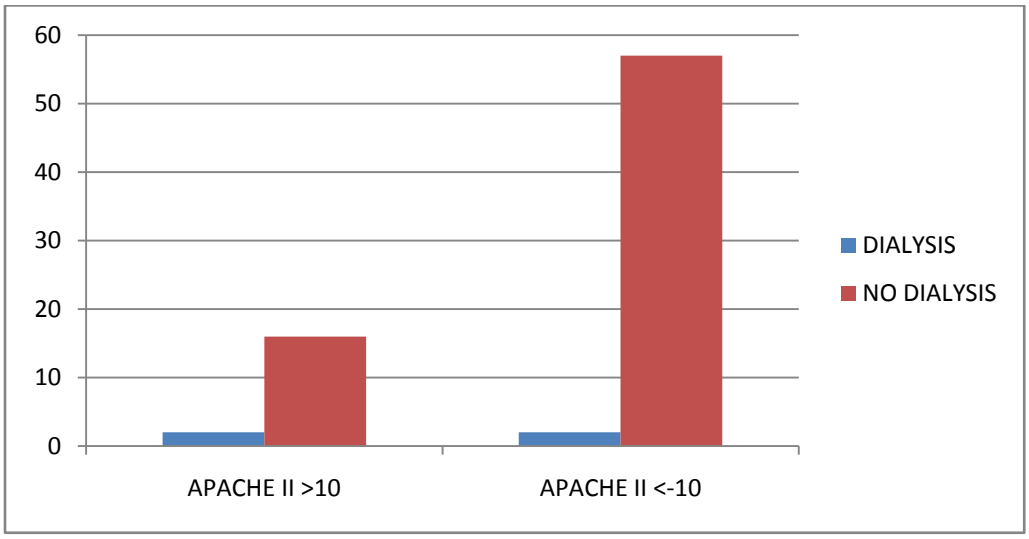
One of the major systemic complication in peritonitis is renal failure, which is usually acute and resolves as the sepsis improved. Rarely patients go on to require dialysis. That was considered as a morbidity indicator in this study,



Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
Dialysis:					
Yes	4	6.8	0	0	0.270
No	55	93.2	17	100	

In this study, four patients required dialysis. All 4 had MPI score>22. This was not statistically significant as there were 59 patients who had MPI>22 but only 4 needed dialysis secondary to renal failure.

Therefore, the sensitivity of MPI in predicting need for dialysis in patients with peritonitis was 6.8% and specificity was 100%.

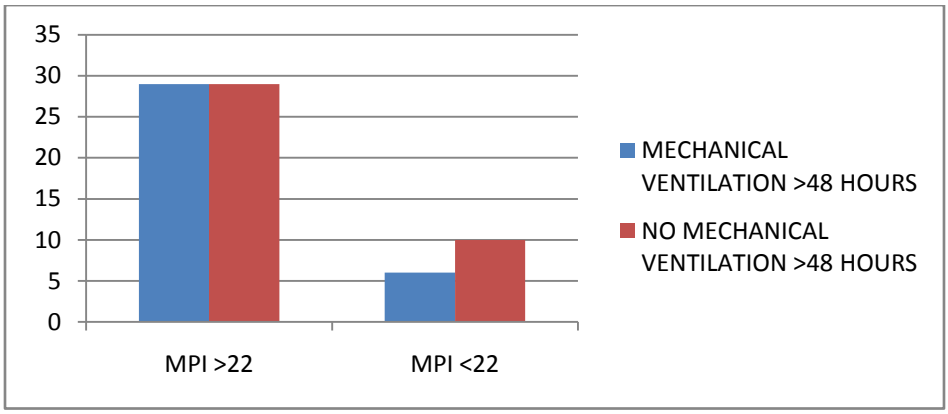


Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
Dialysis:					
Yes	2	11.1	2	3.4	0.196
No	16	88.9	57	96.6	

Among 4 patients who needed dialysis, 2 had score>10 and 2 had score<=10. Therefore, the sensitivity of MPI in predicting need for dialysis in patients with peritonitis was 11.1% and specificity was 96.9%.

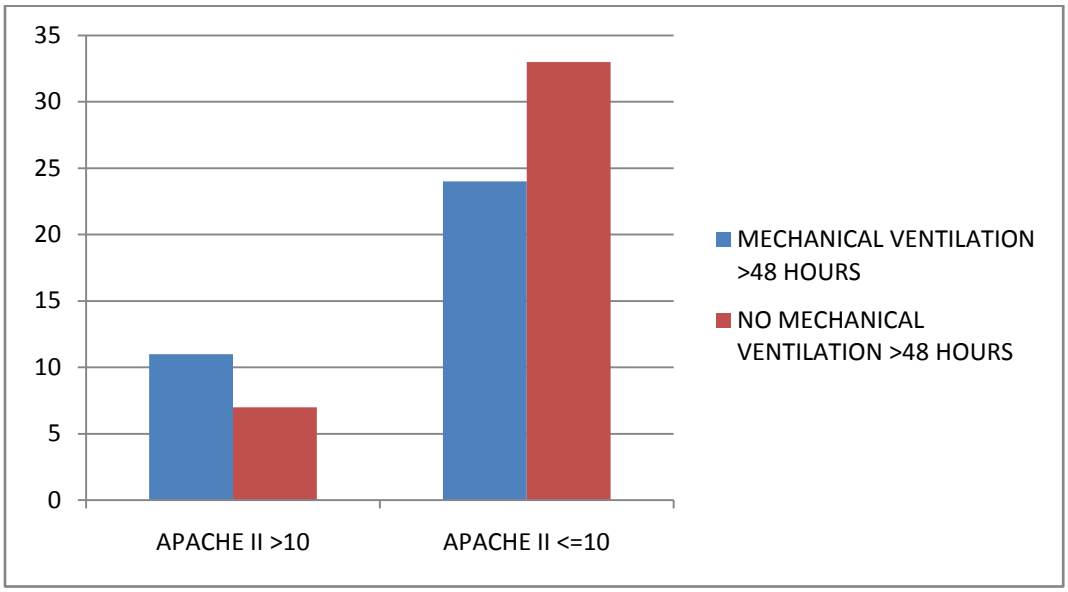
7. MECHANICAL VENTILATION:

Another important complication noted in patients with peritonitis is ARDS(acute respiratory distress syndrome) secondary to systemic sepsis.



Variables	MPI score				p-value
	>22		<=22		
	N	%	n	%	
Mechanical ventilation:					
Yes	29	50	6	36	0.285
No	29	50	10	64	

In this study, thirty five patients needed mechanical ventilation for >48 hours. Of them 29 had MPI score >22. Therefore it appears to be good predictor but the p-value was 0.285. The sensitivity of MPI in predicting need for mechanical ventilation in patients with peritonitis was 50% and specificity was 64.7%.



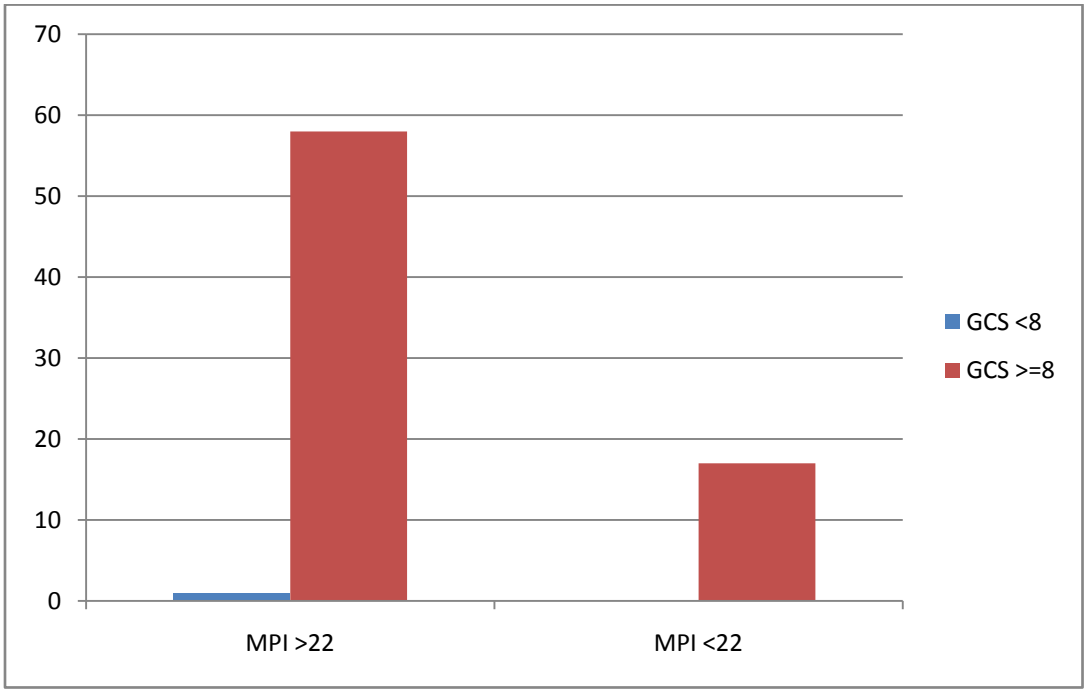
Variables	APACHE score				p-value
	>10		<=10		
	N	%	n	%	
Mechanical ventilation:					
Yes	11	61.1	24	43.1	0.181
No	7	38.9	33	56.9	

Eighteen patients had APACHE II score >10, among which 11 needed mechanical ventilation.

The sensitivity of APACHE II score in predicting need for mechanical ventilation in patients with peritonitis was 61.1% and specificity was 56.9%.

8. GCS <8:

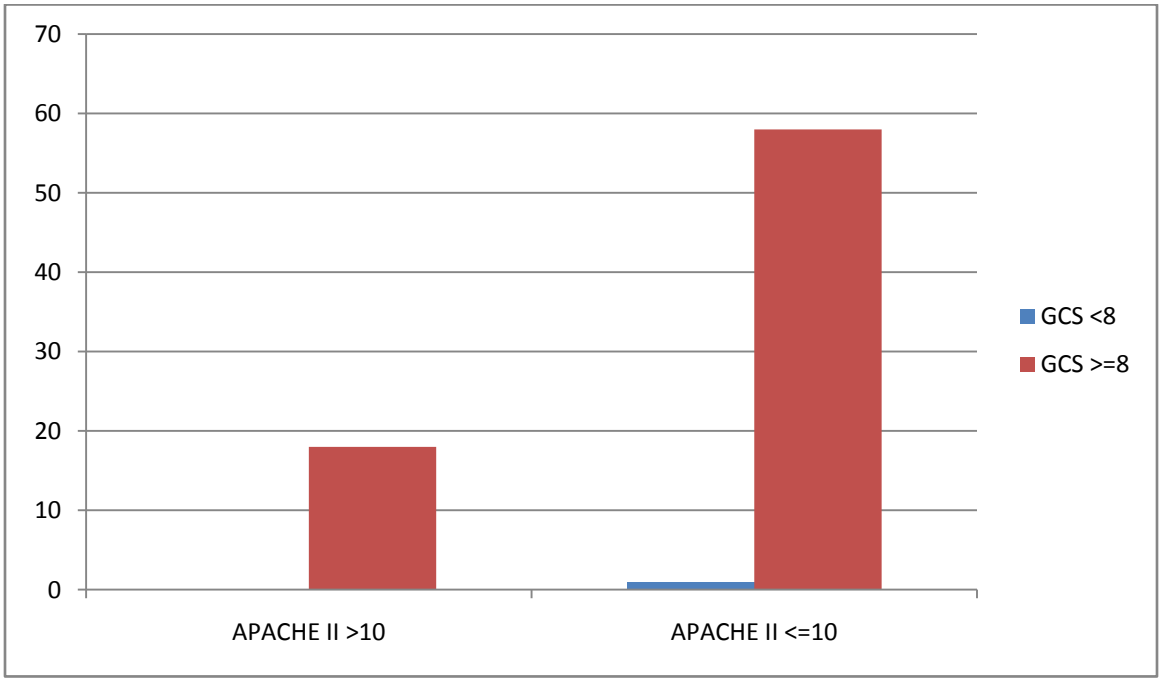
GCS was also used as an indicator of morbidity. Patients who had GCS<8 after 48 hours of stopping sedation were identified.



Variables	MPI score				p-value
	>22		<=22		
	n	%	n	%	
GCS score:					
<8	1	1.8	0	0	0.589
>=8	58	98.2	17	100	

Only one patient who had GCS<8 for more than 48 hours. This patient had a MPI>22. There were 59 patients with MPI>22 but only one had GCS<8.

The sensitivity of MPI in predicting patients with poor GCS was 1.8%% and specificity was 100%.



Variables	APACHE score				p-value
	>10		<=10		
	n	%	n	%	
GCS:					
<8	0	0	1	1.7	0.578
>=8	18	100	58	98.3	

The one patient who had GCS < 8 for more than 48 hours of stopping sedation had an APACHE II score of <10.

The sensitivity of APACHE II score in predicting patients with poor GCS was 0%% and specificity was 98.3%.

9. MEAN HOSPITAL STAY:

In this study, mean hospital stay and mean ICU stay was also included as morbidity indicators. Mean hospital stay was around 11 days.

Variables	MPI		p-value
	>22	<=22	
	Days	Days	
Hospital stay: (Mean ± Sd)	11.1±9.4	11.2±13.1	0.977

Both groups >22 and <22 had a mean hospital stay of 11 days. There was no difference in MPI score predicting mean hospital stay. The p-value was 0.977.

Variables	APACHE		p-value
	>10	<=10	
	Days	Days	
Hospital stay: (Mean ± Sd)	10.1±5.2	11.5±11.3	0.602

Both APACHE II score <10 and >10 had mean hospital stay of 11 days. There was no difference in the groups. The p-value was 0.602.

10. MEAN ICU STAY:

Mean ICU stay this study was 5 days.

Variables	MPI		p-value
	>22	<=22	
	Days	Days	
ICU stay: (Mean ± SD)	5±3.3	4.8±4.4	0.922

There was no difference in MPI score > 22 or <22. The p=value was 0.922.

Variables	APACHE		p-value
	>10	<=10	
	Days	Days	
ICU stay: (Mean ± SD)	5.7±3.3	4.5±3.4	0.306

Similar observation was made in APACHE II score >10 or <10. The p-value was 0.306.

DISCUSSION

1. MORTALITY – PRIMARY OUTCOME

MPI and APACHE II scores were evaluated in predicting mortality which was the primary outcome. Results showed that MPI had a sensitivity of 90% but specificity of 23.1% only.

Sharma et al(3) evaluated MPI in predicting the outcome in patients with peritonitis. The outcome studied was mortality. In his study, he found MPI to have a sensitivity of 92% and specificity of 78%. This study showed comparable sensitivity to the index study but the specificity was very poor.

This study did not prove MPI to be a good predictor of primary outcome which was death or discharge. This was attributed to the low number of deaths in the study period.

As the study was performed at a tertiary care center with good specialty care and ICU facilities, the post-operative management was adequate. This prevented multiple deaths. In order to evaluate the same, the numbers of deaths that have to be studied would be more, which means the total sample also should be more.

With regards to APACHE II score in predicting primary outcome in peritonitis, the sensitivity was only 40% but the specificity was as high as78%. The specificity was comparable to literature, but the sensitivity was poor. In spite of this, APACHE II seemed

to be the better score in predicting mortality in patients with peritonitis as compared to MPI. This was again attributed to the low number of deaths in this study.

In predicting mortality, both scores failed in comparison to literature, but APACHE II score seemed to have a higher specificity and could be deemed as a better scoring system with the available data.

Kulkarni et al(1) studied 50 patients with peritonitis and used APACHE II score to predict mortality in them. The mortality rate in the study was 16%. He found the sensitivity to be 100% and specificity to be 73.8%. This study also had a comparable specificity but the sensitivity this study was poor. This could be attributed to the low death percentage in this study period.

2. **MORBIDITY – SECONDARY OUTCOME:**

These tests were also assessed to evaluate the secondary outcome which included The post-operative complications, studied in terms of local and systemic complications. As mentioned in the results, patients with MPI scores>22 had more wound infection, wound dehiscence, anastomotic leak, intra-abdominal collection and reoperation. But none of these were statistically significant. With regards to MPI score and systemic complications, patients with score>22 required dialysis, mechanical ventilation and also had low GCS off sedation as expected. This was also not statistically significant.

APACHE II score in predicting secondary outcome was also studied. Finding was opposite of what was expected. Patients with scores of <10 were found to have more local and systemic complications. But this observation was not statistically significant. This was attributed to the low sample size. In literature, APACHE II was not used as a predictor of morbidity. This study did not prove this score to be a good predictor of morbidity either.

There were multiple risk factors associated with poor outcome in patients with peritonitis. Those included in either of the scores were already studied. A few of these characteristics were also studied.

3. AGE

Notash et al (17)in a prospective study done on 80 patients in Tehran evaluated the use of MPI and MOF(Multi-organ failure) score in predicting outcome in patients with peritonitis. He concluded patients with age >60 years were at higher risk for in hospital mortality. In this study, among the patients who died there were more patients in the group of age>50. Though there was no statistical significance this study, it correlated with the observations made in the past.

4. DURATION OF SYMPTOMS

Duration of symptoms has played an important role in predicting outcome in many studies in the past. The longer the duration, the poorer the outcome. Khan et al

(14)studied the predictors of morbidity and mortality in patients with peritonitis. In his study, he identified a duration of >48 hours contributed significantly for both morbidity and mortality. In this study, the duration of symptoms in patients who died in both the group had a mean duration of 3 days. No significant difference with regards to duration of symptom was found..

5. GENDER:

From previous studies, female gender had poor outcome in patients with peritonitis. There were 58 males and 19 females in this study and among the females only 3 succumbed to their illness. This study could not definitely conclude that there was gender predilection in outcome of patients with peritonitis. No significant difference was found statistically with regards to gender as a predictor of outcome.

6. CONCOMITANT DISEASE

Khan et al (14)said that the presence of concomitant disease was a contributor for morbidity and mortality in patients with peritonitis. In this study, no such significant association in patients with diabetes, hypertension or other co-morbid illnesses was found in the outcome of patients with peritonitis. In this study these were not significant risk factors in determining outcome in patients with peritonitis.

7. TIME INTERVAL BETWEEN PRESENTATION AND SURGERY

Notash et al(17) studied the duration from presentation to surgery as an indicator of mortality in patients with peritonitis. According to their study, the interval between presentation to surgery of more than 24 hours had a higher risk of in-hospital death. In this study, the mean duration between presentation and surgery was more in the patients who succumbed to the disease. In the patients who died, the mean duration was 41 hours and for those who survived the disease it was 36 hours.. Though there was a difference of 5 hours in this study, it did not prove to be statistically significant.

8. ASA

Higher ASA score was attributed to be a good predictor of mortality in patients with peritonitis in many studies in the past. Kocer et al(15) in his study to evaluate the factors affecting the mortality and morbidity in patients with peptic ulcer disease found that ASA status was an independent predictor of mortality. This was not noted in this study. We had significantly more patients in the ASA 1 category which could have biased the results. Therefore we did not find any significant association between ASA score and outcome with regards to death.

9. LEFT SHIFT

Studies in the past have shown association of leukocytosis and left shift with

poor prognosis in patients with peritonitis. Khan et al(14) showed that elevated counts were a significant risk factor in predicting mortality in patients with peritonitis.

In this study also among the patients who died, there were more patients who had a left shift. But the result was not statistically significant as there were low number of deaths in this study. Therefore, there was no association of left shift as a significant risk factor in predicting poor outcome in peritonitis.

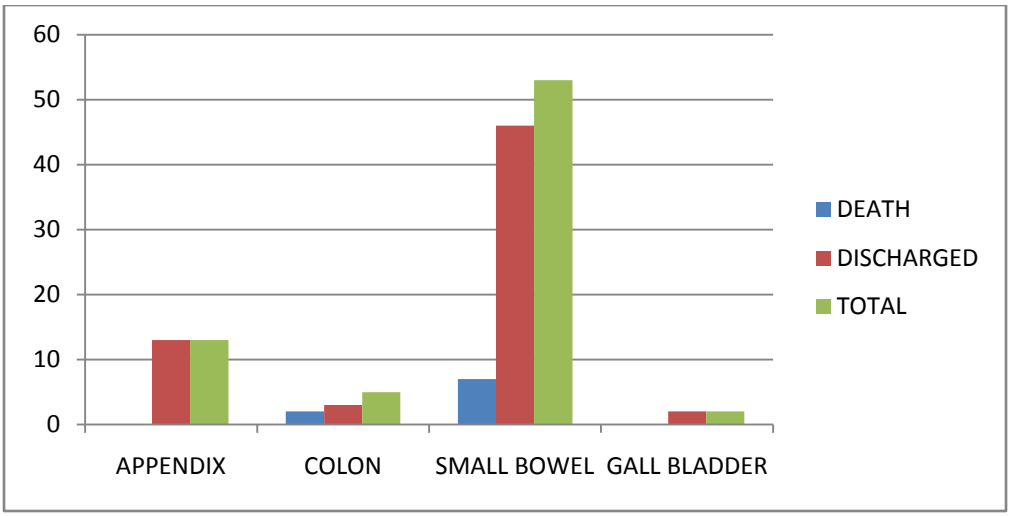
10. PREOPERATIVE SHOCK/IONOTROPIC REQUIREMENT

In past studies, patients who required ionotropic support preoperatively did poorly in peritonitis. Kocer et al(15) in his study on 269 patients with perforation peritonitis who were operated proved that preoperative shock was a significant indicator of mortality.

In this study, 22 patients needed preoperative ionotropes but only 5 of them succumbed. There was no statistical significance to prove an association between preoperative ionotropic requirement and mortality.

11. SOURCE OF PERITONITIS:

In this study source of peritonitis was looked at. This is as mentioned below.



Small bowel included pre-pyloric, gastric, duodenal and other small bowel perforations. They contributed the highest number of cases witnessed. Though there were only 5 cases of colon as source for peritonitis 40% of them died. This was as mentioned in previous studies where source as colon was considered to be a risk factor for mortality in patients with peritonitis.

In this study data was statistically not significant, but it correlated with the data from previous studies.

Notash et al(17) in his study observed highest mortality among patients with peritonitis related to biliary tract. In this study, patients with gall bladder perforation did well and were discharged stable.

LIMITATIONS

The study results were not as expected. This could be due to the sample size being small. We did not have many complications in patients. Thereby we could not definitely study the association of the complications and the ability of the scores to predict the same.

As this was part of a dissertation, there was time limitation to finish the study.

I would like to continue the study after post graduation to determine any change in results.

CONCLUSION

The study did not prove MPI and APACHE II scores as good predictors of mortality or morbidity. In studies from the past, there was a higher mortality rate, thereby the deaths studied being more which could have been the reason for the higher sensitivity and specificity of the scores in predicting outcome. If the total population studied was more there could have been lot more deaths studied thereby assessing the scores better.

Though the tests failed to prove good in study setting it should be evaluated in other centers for better assessment of the scores with a larger sample size.

Though MPI did not prove to be as good as APACHE II in this study, there is definitely benefit in using the MPI scores in primary and secondary level hospitals where facilities are less and investigations such as blood gas may not be available. They can be used to ascertain a certain extent of the patient's present condition and the prognosis.

. Though the scores were not good predictors of complications (secondary outcome), MPI seemed to be better in predicting complications as compared to APACHE.

The risk factors that was assessed in this study though were not statistically significant, some of them such as age>50 years, left shift of WBC counts and time interval between presentation and surgery did contribute to high risk for mortality in peritonitis.

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ANNEXURE I

PATIENT INFORMATION SHEET

The term peritonitis refers to a severe infection of the abdomen. This can be due to various factors like infection of intestine, perforation of the intestine, inflammation of the intestine, death of intestine and leak from surgical anastomosis etc. Patients become very unwell when they develop peritonitis and if not treated quickly enough, they may further deteriorate and die.

There are scoring systems developed to guide as to which patient may not do well in spite of treatment. The outcome of treatment in patients with peritonitis may be predicted by using these scoring systems. The purpose of this study is to assess the usefulness and validity of these scoring systems in patients presenting with peritonitis.

Patients agreeing to participate in the study will receive the standard treatment currently practiced for any patient diagnosed to have peritonitis. There will be no additional intervention on the patient and the patient will not have any added risk by agreeing to be part of the study. Clinical parameters and biochemical findings will be used to calculate the score.

The results from this study may help the clinician to decide the usefulness of these scoring systems on patients with peritonitis to prognosticate outcome. The study may also help in planning a management strategy for each patient based on the individual patient's score.

ANNEXURE-1I

PATIENT CONSENT FORM

Study Title: A study to evaluate the validity of Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis.

Study Number: _____

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age: _____

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I amfree to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).[ ]

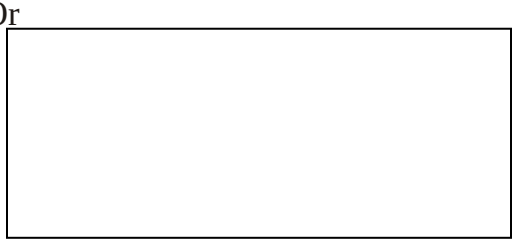
(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable

Date: _____/_____/_____

Signatory's Name: _____Signature:

Or



Representative: _____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature (or) thumb impression of the Witness: _____

Date: _____/_____/_____

Name and Address of the Witness: _____

ANNEXURE III

CLINICAL RESEARCH FORM

MANNHEIM PERITONITIS INDEX AND APACHE II SCORING SYSTEM IN PREDICTING OUTCOME IN PATIENTS WITH PERITONITIS.

Serial number:

Age: Sex:

Date and time of admission to casualty:

Duration of symptoms:

Co-morbid illness: DM HTN Others:

ASA score:

At presentation:

HR- BP- RR- Temperature-

GRBS-

Investigation:

Hb-

Total counts-

Left shift-

Creatinine-

Preoperative ionotropic requirement-

Diagnosis at casualty-

Date and time of surgery-

Time interval between presentation and surgery-

Post operative diagnosis-

Source of peritonitis-

Mannheim Peritonitis index:

Table 1: Mannheim Peritonitis Index[8,11]

Risk factor	Weightage, if any
Age >50 years	5
Female gender	5
Organ failure*	7
Malignancy	4
Preoperative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudates	
Clear	0
Cloudy, purulent	6
Fecal	12

*Definitions of organ failure: Kidney: creatinine >177 μmol/L, urea >167 μmol/L, oliguria <20 mL/h; Lung: pO_2 <50 mmHg, pCO_2 >50 mmHg; Shock:[11] hypodynamic or hyperdynamic; Intestinal obstruction (only if profound): Paralysis >24 h or complete mechanical ileus

Total score:

APACHE II scoring:

THE APACHE II SEVERITY OF DISEASE CLASSIFICATION SYSTEM

PHYSIOLOGIC VARIABLE	HIGH ABNORMAL RANGE					LOW ABNORMAL RANGE			
	+4	+3	+2	+1	0	+1	+2	+3	+4
TEMPERATURE — rectal (°C)	≥41°	39°-40.9°		38.5°-38.9°	36°-38.4°	34°-35.9°	32°-33.9°	30°-31.9°	≤29.9°
MEAN ARTERIAL PRESSURE — mm Hg	≥160	130-159	110-129		70-109		50-69		≤49
HEART RATE (ventricular response)	≥180	140-179	110-139		70-109		55-69	40-54	≤39
RESPIRATORY RATE — (non-ventilated or ventilated)	≥50	35-49		25-34	12-24	10-11	6-9		≤5
OXYGENATION: A-aDO$_2$ or PaO$_2$ (mm Hg) a. FIO$_2$ ≥ 0.5 record A-aDO$_2$	≥500	350-499	200-349		<200				
b. FIO$_2$ < 0.5 record only PaO$_2$					PO$_2$ > 70	PO$_2$ 61-70		PO$_2$ 55-60	PO$_2$ < 55
ARTERIAL pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	< 7.15
SERUM SODIUM (mMol/L)	≥180	160-179	155-159	150-154	130-149		120-129	111-119	≤110
SERUM POTASSIUM (mMol/L)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		< 2.5
SERUM CREATININE (mg/100 ml) (Double point score for **acute** renal failure)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		< 0.6		
HEMATOCRIT (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		< 20
WHITE BLOOD COUNT (total/mm3) (in 1,000s)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
GLASGOW COMA SCORE (GCS): Score = 15 minus actual GCS									
[A] Total ACUTE PHYSIOLOGY SCORE (APS): Sum of the 12 individual variable points									
Serum HCO$_3$ (venous-mMol/L) [Not preferred, use if no ABGs]	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15

[B] AGE POINTS:
Assign points to age as follows:

AGE(yrs)	Points
≤ 44	0
45-54	2
55-64	3
65-74	5
≥ 75	6

[C] CHRONIC HEALTH POINTS
If the patient has a history of **severe** organ system insufficiency or is immuno-compromised assign points as follows:
a. for nonoperative or emergency postoperative patients — 5 points
or
b. for elective postoperative patients — 2 points

DEFINITIONS
Organ insufficiency or immuno-compromised state must have been evident **prior** to this hospital admission and conform to the following criteria:

LIVER: Biopsy proven cirrhosis and documented portal hypertension; episodes of past upper GI bleeding attributed to portal hypertension; or prior episodes of hepatic failure/encephalopathy/coma.

CARDIOVASCULAR: New York Heart Association Class IV.

RESPIRATORY: Chronic restrictive, obstructive, or vascular disease resulting in severe exercise restriction, i.e., unable to climb stairs or perform household duties; or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension (>40mmHg), or respirator dependency.

RENAL: Receiving chronic dialysis.

IMMUNO-COMPROMISED: The patient has received therapy that suppresses resistance to infection, e.g., immuno-suppression, chemotherapy, radiation, long term or recent high dose steroids, or has a disease that is sufficiently advanced to suppress resistance to infection, e.g., leukemia, lymphoma, AIDS.

APACHE II SCORE
Sum of [A] + [B] + [C] :

[A] APS points _____

[B] Age points _____

[C] Chronic Health points _____

Total APACHE II _____

FIG. 1. The APACHE II severity of disease classification system.

Biopsy (if done) –

Number of days of ICU stay-

Number of days of hospital stay-

Complications during stay:

Surgical complications:

- Wound infection: Yes No
- Wound dehiscence Yes No
- Reoperation Yes No
- Intra abdominal collection Yes No
- Anastomotic leak Yes No

Systemic complications:

- Need for dialysis Yes No
- Need for mechanical ventilation 48 hours post surgery Yes No
- GCS of <8 in the absence of anesthetic agent Yes No

Outcome- Death or discharged

Reason for death-

ANNEXURE IV- DATA SHEETS

slno	age	sex	aedate	aetime	dos	dm	htn	comoroth	asascore	hr	sysbp	diabp
1	79	2	########	17.31	4	1	1	1	2	84	110	80
2	58	1	########	17.3	3	2	2	2	1	88	100	60
3	36	2	########	1	3	2	2	2	1	82	110	80
4	56	1	########	9	4	2	2	2	1	100	140	80
5	40	1	########	8.09	1	2	2	2	1	80	100	60
6	60	1	########	14.36	4	2	2	1		130	100	70
7	63	1	########	14.3	4	2	2	1	2	94	100	60
8	43	1	########	14	1	2	2	2	1	92	110	80
9	69	1	########	14.23				1	2	120	140	90
10	50	1	########	21.5	2	2	2	2	1	112	80	40
11	85	1	########	14	3	1	2	2	2	110	80	50
12	41	1	########	13.25	2	2	2	2	1			
13	48	1	########	1.54	3	2	2	2	1	136	100	60
14	27	1	########	6.02	7	2	2	2	1	106	90	60
15	28	2	########	1	1	2	2	2	1	136	70	30
16	62	1	########	22.38	1	2	2	2	1	80	100	60
17	18	1	########	16.47	1	2	2	2	1	140	90	60
18	66	1	########	20.46	1	2	2	2	1	158	110	60
19	61	2	########	22.01	1	2	1	2	2	76	90	50
20	55	2	########	15.45	2	2	1	2	2	90	90	60
21	62	2	########	10.5	1	1	2	2	2	96	130	80
22	23	1	########	18.2	4	2	2	2	1	70	110	70
23	31	1	########	2.42		2	2	2	2	96	100	80
24	62	1	########	15.59	2	2	2	2	1	68	100	60
25	54	1	########	22.4	1	2	2	2	1	102	90	60
26	22	2	########	19.15	3	2	2	2	1	146	100	70
27	40	1	########	14.3	3	2	2	2		130		
28	25	1	########	15.09	1	2	2	2	1	128	130	80
29	70	1	########	23.42	2	2	1	2	2	110	90	60
30	71	1	########	13.25	2	2	2	2	1	106	170	70
31	55	1	########	8	1	2	2	2	1	96	100	60

32	36	1	########	10.5	7	2	2	2	1	140	110	90
33	65	1	########	23.35	1	2	2	1	2	118	100	70
34	45	2	########	8.32	2	2	2	2	1	124	110	70
35	65	1	########	9.25	3	2	2	2	1	144	110	70
36	66	1	########	23.1	2	2	2	2	1	110	120	70
37	75	1	########	16.23	1	2	1	2	2	106	70	40
38	26	2	########	13.55	14	2	2	2	1	140	110	80
39	45	2	########	7	7	2	2	2	1	116	81	50
40	52	1	########	19	1	2	2	2	2	104	100	60
41	55	1	########	16	2	2	2	2	1	88	120	70
42	35	2	########	13.17	1	2	2	2	1	92	90	60
43	52	2	########	13.11	3	2	2	2	1	104	90	60
44	49	2	########	10.45	4	2	2	2	1	160	130	80
45	41	1	########	22.25	2	2	2	2	1	92	100	60
46	61	1	########	7	1	2	2	2	2	120	90	50
47	73	1	########	14.52	2	2	2	2	1	104	120	60
48	55	1	########	11.5	4	2	2	2	1	122	110	80
49	63	1	########	8.34	5	2	2	2	1	150	110	70
50	24	1	########	7.28	3	2	2	2	1	110	70	50
51	47	2	########	15.56	1	2	2	2	1	92	90	60
52	31	1	########	15.1	1	2	2	2	1	100	90	60
53	44	1	########	22.3	1	2	2	2	1	94	110	70
54	23	1	########	13.3	5	2	2	2	2	110	110	70
55	60	1	########	2.29	1	2	2	1	2	100	100	70
56	55	2	########	3.4	2	2	2	2	1	122	90	50
57	20	2	########	16.35	10	2	2	2	1	144	100	90
58												
59	52	1	########	3.3	1	1	2	2	2	100	90	60
60	65	1	########	0.53	1	1	1	2	2	120	200	100
61	45	1	########	14.28	9	2	2	2	1	92	100	70
62	28	1	########	8	2	2	2	2	1	92	110	50
63	41	1	########	9	2	1	2	2	2	88	90	60

64	21	1	########	8.13	3	2	2	2	1	114	100	60
65	53	1	########	11.41	1	1	2	2	2	118	130	60
66	22	1	########	6.19	2	2	2	2	1	106	90	60
67	37	2	########	11.2	4	2	2	2	1	120	90	60
68	24	1	########	0.42	3	2	2	2	1	92	100	60
69	39	2	########	1.5	2	2	2	2	1	142	100	60
70	66	1	########	1.52	1	2	1	2	2	120	90	70
71	37	1	########	0.1	4	2	2	1	2	130	100	60
72	68	1	########	18	1	2	2	2	1	122	100	60
73	41	1	########	1	1	2	1	2	2	120	135	100
74	65	2	########	10.34	3	2	2	2	1	90	100	60
75	21	1	########	18	3	2	2	2	1	106	100	60
76	46	1	########	16	1	2	2	2	1	94	100	60
77	69	1	########	21.36	4	2	2	2	1	110	90	50
78	61	1	########	5.4	4	2	2	2	1	112	100	70
79	55	1	########	17.4	12	2	2	1	2	112	110	70

rr	temperatu	grbs	hb	totalcount	leftshift	creatinine	preopiono	diagcasual	surgdate	surgtime	date	time
26	101.6	187	9	14600	1	0.81		appendicul	########	21	0	3.3
	99	116	13.6	13300	2	0.88	1	obstructio	########	2.3	1	9
20	99.8	12	9.7	82000	2	0.45	2	appendicul	########	2	5	1
20	100	102	11.8	20300	1	1.4		appendicul	########	14	0	5
22	101	122	16.3	13500	1	0.69	2	appendicit	########	12	0	4
24	102	105	14.9	9600	2	0.7		appendicul	########	18	0	3.24
22		132	18.7	13500	1	5.2	1	hollow visc	########	18.3	0	4
80	99	130	13.6	16700	1	0.64	2	duodenal p	########	19	0	5
46		158	13.7	6200	2	1.83	2	hollow visc	########	21	0	7
	100	129	16	8100	2	1.5	1	hollow visc	########	2	1	4.1
26	100	100	14.8	8300	2	1.83		hollow visc	########	21	0	7
36	99.8	68	16	7900	1	4.71	1	hollow visc	########	16.3	0	3.05
34	100	114	12.5	6700	1	1.4	2	hollow visc	########	9	0	7.06
20	100.8	159	16.2	3200	1	1		hollow visc	########	11	0	5
40	99.8	125	13.1	6400	1	0.4	1	hollow visc	########	10	0	9
26	100.8	157	13.2	2600	1	0.89	2	hollow visc	########	2	0	3.22
24	100	105	19.3	9400	1	1.1	2	duodenal p	########	23	0	6.13
46	100.8	230	16.3	11300	1	2.06	2	hollow visc	########	23	0	2.14
20	99	185	8.2	6100	1	2.18	1	hollow visc	########	4		6
20	98.6	105	8.1	22000	1	0.47		peritonitis	########	21	0	5.15
22	100.8	158	11.3	11700	1	1.53	2	hollow visc	########	15	0	4.1
24	100	124	14.9	21900	1	0.93	2	hollow visc	########	0.3	0	6.1
30	100.8	96	14.8	17000	1	1.02		hollow visc	########	14	0	11.18
24	99.8	104	16.9	13800	1	1.01	2	hollow visc	########	0.3		8.3
22	98.4	127	16.4	22000	1	0.94		hollow visc	########	3		4.2
20	98.6	100	11.9	6400	1	0.75		hollow visc	########	1		6.45
30	100.4	90	18.5	3000	1	2.6	1	hollow visc	########	18.3	0	4
16	35.8	96	15	38000	1	1.13			########	9.3	1	18.21
24	100.8	82	14.2	1700	1	1.5	1	hollow visc	########	5	0	5.28
40	98.4	88	9.9	9600	1	1.26	1	hollow visc	########	21	0	7.35
20	100.4	104	8.8	17300	1	0.7	2	hollow visc	########	15	0	7

36	99.8	96	15.1	4300	2	1.24	1	hollow visc	########	16.2	0	5.3
30		163	19.2	2500	1	1.18	2	hollow visc	########	12.15		12.4
20	100.4	109	9.8	17600	1	0.76		appendicul	########	18	0	9.68
20	99	106	18.9	8400	1	1.55	1	appendicul	########	15	0	5.35
24	101.7	95	15	2300	1	1.29	1	hollow visc	########	5		5.5
40	100.4	84	14.5	9100	1	3.15	1	duodenal p	########	23	0	6.37
34	102.8	135	6.6	1100	1	0.66	1	hollow visc	########	1		11.05
26	100.8	124	11.7	18200	1	2.13	1	hollow visc	########	14	0	7
18	102.4	96	9.6	7900	1	6.5	1	hollow visc	########	14		44
24	100.4	104	13.3	10100	1	1.14	2	hollow visc	########	2		10
20	98	93	13.6	6300	1	0.64	2	hollow visc	########		1	11.13
20	101	144	21	7500	1	1.17	2	appendicit	########	0.2		11
36	100.4	89	4.9	20950	1	0.42	1	hollow visc	########	13	0	2.15
20	100.4	140	18.4	5000	1	0.96	2	hollow visc	########	5		6.35
40	100.4	104	18.2	39000	1	1.63	1	hollow visc	########	0.3	3	17.3
20	102.1	133	10.8	25300	1	1.14	2	gb perfora	########	21.5	0	6.58
50	101.1	139	13.7	13000	1	0.79	2	hollow visc	########	18	1	6.1
28	100.4	111	11.8	3400	2	1.06		hollow visc	########	18	0	9.26
20	100.8	96	13.6	15300	1	0.75	2	acute appe	########	21	0	13.32
46	101	114	12.1	9600	1	0.66	2	hollow visc	########	2		10.04
20	101	106	15.6	4900	1	1.17	1	hollow visc	########	22	0	6.5
20	100.8	85	16.1	13600	1	0.98	2	hollow visc	########	3	2	4.3
50	99.6	94	9.9	6800	1	0.87	2	hollow visc	########	22	0	8.3
16	100.3	171	14.5	2900	1	1.1	1	hollow visc	########	18.3	0	16.01
24	99.8	129	9.1	40300	1	0.36	2	hollow viscus perforation				
16	98.2	98	12.8	6400	1	0.74	1	hollow visc	########	21	0	4.25
20	100.4	156	12.7	22900	1	0.87	2	appendicul	########	10	0	6.3
30	98.5	153	16.7	4200	1	1.06	2	hollow visc	########	8	0	7.07
20	100.4	90	12.1	24300	1	0.52	2	hollow visc	########	21	0	6.32
22	100.4	96	16.4	11800	1	1.01	2	hollow visc	########	14	0	6
20	98.4	100	14	12700	2	0.85	2	hollow visc	########	15	0	6

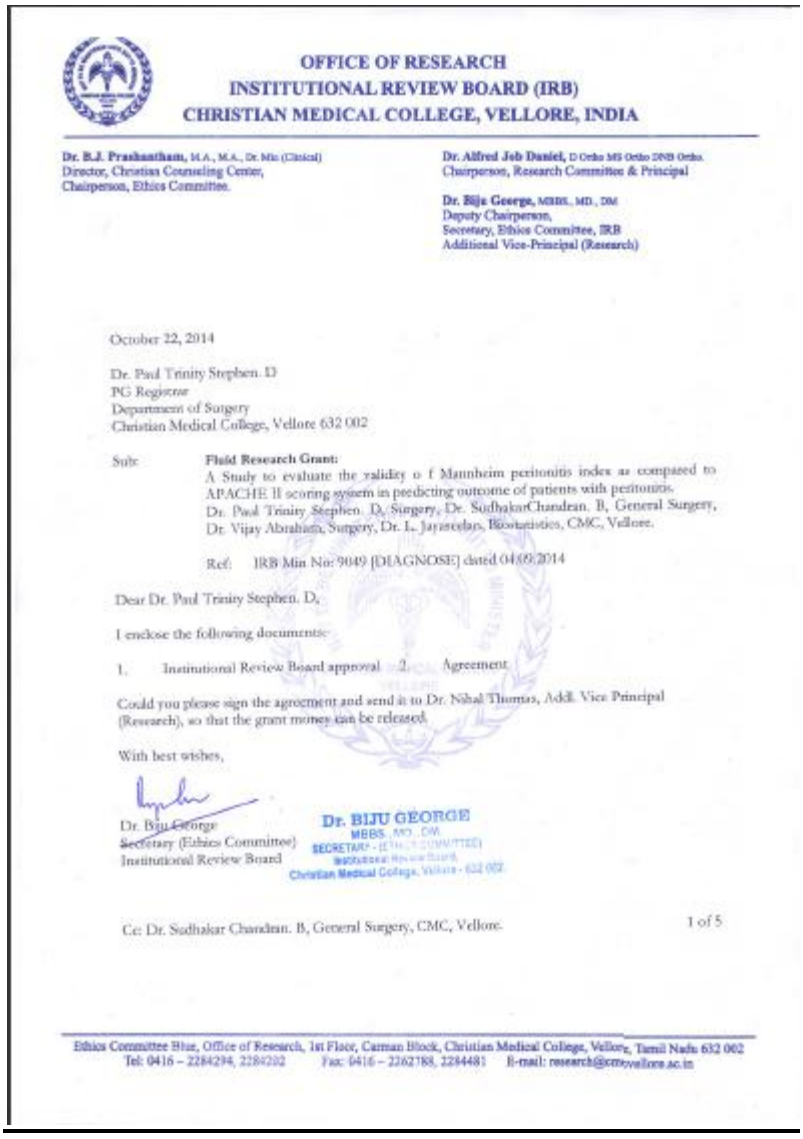
24	99.8		18	13800	1	1.03	2	peritonitis	########	10.1	0	1.57
20	98.2	226	15.8	13000	1	1.76	2	acute panc	########	8	2	
36	97.6	114	16	3000	1	0.79	2	hollow visc	########	7	1	0.41
24	98.4	121	11.2	14800	1	0.6	2	acute appe	########		1	
20	99.2	150	14.9	13	1	1.17	2	hollow visc	########	10	0	9.18
28	100.4	189	10.5	8700	1	0.83	2	appendicul	########	2	3	0.1
36	99.4	110	18.2	7300	1	2.19	2	hollow visc	########	10	0	8.08
22	101.1	140	6.3	4800	2	0.53		perforated	########	18	0	17.5
26	99.4	128	14	8120	1	1.04	2	hollow visc	########	11		17
20		117	9.4	3700	1	0.93	2	hollow visc	########	10.3	0	9.3
24	98	145	12.3	2800	1	3.02	2	hollow visc	########	21	1	10.26
20	100	85	15	11100	1	1.12	2	acute appe	########	15	1	3
			9.6	9700	1	0.89	1	anastomot	########	3.45		11.45
20	37.1	89	12	14300	1	1.69		peritonitis	########	9.3		12
22		110	14.9	11700		0.91	2	hollow visc	########	10	1	4.2
30		109	15.1	5800	2	0.84	2	hollow visc	########	23	0	5.2

postopdiag	sop	mpiscore	apachesco	biopsy	icustay	hosstay	woundinfe	wounddeh	reoperat	intrabdom	anasto	dialysis	
appendicul	appendix	24	13	acute appe	4	6	1	2	2	2	2	2	
		32	6	transmural	2	3	2	2	2	2	2	2	
ileal gangr	ileal	27	3	acute appendicitis		13	2	2	2	2	2	2	
small bowe	small bowe	26	9	transmural	6	19	2	2	2	2	2	2	
appendicul	appendix	10	0	acute appendicitis		5	2	2	2	2	2	2	
ileal perfor	ileum	32	8		2	7	2	2	2	2	2	2	
duodenal p	duodenal	32	10		13	14	2	2	2	2	2	1	
duodenal p	duodenal	16	1			7	2	2	2	2	2	2	
gastric per	stomach	36	12	acute inflammation		8	2	2	2	2	2	2	
pre - pylori	stomach	32	12		10	12	1	1	2	2	2	2	
duodenal p	duodenal	32	13		1	1	2	2	2	2	2	2	
duodenal p	duodenum	27	17		3	11	2	2	2	2	2	2	
pre - pylori	stomach		11			15	1	2	2	1	2	2	
appendicul	appendix	20	0	necrotic ti	3	10	2	2	2	1	2	2	
pre pyloric	stomach	32	9		0	20	2	2	2	2	2	2	
duodenal p	duodenum	28	5		4	9	1	2	2	2	2	2	
duodenal p		23	3			6	2	2	2	2	2	2	
duodenal p	duodenum	28	18		4	4	2	2	2	2	2	1	
gastric per	stomach	37	6	acute infla	7	11	2	2	2	2	2	2	
sigmoid pe	sigmoid co	43	7	adenocarci	3	6	2	2	2	2	2	2	
ileal perfor	ileum	26	3	inflammation		15	2	2	2	2	2	2	
duodenal p	duodenum	20	0			3	2	2	2	2	2	2	
appendicul	appendix	20	0	acute appe	2	6	2	2	2	2	2	2	
duodenal p	deodenum	25	3		5	11	2	2	2	2	2	2	
pre pyloric	stomach	21	3			10	2	2	2	2	2	2	
duodenal p	duodenum	32	4		0	5	2	2	2	1	2	2	
duodenal p	duodenum	27	10			15	1	2	2	1	2	2	
perforatior		27	3			10	2	2	2	2	2	2	
duodenal p	duodenum	32	17			17	2	2	2	1	2	2	
pre pyloric	stomach	32	12	necrosis		7	2	2	2	2	2	2	
duodenal p	duodenum	21	6			15	1	2	2	1	1	2	

appendicul	appendix	27	9	necrosis	5	11	2	2	2	2	2	2
duodenal	duodenum	21	15		10	17	1	2	2	2	2	2
appendicul	appendix	32	5	acute appe	2	7	2	2	2	2	2	2
gallbladder	gallbladde	32	12		4	7	2	2	2	2	2	2
duodenal	duodenum	32	8			12	1	2	2	2	2	2
rectosigmo	colon	34	8		3	7	2	2	2	2	2	2
ileal perfor	ileum	32	11		8	17	2	2	2	2	2	2
appendicul	appendix	37	10		7	10	2	2	2	1	2	2
rectosigmo	colon	34	10	foreign bo	6	8	2	2	2	2	2	1
duodenal	duodenum	25	4			8	2	2	2	2	2	2
duodenal	duodenum	21	1			8	2	2	2	2	2	2
appendicul	appendix	37	2	acute appendicitis		7	2	2	2	2	2	2
sigmoid pe	colon	38	14		2	2	2	2	2	2	2	2
prepyloric	stomach	20	2		4	12	1	2	2	2	2	2
ileal perfor	ileum	38	7		3	6	2	2	2	2	2	2
gallbladder	gallbladder		10	cholecystit	3	7	2	2	2	2	2	2
prepyloric	stomach	32	8	inflammation		6	2	2	2	2	2	2
small bowe	samll bowe	32	9	transmural	8	13	2	2	2	2	2	2
appendicul	appendix	21	5	acute appendicitis		5	2	2	2	2	2	2
prepyloric	stomach	28	8		5	11	2	2	2	2	2	2
prepyloric	stomach	23	2	scanty fibr	2	10	2	2	2	1	2	2
duodenal	duodenum	23	0			8	2	2	2	2	2	2
ileal perfor	ileun	27	14	inflammat	4	10	2	2	2	2	2	2
ileal perfor	ileun	34	11	tb	11	18	2	2	2	1	2	2
ileal perfor	ileum	33	10		7	72	2	2	2	2	2	2
ileal perfor	ileum	32	3	transmural	13	17	2	2	1	1	2	2
appendicul	appendix	28				7	2	2	2	2	2	2
gastric per	stomach	28	10	chronic ulc	5	7	2	2	2	2	2	2
appendicul	appendix	20	6		3	8	2	2	2	2	2	2
pre pyloric	stomach	20	0			5	2	2	2	2	2	2
ascending	colon	18	0	transmural necrosis		7	2	2	2	2	2	2

duodenal	duodenum	20	6			5	2	2	2	2	2	2
perforated	appendix	26	9	appendicetomy sepei		10	1	2	2	2	2	2
duodenal	duodenum	32	4			9	1	2	2	2	2	2
ileal perfor	ileum	26	0	ileum submucosal ede		8	2	2	2	2	2	2
sealed duo	duodenum	27	0			7	2	2	2	2	2	2
appendicul	appendix	22	0	acute appe	0	8	2	2	2	2	2	2
pre pyloric	stomach	26	19		3	13	2	2	2	2	2	2
distal ileal	ileum	27	8	evidence o	2	12	2	2	2	2	2	2
pre pyloric	stomach	32	8	pre pyloric perforatio		7	1	1	2	2	2	2
jejunal per	jejunal	26	5	high grade nhl		25	1	2	2	2	2	2
duodenal	duodenum	37	12		8	8	2	2	2	2	2	1
perforated	appendix	27	0	acute appendicits with		5	2	2	2	2	2	2
anastomot		20	1	inflammat	12	60	1	1	2	1	2	2
ileal perfor	ileum	32	10	tuberculosis		9	1	1	1	2	2	2
duodenal	duodenum	25	9			25	2	1	1	2	2	2
dudodenal	duodenum	28	14		8	9	1	2	2	2	2	2

ANNEXURE V- INSTITUTIONAL RESEARCH BOARD APPROVAL



OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

October 22, 2014

Dr. Paul Trinity Stephen. D
PG Registrar
Department of Surgery
Christian Medical College, Vellore 632 002

Sub: **Fluid Research Grant:**
A Study to evaluate the validity o f Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis.
Dr. Paul Trinity Stephen. D, Surgery, Dr. SudhakarChandran. B, General Surgery, Dr. Vijay Abraham, Surgery, Dr. L. Jayaseelan, Biostatistics, CMC, Vellore.

Ref: IRB Min No: 9049 [DIAGNOSE] dated 04.09.2014

Dear Dr. Paul Trinity Stephen. D,

I enclose the following documents:

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Nihal Thomas, Addl. Vice Principal (Research), so that the grant monies can be released.

With best wishes,

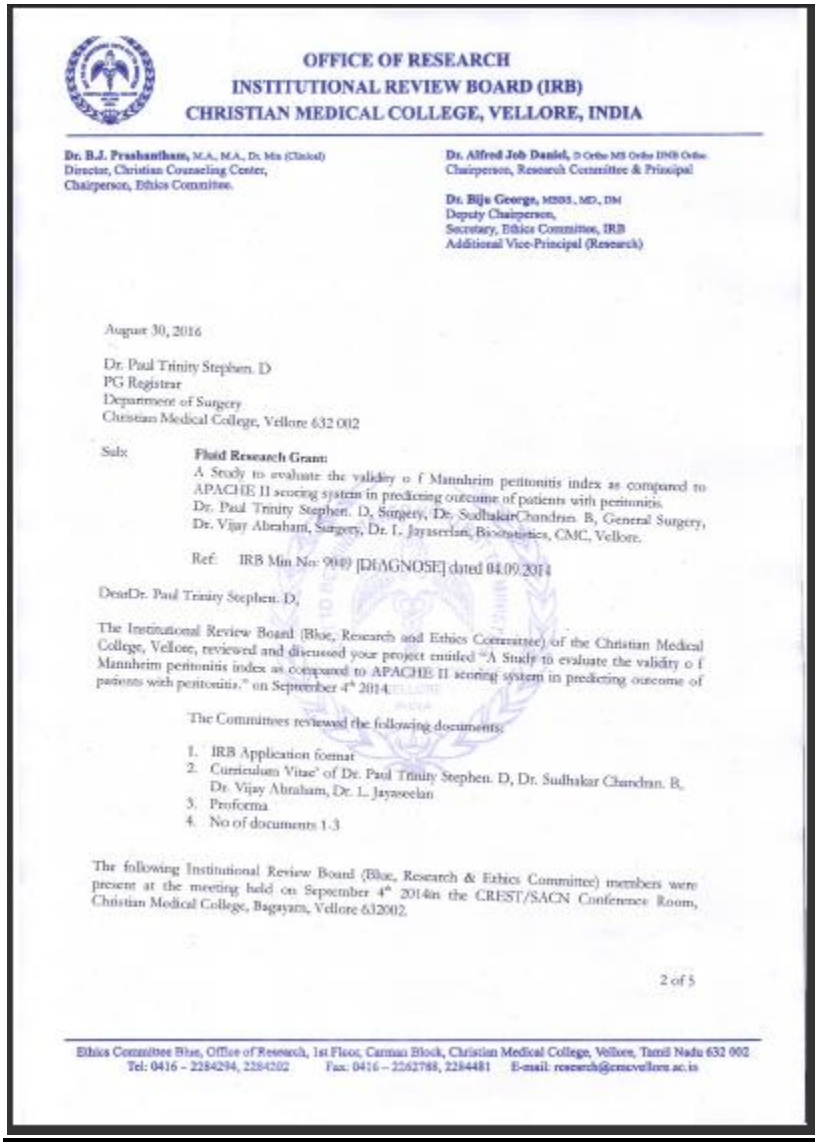
Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS., MD., DM.
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board
Christian Medical College, Vellore - 632 002

Cc: Dr. Sudhakar Chandran. B, General Surgery, CMC, Vellore.

1 of 5

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in



OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Alfred Job Daniel, D Ortho MS Ortho DNB Ortho
Chairperson, Research Committee & Principal

Dr. Biju George, MSOS., MD., DM
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

August 30, 2016

Dr. Paul Trinity Stephen. D
PG Registrar
Department of Surgery
Christian Medical College, Vellore 632 002

Sub: **Fluid Research Grant:**
A Study to evaluate the validity o f Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis.
Dr. Paul Trinity Stephen. D, Surgery, Dr. SudhakarChandran. B, General Surgery, Dr. Vijay Abraham, Surgery, Dr. L. Jayaseelan, Biostatistics, CMC, Vellore.

Ref: IRB Min No: 9049 [DIAGNOSE] dated 04.09.2014

DearDr. Paul Trinity Stephen. D,

The Institutional Review Board (Bloc, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "A Study to evaluate the validity o f Mannheim peritonitis index as compared to APACHE II scoring system in predicting outcome of patients with peritonitis." on September 4th 2014.

The Committees reviewed the following documents:

1. IRB Application format
2. Curriculum Vitae' of Dr. Paul Trinity Stephen. D, Dr. Sudhakar Chandran. B, Dr. Vijay Abraham, Dr. L. Jayaseelan
3. Proforma
4. No of documents 1-3

The following Institutional Review Board (Bloc, Research & Ethics Committee) members were present at the meeting held on September 4th 2014in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

Ethics Committee Bloc, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax. 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

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Chairperson, Research Committee & Principal

Dr. Biju George, MBBS., MD., DM
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

Fund Grant Allocation:

A sum of 28,500/- INR (Twenty Eight Thousand Five Hundred only) will be granted for 2 years.

Yours sincerely

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS, MD, DM
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board
Christian Medical College, Vellore - 632 002.

Cc: Dr. Sudhakar Chandran. B, General Surgery, CMC, Vellore.

IRB Min No: 9049 [DIAGNOSE] dated 04.09.2014

5 of 5

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