

## Retrospective study of Mannheim peritonitis Index in predicting the outcome in patients presenting with secondary acute peritonitis.

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### ABSTRACT

**Background:** Despite advances in diagnosis, management and critical care of patients with peritonitis due to hollow viscus perforation, prognosis remains poor. Early assessment by scoring systems will influence the management and prognosis.

**Aim :** To predict the prognosis and outcome of peritonitis due to hollow viscus perforation using Mannheim peritonitis index (MPI) scoring system.

**Material and methods:** Retrospective study in patients who presented to emergency with perforation peritonitis. Patients of age >15 years patients with hollow viscus perforation anywhere in the gastrointestinal tract from stomach to rectum and on whom surgical intervention is performed.

**Results:** The study's most prevalent age group is >55 years old, with 62.5%. Males exceed females by a ratio of 2.7:1 with males being more numerous. The two most typical symptoms are pain and vomiting. If peritonitis is detected within 24 hours, more

individuals will survive. With an increase in MPI score, hospital stays increase. The most frequent site of perforation with a significant death rate is the gastroduodenum. In the current study, mortality increases as the MPI score rises. In the current investigation, Graham's omental patch surgical intervention was approached with 47.9%. In the current study, wound surgical site infection is the most frequent complication. **Conclusions:** MPI is an effective tool for prediction of mortality in cases of perforation peritonitis.

**Keywords:** perforation peritonitis, Mannheim peritonitis index , Graham's omental patch.

## INTRODUCTION

Inflammation of the peritoneum and peritoneal cavity is defined as peritonitis. It is usually due to a localised or generalised infection. It can be primary or secondary. Primary peritonitis occurs by contamination of peritoneum by bacterial, fungal, chlamydial, mycobacterial infection in the absence of hollow viscus perforation or inflammation related to gastrointestinal (GIT) or genitourinary tracts (GUT). It may be due to distant source of infection or haematogenous spread. Secondary peritonitis occurs due to perforation or inflammation of GIT or GUT. Intraperitoneal source is a common cause for secondary peritonitis which is usually due to perforation from hollow viscera with other common causes being colonic diverticulitis, acute appendicitis, pelvic inflammatory disease (PID).<sup>1</sup> Secondary peritonitis is a common surgical emergency which is associated with high morbidity and mortality which significantly increases with age.<sup>2</sup> Many factors were implicated in prognosis and outcome of perforation peritonitis. The outcome i.e., mortality, morbidity, uneventful discharge of the peritonitis of the patients not solely depends on the surgeon skills. It also depends upon the physical status of the patient, disease, nature of the operation, pre - operative and post operative care.<sup>3</sup> In spite of advances in diagnosis, treatment, critical care management, perforation peritonitis prognosis is still poor. Several scoring systems are there to predict the outcome of peritonitis. These scoring systems can be categorized into two groups. Disease (peritonitis) specific scoring systems – ‘Mannheim peritonitis index (MPI)’, the Peritonitis Index Altona (PIA)<sup>4</sup>. Disease independent nonspecific scoring systems are used to assess the critical care patients; -APACHE II, the sepsis score, the physiological and operative severity score for enumeration of mortality and morbidity (POSSUM)<sup>5,6,7</sup>.

Among the all-scoring systems Mannheim peritonitis index is disease specific, simple, effective and easy to predict the prognosis of perforation peritonitis<sup>8</sup>. There are no published Indian studies to assess the validity of this system.

Mannheim's scoring system was introduced by Wacha and Linder in 1983, based on the retrospective study of 1253 patients between 1963-1979. Initially Wacha developed 17 possible risk factors, 8 out of these were of prognostic relevance.<sup>9</sup>

To evaluate the reliability and predictive power of MPI, Billing et al conducted a study of 2003 patients of peritonitis caused by appendicitis, mesenteric ischemia and pancreatitis from 7 different centres in three European countries and their data compared.<sup>10</sup>

Based on MPI score Fugger et al divided the patients in 3 groups. The total score is 47, if the score is <21 had a minimal risk, score of 21-29 had an intermediate risk and score >29 had a high risk of morbidity and mortality.<sup>11</sup>

This study is to evaluate the prognosis of the peritonitis secondary to hollow viscus perforation using MPI.

Variables that are used to calculate the score of MPI .<sup>11</sup>

<i>Variable</i>	<i>Score</i>
Age >50 years	5
Female sex	5
Organ failure*	7
Malignancy	4
Preoperative duration of peritonitis >24 hours	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
<b>Exudate</b>	
Clear	0
Cloudy, purulent	6
Faecal	12
<b>Total</b>	

Organ failure\* means critical values- Renal failure as serum creatinine >2 mg/dl (177umol/l), urea >46.78mg/dl (167mmol/l), oliguria <20ml/hr; Lung failure as partial pressure of oxygen (Po<sub>2</sub>) <50mmHg or partial pressure of carbon dioxide (Pco<sub>2</sub>) >50mmHg; Shock as systolic blood pressure (SBP) <90mmHg or decrease of > 40 mmHg from normal range. Intestinal obstruction / paralytic ileus >24 hours.

## **MATERIALS AND METHODS**

**Study design:** Retrospective study

**Place of study:** General surgery department, SVIMS-SPMCW, Tirupati.

**Sample size:** Patients who presented to emergency with perforation peritonitis and got admitted in Department of general surgery are included in the study.

**Study period:** August 2021- September 2022

**Inclusion criteria:** Age >15 years patients with hollow viscus perforation anywhere in the gastrointestinal tract from stomach to rectum and on whom surgical intervention is performed.

1. Age >15 years.

**Exclusion criteria:** Perforation due to trauma or any associated any other abdominal organ injuries.

**Regulatory clearances:** The study is conducted after approval from Institutional Ethics Committee (IEC), SVIMS-SPMCW.

### Method of study:

All patients admitted with clinical suspicion of perforation peritonitis in the department of general surgery SVIMS-SPMCW, Tirupati in a period of 13 months from August 2021 to September 2022 were included into this study. Ethical clearance approval was taken from Institutional Ethics Committee (IEC), SVIMS-SPMCW. Consent was taken from chiefs of all units of general surgery department to include their cases into this study. All the required data of this study was taken from the medical records department of the SVIMS-SPMCW hospital. preoperatively like age, sex, co-morbidities, presenting complaints with duration, general condition of the patient, vitals at the time of presentation, resuscitative measures, per abdomen examination findings of peritonitis, relevant blood and radiological investigations (erect x-ray abdomen, USG, CT scan) reports, intraoperatively site size, number of perforations, nature and amount of exudates, mode of surgery were included. Post operative data like ICU care, biopsy and fluid culture and sensitivity reports, antibiotics for sepsis control, any complications, duration of the hospital stay, final outcome of the patient were included. The type of surgical procedure depends on the disease pathology and general condition of the patient. Surgical procedure, includes primary closure of perforation, graham's patch closure, appendectomy, resection and anastomosis and proximal diverting stomas. Adequate post operative care was given. Patients were followed and evaluated their outcome, like any complications, discharge, or death. All the required data was collected from medical records and transformed to a excel sheet and individual scores of each patient was calculated and predicted the morbidity, mortality of the peritonitis patients.

### STATISTICAL ANALYSIS

**Statistical Analysis**  
All data was double checked to exclude any clerical errors. Data was recorded on a predesigned proforma and managed using Microsoft Excel worksheet (Microsoft Corp, Redmond, WA). Descriptive statistics for categorical variables was performed by computing the frequencies (percentages) in each category. For the quantitative variables, approximate normality of distribution was assessed. Variables following normal distribution were summarized by mean  $\pm$  standard deviation; the remaining variables were summarized as median [interquartile range (IQR)].

### RESULTS:

**Table-1: Age and gender distribution in present study**

Age in years	Number	Percentage
15-24	4	8.3
25-34	4	8.3
35-44	4	8.3
45-54	6	12.6
>55	30	62.5
Male	35	72.9

Female	13	27.1
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Most common age group in study is >55 years with 62.5% . Males are more in number in compared to females with male : female of 2.7:1

**Table-2: Distribution of symptoms**

Symptoms	Yes	No
Pain	41	7
Vomiting	34	14
Fever	30	18
Anorexia	27	21
Constipation	9	39
Abdominal distension	6	42

Pain and vomiting is most common symptom in present study

**Table-3: Duration of peritonitis**

Duration of peritonitis	Deceased (%)	Survived (%)
< 24 hours	3(6.25%)	23(47.9%)
>24 hours	9(18.75%)	13(27.1%)

### stay in hospital according to MPI score

Duration	Number of patients with MPI score		
	<21	21-29	>29
Less than 1 week	7(14.5%)	7(14.5%)	5(10.4%)
1-2 weeks	9(18.75%)	8(16.7%)	7(14.5%)
2-3 weeks	1(2.1%)	2(4.2%)	2(4.2%)
Total	17(35.4%)	17(35.4%)	14(29.2%)

Hospital stay is increased with increase in MPI score.

### -5: Site of perforation vs MPI score vs mortality

Site of perforation	Number of patients	Percentage	Number of deaths	Mortality %
Gastroduodenal	23	47.9	5	10.4
Small bowel	8	16.7	3	6.25
Appendix	15	31.3	2	4.2
Large bowel	2	4.2	2	4.2
Total	48	100%	12	25%

Gastroduodenal is most common site of perforation with high mortality.

**Table-6: MPI score and mortality**

MPI score	Number of patients	Percentage	Mortality	Mortality percentage
< 21	19	39.6	1	2.1
21-29	24	50	4	8.3
>29	5	10.4	7	14.6

In present study as MPI score is increasing mortality is increased.

**Table-7: Surgical Intervention approach in present study**

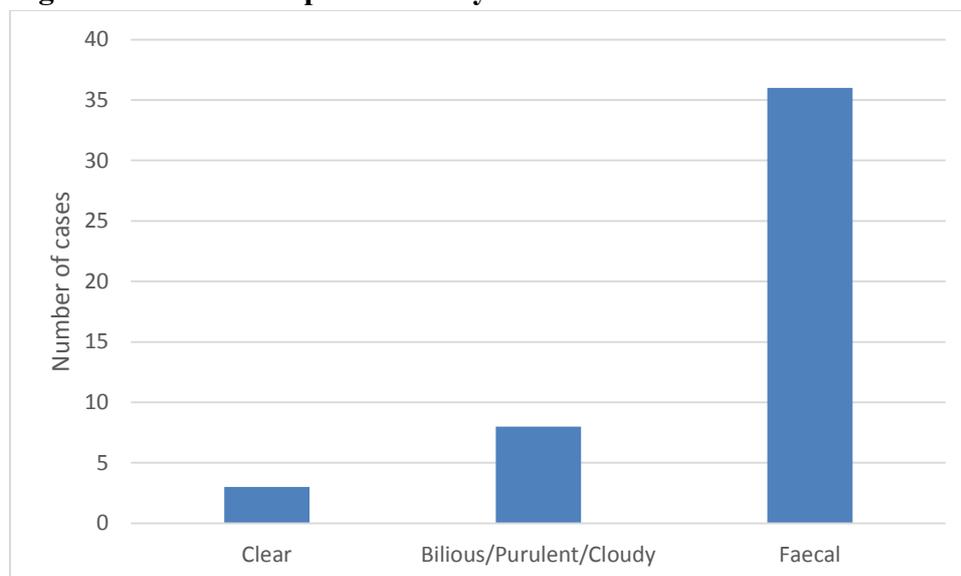
Surgery underwent	Number	Percentage
Graham's omental patch	23	47.9
Appendectomy	14	29.2
Resection and Anastamoses	2	4.2
Colostomy/ ileostomy	9	18.75

Graham's omental patch surgical intervention approached in present study with 47.9%.

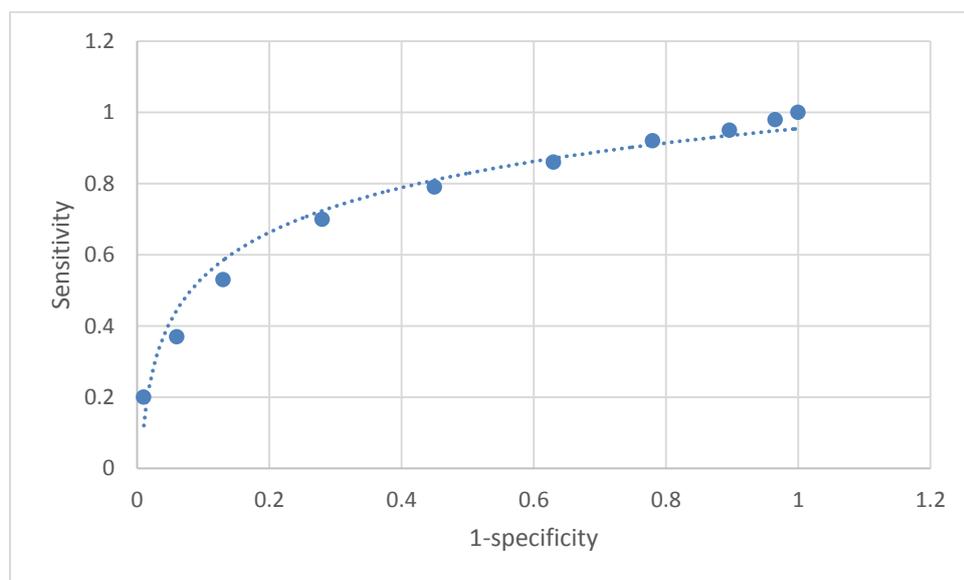
**Table-8: Morbidity in present study**

Morbidity	Number	Percentage
Chest infections (pulmonary complications)	3	6.25
Wound SSI (surgical site infection)	7	14.6
Anastomotic leak	2	4.2
EC fistula (enterocutaneous)	2	4.2
Re-do surgery	1	2.1
Stoma	1	2.1
GI bleed	1	2.1
Burst abdomen	1	2.1

Wound surgical site infection is most common complication in present study

**Figure-1: Exudate in present study.**

Faecal exudate is most common

**Figure-2: Receiver operating characteristic curve**

The mortality rates observed were higher in category 3 of MPI. The difference in mortalities among MPI score categories was observed to be highly significant ( $P < 0.0001$ ). On plotting the ROC curve, the sensitivity was 98%, and specificity was 96% with area under curve (AUC) being 0.9 at a cut-off of 21 MPI score .

## DISCUSSION

Various studies have reported efficacy of MPI as an independent prognostic scoring system in predicting outcome in secondary peritonitis. We have compared our study findings with previously reported studies . In the present study, the sensitivity and specificity of MPI were 98% and 96%, respectively, at a cut-off of 21 MPI score. The area under ROC curve was 0.98. Our results are comparable to previous reports. Although a minor higher sensitivity and lower specificity observed may be attributed to differences in sample sizes and setting of cut-off values.

[Rajesh Sharma](#) et al<sup>12</sup> study, the sensitivity and specificity of MPI were 92% and 78%, respectively, at a cut-off of 21 MPI score. The area under ROC curve was 0.9.

Correia *et al.*<sup>13</sup> retrospectively analyzed data of 89 cases with perforation peritonitis and found the mean MPI score to be 26.6 points (range: 5-47), with a sensitivity of 87.3%, and a specificity of 41.2%. The best accuracy (69.7%) was reached at a score of 21. Notash *et al.*<sup>14</sup> did a prospective study on 80 consecutive cases of perforation peritonitis and compared MPI with the multiple organ failure score. The AUC of ROC for MPI was 0.972. MPI of 21 had a sensitivity of 100% and specificity of 79%. With MPI of 29 the sensitivity was 79%, and specificity was 96%. These results were comparable to the findings of our study.

The results of our study were comparable, and the increase in mortality with the increment of MPI scores deduced that MPI score proved to be a useful tool to predict the mortality in patients of peritonitis. Batra *et al.*<sup>15</sup> calculated MPI score in a cross-sectional study of 160 patients of perforation peritonitis to evaluate MPI scoring system in defining the prognosis of the patients and to be able to deliver better patient care and furnish efficient management.

The cut-off from ROC curve was 26. Sensitivity and specificity of MPI in predicting mortality were calculated to be 100% and 65.54%, respectively. However, the validity results of MPI in the present study was not comparable to Demmel *et al.*,<sup>16</sup> Ohmann *et al.*<sup>17</sup> and Delibegovic *et al.*<sup>18</sup> despite similar AUC of ROC curves, which may be due to variations in the sample sizes and cut-off values.

In a prospective study of 108 cases of severe intraabdominal infections managed by open treatment, Demmel *et al.*<sup>16</sup> compared MPI and Acute Physiology and Chronic Health Evaluation II (APACHE II) scores. Statistical validation showed a sensitivity of 93% and a specificity of 16% for MPI. The Peritonitis study group<sup>[15]</sup> performed a multicentric study and compared APACHE II, MPI and peritonitis index altona scores in 271 cases of laparotomies for perforation peritonitis. The sensitivity and specificity of MPI were 60% and 80%, respectively. The AUC of ROC for a cut-off point of 26 was 0.79.

Kusumoto yoshiko *et al.*<sup>19</sup>, evaluated the reliability of the MPI in predicting the outcome of patients with peritonitis in 108 patients. A comparison of MPI and mortality showed patients with a MPI score of 26 or less to have mortality of 3.8%, where as those with a score exceeding 26 had mortality of 41.0%. In a study conducted by Qureshi AM *et al.*<sup>20</sup>, score of < 21 had mortality of 1.9%, score of 21-29 had 21.9% and score > 30 had mortality of 28.1%. Mortality rate for MPI score more than 26 was 28.1% while for scores less than 26 it was 4.3% Malik AA *et al.*<sup>21</sup>, did prospective study using 101 consecutive patients having generalized peritonitis over a two-year period. In the MPI system, mortality was 0 in the group of patients with a score of less than 15, while it was 4% in the patients scoring 16-25 and 82.3% in those with scores of more than 25 .

We conclude that MPI scoring is a reliable predictor of death in perforation peritonitis patients and can be helpful in planning and evaluating future treatments with great ease. We would like to recommend its use in the prognostic evaluation of secondary peritonitis cases.

## CONCLUSION

MPI is disease specific, easy scoring system for predicting the mortality in patients with secondary peritonitis. Increasing scores are associated with poorer prognosis, needs intensive management and hence it should be used routinely in clinical practice. MPI is an effective tool for prediction of mortality in cases of perforation peritonitis.

## REFERENCES

1. Townsend, J. C. M., Beauchamp, R. D., Evers, B. M., & Mattox, K. L. Sabiston textbook of surgery (21th ed)Elsevier - Health Sciences Division.2021;1:1092-95
2. Ahuja ,pal R. Prognostic scoring indicator in evaluation of clinical outcome in intestinal perforations. J Clin Diagn Res.2013;7(9):1953-5.

3. Batra P, Gupta D, Batra R, Kothari R, Deshmukh PR. Mannheim peritonitis index as an evaluative tool in predicting mortality in patients of perforation peritonitis. *Tech Journal of Surgery*. 2013;2(3):30-6.
4. Dani T, Ramachandra L, Nair R, Sharma D. Evaluation of prognosis in patient's with perforation peritonitis using mannheims peritonitis index. *Int J Scientific Res publications*. 2015 May;5(5):126-31.
5. Ukwenya AY, Muhammad I, Nmadu PT. Assessing the severity of intraabdominal infections; the value of APACHE II Scoring system. *Nigerian J Surgical Res* 2006;8:1.
6. Tavakoolizadeh A. Small intestine In: Brunicki FC. *Schwartz's principles of surgery*, USA: Mc GrawHill;2010;9:1021
7. Wittmann DH, Schein M, Condon RE. Management of secondary peritonitis. *Annals surg*. 1996;224(1):10.
8. Wacha H, Linder MM. Mannheim peritonitis index- prediction of risk of death from peritonitis; construction of a static and validation of an empirically based index. *Theoretical surg*. 1987; 1:169-77.
9. Linder MM, Wacha H, Feldmann U, Wesch G, Streifensand RA, Gundlach E. Der Mannheimer Peritonitis-Index. Ein Instrument zur intraoperativen Prognose der Peritonitis [The Mannheim peritonitis index. An instrument for the intraoperative prognosis of peritonitis]. *Chirurg*. 1987;58(2):84-92.
10. Billing A, Fröhlich D, Schildberg FW. Prediction of outcome using the Mannheim peritonitis index in 2003 patients. Peritonitis Study Group. *Br J Surg*. 1994;81(2):209-13.
11. Függer R, Rogy M, Herbst F, Schemper M, Schulz F. Validierungsstudie zum Mannheimer Peritonitis-Index [Validation study of the Mannheim Peritonitis Index]. *Chirurg*. 1988;59(9):598-6.
12. Sharma R, Ranjan V, Jain S, Joshi T, Tyagi A, Chaphekar R. A prospective study evaluating utility of Mannheim peritonitis index in predicting prognosis of perforation peritonitis. *J Nat Sci Biol Med*. 2015 Aug;6(Suppl 1):S49-52. doi: 10.4103/0976-9668.166076. PMID: 26604619; PMCID: PMC4630763.
13. Correia MM, Thuler LC, Velasco E, Vidal EM, Schanaider A. Prediction of death using the Mannheim peritonitis index in oncologic patients. *Rev Bras Cancerologia*. 2001;47:63-8. [
14. Notash AY, Salimi J, Rahimian H, Fesharaki Ms, Abbasi A. Evaluation of Mannheim peritonitis index and multiple organ failure score in patients with peritonitis. *Indian J Gastroenterol*. 2005;24:197-200.
15. Batra P, Gupta D, Batra R, Kothari R, Deshmukh PR. Mannheim peritonitis index as an evaluative tool in predicting mortality in patients of perforation peritonitis. *CIBTech J Surg*. 2013;2:30-6.
16. Demmel N, Muth G, Maag K, Osterholzer G. Prognostic scores in peritonitis: The Mannheim peritonitis index or APACHE II? *Langenbecks Arch Chir*. 1994;379:347-52.
17. Ohmann C, Wittmann DH, Wacha H. Prospective evaluation of prognostic scoring systems in peritonitis. Peritonitis Study Group. *Eur J Surg*. 1993;159:267-74.

18. Delibegovic S, Markovic D, Hodzic S. APACHE II scoring system is superior in the prediction of the outcome in critically ill patients with perforative peritonitis. *Med Arh.* 2011;65:82–5. [
19. Kusumoto Yoshiko, Neyagawa Masayuki, et al. Study of Mannheim Peritonitis Index to Predict Outcome of Patients with Peritonitis. *Japanese Journal of Gastroenterological Surgery.* 2004;37(1):7–13.
20. Qureshi AM, Zafar A, Saeed K, Quddus A. Predictive power of Mannheim peritonitis index. *J Coll Physicians Surg Pak.* 2005;15(11):693–6.
21. Malik AA, Wani KA, Dar LA, Wani MA, Wani RA, Parray FQ, et al. Mannheim Peritonitis Index and APACHE II - prediction of outcome in patients with peritonitis. *Ulus Travma Acil Cerrahi Derg.* 2010;16(1):27–32.