# Evaluation of Mannheim's Peritoneal index score (MPI) for predicting mortality in patients with peritonitis.

Syed Ali Haider Rizvi[1], Raheel Ahmed [2,*] Erum Kazim[3], Rabia Feroz[4], Aisha Siddiqua[5], Asma Amin[6].

## Abstract:

**Introduction:** Despite latest development the diagnosis and prognosis of acute intraperitoneal infection is still offer a challenge. Different scoring algorithms have been formulated to grade the severity and decision making.

**Objective:** To document reliability of Mannheim Peritonitis Index as a criterion for prediction of mortality after acute intraperitoneal infection

**Methodology:** This cross-sectional study was conducted at department of Surgery; Civil Hospital Karachi/Dow University of Health Sciences during December 2019 to June 2020. Total 200 patients aged 16 to 55 years from either gender, presenting with peritonitis were enrolled. Patients were evaluated using Mannheim Peritonitis I ndex (MPI) score for mortality taking real mortality within 7 days as gold standard.

**Results:** The mean age was 37.3 ±9 years with male (71%) dominance, while mean MPI score was 27.12 ±7.1. The sensitivity was 91.8 %, specificity was 84.4 %, while positive predictive and negative predictive values and diagnostic accuracy values were 87.8 %, 89.4 % and 93% respectively.

**Conclusion:** Several scoring systems are utilized to evaluate and stratify patients in overcrowded emergency department which is crucially important for selection of patients who need early clinical decisions. MPI scoring index is the specific and simply accessible in such condition to predict the mortality.

**Keywords:** Mannheim Peritonitis Index, acute intraperitoneal infection, In-hospital mortality, Diagnostic accuracy.

## Introduction:

Peritonitis following hollow viscus perforation is potentially life threatening emergency associated with a poor prognosis unless strict surgical principles or intervention is not implemented.1 The consequences of such abdominal sepsis involve the complicated interaction of multiple factors including patient and disease related, and better obtained with the prompt appropriate antibiotics administration and early decisive and specific therapeutic procedures.2,3 Several other factors also account for the final outcome including actual severity recognition of the condition, diagnostic accuracy and standard classification of the risks involving the intervention.4,5 Despite the advancement in surgical care, sophisticated monitoring in intensive care units, novel class of broad spectrum antimicrobial therapy and a broad knowledge of pathophysiology involving the peritonitis, the hospital mortality ratio is still high, ranging from 10-20% despite managed in high volume centres.6

Hollow viscous perforation may result from wide range of disease processes. However, there are four most common mechanism which can lead to perforation including ischaemia (e.g. intestinal obstruction or necrosis), infection (e.g. acute appendicitis, tuberculosis or diverticulitis), erosion (e.g. neoplasia or ulcers) and physical trauma or iatrogenic insult leading to bowel perforation. Regardless of the cause, intestinal perforation leads spillage of its luminal contents into the cavity which may include several pathologic microorganisms and proteolytic enzymes that interact extensively with peritoneal surface resulting into enzymatic digestion, necrosis and considerable shifting of electrolytes and proteins of blood inside the peritoneal cavity. It follows an inflammatory exudate formation comprised of granulocytes which may spread generalized or localise to the formation of an abscess. The systemic response evoked by this includes paralysis of bowel motility, haemoconcentration, significant alteration in circulatory system due to

*1: Associate Consultant General Surgery, Civil Hospital Karachi.*
*2: Consultant General Surgery, Surgical Unit-1, Civil Hospital Karachi*
*3: Assistant Professor General Surgery. Surgical Unit4, DUHS/Civil Hospital Karachi*
*4: Assistant Professor, Surgical Unit 4, Civil Hospital Karachi*
*5: Senior Registrar, Surgical Unit-5. DUHS / Civil Hospital Karachi*
*6: Consultant, General Surgeryasmaamin91@gmail.com*
***=corresponding author:***
*Email:* draheelahmed@gmail.com

shift of intravascular volume and metabolic acidosis, impaired respiratory drive with generalized hypoxia. The other sequelae to this may include decreased renal perfusion with progressive azotaemia and acute tubular necrosis, weight loss due to decreased diet intake and excessive protein catabolism, impaired thermoregulatory mechanism resulting into decreased core body temperature and other irreversible adverse changes which can cause death if not treated timely and efficiently.7,8

However patients with poor prognostic factors including delayed or even missed diagnosis, advanced age, comorbidities, malignancy or advanced disease may deteriorate rapidly and develop septic shock and organ failure.

The standard treatment of peritonitis involves timely surgical intervention and extensive abdominal cavity lavage to reduce bacterial inoculum and control infection with appropriate antimicrobial therapy. The choice of surgical intervention is dependent on multiple factors including the cause of infection, degree of contamination, severity of sepsis and existing comorbidities of patient. 9. Multicentre studies have reported the mortality rate of peritonitis between 19.5% - 60% even in well-equipped hospitals10-14 Several scoring systems have been postulated in severe and critically ill patients to predict the outcome including Acute Physiology and Chronic Health Evaluation II (APACHE II), Sepsis Severity Score (SSS), Glasgow-Imrie Score, Simplified Acute Physiology Score (SAPS), Ransons criteria, Mannheim's Peritoneal index score (MPI). The scoring systems help to improve proper allocation of scarce healthcare resources. The Mannheim's Peritoneal index score (MPI) was formulated more than three decades back by Wacha and Linder and then extensively elaborated in emergency and found to have prognostic relevance.15 The Mannheim's Peritoneal index score (MPI) is dynamic model and can predict the outcome independently of other factors, with the score above 26 associated with increased mortality rate. Increased scores can therefore necessitate admission and management and be applied frequently in patients with peritonitis.15,16

To select high risk patients for critical care management it is imperative to have initial prognostic evaluation of patients. For the purpose most authentic and reliable tools should be used to classify prognosis and sepsis severity and evaluate surgical intervention risk.

## Objective:

This study was conducted to calculate Mannheim's Peritoneal index score (MPI) for predicting the ultimate outcome in our patients treated for peritonitis.

## Methodology:

This cross-sectional study was conducted at Dr. Ruth K.M Pfau Civil Hospital Karachi/Dow University of Health Sciences in department of Surgery Karachi from December 2019 to June 2020 and included 200 patients. Consecutive non probability type of sampling technique was carried out. Patients who met the criteria consistent with peritonitis after hollow organ perforation was included while patients with blunt or penetrating abdominal trauma, previous abdominal surgery, deranged coagulation profile, history of chemo-radiation and referral for reassessment were excluded. Informed consent was from taken after explaining the purpose of study and approval was taken from hospital ethical committee. Demographic detail (including name, age and gender) were noted. All patients were subjected to detailed history of peritonitis including duration as per operational definition. Patient optimisation was achieved by good hydration and prophylactic antibiotics. After initial preoperative work up, nasogastric decompression was done in all patients. Site of intestinal perforation was identified during surgery and managed accordingly with appropriate surgical intervention.

All surgeries were performed by trainee surgeon under direct supervision of consultant surgeons. After surgery patients were shifted to post-surgical wards and followed-up for 7 days during hospital stay. Blood samples were obtained from all patients after venepuncture within the first 24 hours of exploratory laparotomy and laboratory values used to label organ failure including urea, creatinine, electrolytes urinary creatinine excretion (UCE) and ABGs. The MPI was applied for final outcome (mortality) during hospital stay. All the information was recorded on predesigned proforma. The statistical analysis of data was made using SPSS windows package version 24. Descriptive analysis and categorical variables were analysed as frequencies and percentages. Mean value and standard deviation was measured for quantitative variables including age, MPI score, duration of symptoms. Cross tabulations were constructed for calculating sensitivity, specificity, positive and negative predictive values and accuracy of Mannheim's Peritoneal index score (MPI) to predict the mortality taking actual mortality within 7 days as gold standard.

## Results:

The Mannheim’s Peritoneal Index is shown in table no:1.

**Table No 1: Mannheim's Peritoneal index score (MPI)**

| Risk factor | Weighting if present |
|---|---|
| Age > 50 years | 5 |
| Female Sex | 5 |
| Organ Failure | 7 |
| Malignancy | 4 |
| Origin of Sepsis not colonic | 4 |
| Diffuse generalized peritonitis | 6 |
| Pre-op duration of peritonitis >24h | 4 |
| Intra peritoneal exudate | |
| i-Clear | 0 |
| ii-Cloudy and purulent | 6 |
| iii-Fecal | 12 |

**Table No 2: MPI score and Cross tabulation**

| | | Morality | | Total |
|---|---|---|---|---|
| | | Yes | No | |
| MPI Severity | Yes | 101 | 14 | 115 |
| | No | 9 | 76 | 85 |
| Total | | 110 | 90 | 200 |
| *Sensitivity 91.8%,*<br>*Specificity 84.4%,*<br>*Positive Predictive value 87.8%,*<br>*Negative Predictive value 89.4%,*<br>*Diagnostic Accuracy 93.0 %* | | | | |

**Table No 2: Organ Failure**

| organ | Criteria |
|---|---|
| Kidney<br>i-Creatinine level<br>ii-Ureal Level<br>iii-Oliguria | <br>≥177 µmol/L (≥2.3 mg/dl)<br>≥167 mmol/L (≥467.7 mg/dl)<br><20 ml/h |
| Lung<br>$PaO_2$<br>$PaCO_2$ | <br>< 50 mmHg<br>> 50 mmHg |
| Shock | Hypodynamic or Hyperdynamic |
| Intestinal Obstruction (Profound) | With Paralytic Ileus >24 h, Complete (Mechanical) |

For current study mean age of patients was 37.3 ± 9; with a range of 16 to 55 years.

There were 71 % male and 29 % females. Duration of symptoms found very much wide, as low as 8 hours to as high as 48 hours with a mean duration of 23.5 ± 6.3 hours. The results of cross tabulation are shown in table no 2. The sensitivity of MPI was found to be 91.8 % and specificity was 84.4%. Positive and Negative predictive values of MPI was found to be 87.8 % and 89.4% respectively. Overall diagnostic accuracy of MPI was found to be 93 %. The most common cause of the death was multiple organ failure (table no 3).

## Discussion:

Acute peritonitis secondary to intestinal perforation is still the most commonly attended emergency department priority to be attended by the surgeons worldwide. The various factors which may significantly influence the ultimate outcome include advanced age, single or multiple organ failure, H. Pylori resistance, chronic use of non-steroidal anti-inflammatory drugs, drug resistant enteric fever, extent and duration of peritonitis, site and number of perforations and timely surgical interventions. Despite recent innovations in antibiotics therapy and post-operative critical care, the efforts to reduce the mortality of patients diagnosed with acute peritonitis remain a challenge for health care providers. The surgical intervention in such sick patients and the evaluation of different damage control therapeutic procedures are unfortunately delayed due to imprecise identification and categorization. There is need to consider a scoring system which can quickly evaluate the need and quality of the intensive care required for different types of patients. Different scoring systems are currently in practice which can stratify such sick patients with peritonitis secondary to intestinal perforation and thereby help the clinicians to identify high risk patients and decision to choose between extensive and expensive peri-operative care without waste or the concept of less is more where such efforts may be futile.17 The Mannheim peritonitis index is the simple and specific method that yields a reliable evaluation of patients with peritonitis and predicting their morbidity and mortality.18 In our study we have determined sensitivity, specificity and diagnostic accuracy of MPI score and had found promising and comparable results like other international studies.

M Nachiappan et al conducted study on 100 patients, where 77 % were male and 23% were female. Study had concluded Mean MPI score, sensitivity, specificity, diagnostic accuracy, positive and negative predictive value as 24.5, 80%, 83 %, 82.8 %, 46 % and 96 % respectively. 19 The nearly all findings of study by M Nachiappan et al were in agreement to the current study except positive predictive value (47%) which is in sharp contrast to the current study (87.8%) as this difference may be attributed to larger sample size of current study.

Sharma conducted study on 47 patients with peritonitis. There were 38 male patients and 09 female and found that for a MPI score of 27, the sensitivity, specificity, positive predictive value and accuracy was calculated as 66.67%, 100%,100% and 94% respectively. In this study the specificity was higher and sensitivity was lower as compared to our which can be due to increased MPI score. In our study we used 25 as cut off value while Sanjeev Sharma used 27 which had increased its specificity.1

Muralidhar VA et al showed sensitivity and specificity of 72.09% and71.43% respectively using MPI cut off value as 25 on 50 patients presented with peritonitis.16 Correia conducted similar study in patients diagnosed with peritonitis secondary to malignancy related causes and found MPI score in range of 5 to 47 with the mean as 26.6, with a sensitivity and specificity of 87.3% and 41.2% respectively. The best accuracy in such patients with malignancy of was obtained at MPI score of 21. In his study it was concluded that MPI was a reliable predictor of death in patients diagnosed with peritonitis secondary to intra-abdominal malignancy and can be helpful in planning and evaluating future treatments.20 In this study the sensitivity and specificity was lower as compared to our study and it can be due to population difference and sample size. In another study21 similar cut off point was used as our study, for a threshold index score of 26, the sensitivity and specificity was 86% and 74% respectively while diagnostic accuracy of 83% was achieved.

## Conclusion:

Among several algorithms MPI score is straightforward and reliable to calculate and predict worse outcome in patients treated for acute peritonitis. It is essential that patients with high scores must be triaged and monitored closely to support vital systems and maximize the need of early surgical intervention and ICU benefit in selected patients.

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