

Mannheim's Peritonitis Indexes as a Prognostic Tool in Perforative Peritonitis

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Abstract

Introduction: Peritonitis due to gastrointestinal tract perforation is the most common surgical emergency all over the world. Thus early prognosis of the severity of the disease is necessary for reducing the mortality. Hence the need for a scoring system for exact recognition of seriousness of disease.

Objectives of the Study: This study is done to evaluate Mannheim's peritonitis index score and its role in predicting mortality in patients of perforation peritonitis. In this study comorbidities and their effect in outcome of perforation peritonitis patients is also analysed.

Methods: This is a one and a half year study, done from January 2021 to June 2022. A total of 35 cases suffering from peritonitis were included in the study. Patients are evaluated using a prestructured proforma to study the variables. The MPI score was calculated for each patient. The Patients were grouped into three categories based on disease severity: those with MPI less than 21, between 21 and 29, and greater than 29.

Results: In our study with the two mortality the MPI variables of adverse outcome namely, presence of organ failure; time elapsed > 24hrs; presence of malignancy; age > 50 years, generalized extension of peritonitis, type of exudate and the non colonic origin of sepsis in peritonitis behaved as expected.

Conclusion: The Mannheim's peritonitis index was a very useful tool for prognosis of the morbidity and mortality of patients with peritonitis. MPI score allows the clinician to counsel the patient's attendant with greater perspective.

Keywords: Perforation, Peritonitis, Mortality, Mannheim Peritonitis Index (Mpi), Prognosis

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Introduction

Peritonitis due to gastrointestinal tract perforation is the most common surgical emergency all over the world. The spectrum of perforation peritonitis is still different from that of western nations and there is very little data from India regarding the various prognostic factors, causal factors, morbidity and mortality pattern [1]. The annual incidence of peptic ulcer disease ranges from 0.1% to 0.3 % [2]. Internationally its frequency varies among different countries.

Perforation due to different etiologies will present with distinct complications and will require specific management.[2] Emergency surgery for perforated peptic ulcer is associated with a high rate of postoperative complications (between 21% and 43%) [3]. It is a potentially life threatening condition which carries 90% mortality if treatment is not provided [4].

Even with the advances in surgical skills, new generation antimicrobial agents and intensive supportive care, the mortality of peritonitis remains high ranging 13-43% and the postoperative period is still unpredictable [5]. Moreover, secondary peritonitis is the commonest-indication for admission in the surgical wards-resulting into increased workload, increased duration of hospital stays and complications such as enterocutaneous fistula, surgical site infections and sepsis [6]. The outcome of perforation peritonitis is very unpredictable. Elderly patients often having comorbid conditions will have worse outcome. Presence of hypotension (systolic blood pressure <90mmhg) along with multi organ failure have poor prognosis [7]. an effective predictive model would offer an affordable prognostic assessment, which may even result in reduction of malpractice [8].

Many scoring systems have been developed like Acute Physiological and Chronic Health Evaluation score (APACHE II),the Mannheim Peritonitis Index (MPI), the Peritonitis Index

Altona (PIA), the Sepsis Score, and the Physiological and Operative Severity Score for Enumeration of Mortality and Morbidity (POSSUM). Various authors have reported APACHE to be a better system for prognostication of the outcome of patients with peritonitis, while the others concluded that MPI provides a more reliable means of risk evaluation [9].

Mannheim's Peritonitis index developed by Wacha and Linder [10] in 1983 is one of the simple and accurate scoring systems with good sensitivity and specificity. The MPI score, defined as an "empirically deduced first risk score."It takes into account 8 risk factors which are prognostically significant namely age, gender, organ failure, duration of peritonitis, involvement of colon, extent of spread and character of peritoneal fluid. Patients exceeding 26 score were defined as having high mortality [11].

Our study has been devised to recognise the spectrum of perforation peritonitis in Chitradurga. In this study presence of comorbidities (like Diabetes mellitus, Hypertension, Ischemic heart disease) is also analysed for its effect on outcome that was not included in MPI as these factors are likely to affect outcome.

Subjects and Methods

Study Design: Prospective observational study

Source of Data: After obtaining clearance and approval from the institutional ethical committee, 35 cases suffering from peritonitis and fulfilling the inclusion/exclusion criteria were included in the study. This is a one and a half year study, done from January 2021 to June 2022 of patients admitted with perforation peritonitis at a tertiary care centre.

Inclusion Criteria for the Study Group: Cases of peritonitis secondary to gastrointestinal tract perforation admitted

in our hospital within the study period from January 2021 to June 2022.

Exclusion Criteria for the Study Group:

- Patients of less than 15 years of age.
- Patients who are discharged against medical advice.

Study Period: Total – 18 months.

Sample Size: A total 35 cases of perforation peritonitis admitted within the study period were included in the study. Based on the study conducted by M.M. Correia *et al.*, [12-18] in which the prevalence of mortality rate under MPI score 21 was 33.3% and equal or over 21 was 70.6%.

Sample size was calculated using the formula $n = \frac{4pq}{l^2}$ n-sample size, p-prevalence, l-allowable error, $q = 100 - p$. Sample size calculation was done using open Epi software 2.3.1 at 95% confidence interval and 80% power of study. Sample size calculated was $32 \approx 35$.

Methodology

After approval from the Institutional Ethics Committee of our hospital, all the cases of peritonitis admitted in General surgery department at tertiary care centre were investigated and cases diagnosed as perforation peritonitis were included in the study. After taking written informed consent, patients were evaluated using a pre structured proforma to study the following variables like age, gender, organ failure, whether patient having malignancy, evolution time of peritonitis, intra operative findings like origin of sepsis, extension of peritonitis and character of exudate. Presence of comorbidities is also included in the study. Patients are investigated blood investigations done for complete blood count, arterial blood gas analysis, serum

electrolytes, X- ray erect abdomen, ECG and USG abdomen- pelvis if required.

The organ failure criteria as-published by Deitch [8] (1992) is followed.

Organ failure criteria

- Creatinine level >177 micro mol per litre
- Urea level >167 mmol per litre
- Oliguria <20 ml per hour
- $PaO_2 < 50$ mm of hg
- $PaCO_2 > 50$ mm of hg

Shock: systolic blood pressure <90 mm of hg, MAP <60 mm of hg

Intestinal obstruction only if profound with paralytic ileus >24 h, complete mechanical obstruction.

Laparotomy was performed through an upper or lower midline incision. Cause of peritonitis was established, intra operative findings noted down. Standard operative procedures were followed for different causes of perforation peritonitis. Effective peritoneal toilet / lavage done using Normal saline, abdominal drain are placed depending on the need for each patient. The patients were followed up until the patients get discharged or patient expires during hospital stay. Post-operative morbidities in surviving patients and mortality if any within that period of hospital stay were considered. The scoring is done for each individual as per MPI index added and calculated MPI score.

Patients were divided into three groups according to score

1. Score < 29
2. Score between 21-29
3. Score >29 .

Statistical Analysis

The Patients were grouped into three categories based on disease severity: those

with MPI less than 21, between 21 and 29, and greater than 29.

Data were entered in MS Excel and analysed in SPSS V22. Descriptive statistics for qualitative data was represented with percentages. Chi-square test was applied to find the significance and $P < 0.05$ was considered as statistically significant. Mortality based on the descriptive statistics of MPI score was analysed. Sensitivity and specificity for prediction of mortality could not be analysed as the mortality was very low i.e. 2.

Morbidity in surviving patients was also analysed in this study based on MPI score

Results

Table 1: Showing number of patients in each age group

Age	Frequency	Percent
<30	7	20.0
30-45	7	20.0
46-60	11	31.4
>60	10	28.6
Total	35	100.0

The 20 (57%) of patients out of 35 are above the age group of 50.

Table 2: Showing anatomical site of perforation in study patients

Origin of Sepsis	Frequency	Percent
Appendix	3	8.6
Colon	1	2.9
Colon and Ileum	2	5.7
Duodenum	21	60.0
Ileum	6	17.1
Rectum	1	2.9
Stomach	1	2.9
Total	35	100.0

As the table shows maximum number of patients had duodenal perforation 21(60 %) followed by Ileal perforation 51 (17.1 %). Appendicular, colonic and gastric perforations were 3(8.6 %), 1(2.9 %) and 1(2.9 %) respectively. Rectal, and combined ileal – colon perforations were among the least common perforations i.e. 1(2.9 %) and 2 (5.7 %).

RISK FACTOR - IF PRESENT

- AGE>50 years- 5
- Female sex - 5
- Organ failure- 7
- Malignancy- 4
- Origin of sepsis not colonic- 4
- Diffuse generalised peritonitis- 6
- Preoperative duration of peritonitis >24h - 4
- Exudates
- Clear- 0
- Cloudy, purulent - 6
- Fecal-12

Table 3: Showing distribution of various intraoperative procedures done

Surgery Done	Frequency	Percent
Divesrion Colostomy	1	2.9
EL with Ileostomy	1	2.9
EL with Appendecectomy	3	8.6
EL with Omental Patch Repair	22	62.9
EL with Primary Closure Ileal Perf	3	8.6
EL with Primary Closure of jeunal Perf	1	2.9
EL Right Hemicolectomy with Ileotransverse Anastomosis	3	8.6
EL with Resection and Anastomosis	1	2.9
Total	35	100.0

Most common procedure performed was exploratory laparotomy with omental patch repair in 22 (62.9%) patients. Followed by primary closure of ileal perforation, appendectomy 3(8.6%) and 3(8.6%) patients respectively. 3(8.6%) patient underwent EL Right Hemicolectomy with Ileo transverse Anastomosis. EL with Resection and Anastomoses was done in 1(2.9%) patient.

Table 4: Origin of sepsis (site of perforation) with incidence of mortality

Diagnosis	Outcome		Total
	Recovered	Death	
Appendicular Perforatin Peritonitis	3	0	3
	100.0%	0.0%	100.0%
Colonic Perforation Fecal Peritonitis	3	0	3
	100.0%	0.0%	100.0%
Duodenal Perforation Peritonitis	21	0	21
	100.0%	0.0%	100.0%
Ileal Perforation Peritonitis	3	1	4
	75.0%	25.0%	100.0%
Jejunal Perforation Peritonitis	1	0	1
	100.0%	0.0%	100.0%
Multiple Ileal Perforation Peritonitis	1	0	1
	100.0%	0.0%	100.0%
Rectal Perforation Peritonitis With CA Rectum	0	1	1
	0.0%	100.0%	100.0%
Stomach Perforation Peritonitis	1	0	1
	100.0%	0.0%	100.0%
Total	33	2	35
	94.3%	5.7%	100.0%

Incidence of mortality was seen in patients with Ileal perforation 1 (25%) and Rectal perforation1 (100%).

Table 5: Co morbidity with the outcome

Co morbidity	Outcome		Total
	Recovered	Death	
Absent	28	2	30
	93.3%	6.6%	100.0%
DM	2	0	2

	100%	0.0%	100.0%
IHD	2	0	2
	100.0%	0.0%	100.0%
DM with IHD	1	0	1
	100%	0.0%	100.0%
Total	33	2	35
	93.3%	6.6%	100.0%

In this study the patients with co morbidity had no incidence of mortality ie., 0.

Table 6: Showing correlation of MPI score with incidence of mortality

MPI	Outcome		Total
	Recovered	Death	
<21	6	0	6
	100.0%	0.0%	100.0%
21-29	17	1	18
	94.4%	5.6%	100.0%
>29	10	1	11
	90.9%	9.1%	100.0%
Total	33	2	35
	94.3%	5.7%	100.0%

Table shows incidence of mortality 1 (5.6%) seen in each MPI score 21-29 and >29.

Table 7: Showing correlation of MPI score with incidence of POST OP Morbidity

MPI	Post OP Morbidity		Total
	Present	Absent	
<21	0	6	6
	0.0%	100.0%	100.0%
21-29	8	10	18
	44.4%	55.6%	100.0%
>29	4	7	11
	36.4%	63.6%	100.0%
Total	12	23	35
	34.3%	65.7%	100.0%
Chi-square value = 3.98; df= 1; P=0.14			

In correlation of MPI score with incidence of post op morbidity p value in our study was 0.14 which is not statistically significant.

Discussion

In this study Mannheim's peritonitis index as a prognostic tool in perforative peritonitis included 35 patients, the spectrum of perforation peritonitis is analysed as follows.

Age

Total of 35 patients were included and studied. The age range is from 20 years to 84 years. The mean age of the study population was 47.57 years. The highest numbers of patients were found in the age group of 46-60 years and they constitute about 31.4% of the study population. In a study by Aijaz A Memon *et al.*, [12] (2008) in which the spectrum of acute

abdomen was studied the age range was from 13 years to 87 years.

Age and Mortality

In our study a total of 19 patients were less than 50 years of age. Out of 19 patients of age less than 50 years 1 patient died while out of, 16 patients with age more than 50 years 1 patient died.

In a study by Rodolfo L Braco *et al.*, [13] the mean age of the survivors was 32.7 years (SD \pm 16.64), among non-survivors mean age was 63 years (SD \pm 18.94). In our study there is equal incidence of mortality in each age group.

Sex

In our study the incidence of male sex was 88.6 % while that of female sex was 11.4 %. In a study by Rajender Singh Jhobta *et al.*, [1] (2006) regarding the spectrum of perforation peritonitis in India 84% patient's were male.

In a study by Aijaz A Meman (2008) *et al.*, [12] about the spectrum of disease in patients with acute abdomen, 70.30 % was males and 29.69% were females. The increased prevalence of male sex in our study is mainly due to increased number of male patients in the group of duodenal perforation and the presence of risk factors such as smoking, alcoholism.

Sex and Mortality

In our study total of 31 patients belong to the male sex among which 2 died resulting in a mortality of 17.6 %. Female sex had a mortality of 0 and thus female sex does not found to have adverse outcome.

T M Cook *et al.*, [14,15] found out in their study that female sex is one of the parameter associated with death with an odds ratio of 0.21.

Site of Perforation

In our study duodenal perforations account for 60%, ileal perforation for 17.1%, colonic perforation for 8.6%, appendicular perforations for 8.6%, gastric perforation for 2.9%, jejunal and rectal perforations for 2.9% each. In a study by Rodolfo L *et al.*, [13] majority were appendicular perforations constituting 48.28% while gastric and small bowel perforations constitutes 2.87% each and colonic found to be 2.30%. The increased number of duodenal perforations in our study is due to increased prevalence of the acid peptic disease in this part of region. Also the increase number of ileal perforations point to typhoid being the etiology.

Intra Operative Procedure Done

Majority of patients underwent exploratory laparotomy and omental patch repair for duodenal perforation. Right hemicolectomy with ileotransverse anastomosis was done for 3 (8.6 %) patients.

Followed by primary closure of ileal perforation, appendectomy 3(8.6%) and 3(8.6%) patients respectively. Resection and anastomosis was done in only 1 (2.9 %) patient, while in 1(2.9%) patients ileostomy was done along with resection and anastomosis. 1(2.9 %) patient underwent Hartmann's procedure.

Distribution of Organ Failure

In our study 11 patients i.e.31.4% of the study population shows evidence of organ failure at presentation. Distributions of organ failure in different studies are 48.5 % in MM Correia *et al.*, [17,18]. 29 11.5 % in Rodolf L *et al.*, [13]

The high rate organ failure in our study shows that delay in presentation of most cases. This delay is may be due to poor

referral services and negligence due to illiteracy. In our study a total of 11 patients showed evidence of organ failure. 2 patients died among this patients thus resulting in a mortality rate of 18.2 %. 24 patients out of patients who showed no evidence of organ failure had no mortality. M Hynninen *et al.*, [16] showed that the degree of organ dysfunction as measured by the SOFA (Sequential Organ Failure Assessment) score was the best predictor for hospital mortality in patients suffering from secondary peritonitis. In this study both patients who died had organ failure making it one of the significant factors for causing mortality. Therefore early identification and prompt resuscitation with aggressive treatment is recommended.

Preoperative Duration

In our study 9 patients i.e. 25.7 % presented within 24 hours while 26 patients i.e. 74.3 % presented after 24 hours of onset of the disease.

Preoperative Duration of Peritonitis and Mortality

In our study out of the 9 patients with a preoperative duration of peritonitis of less than 24 hrs no patient died. Out of the 26 patients who have preoperative duration of peritonitis of more than 24hrs, 2 died thus placing the mortality rate of 7.7%. This is similar to the study by Rodolfo L13 *et al* all the patients who died were having a preoperative duration of greater than 24 hours. Ali Yaghoobi Notash *et al.*, [17] found mortality of 11.4% in patients presenting within 24 hours of the onset of symptoms while the mortality was 25% in patients presenting late. In our institute the cause of delayed presentations due to Illiteracy among the study population Lack of proper referral services. In some

patients the delay was due to diagnostic dilemma which demands early use of more sophisticated investigations like CT scan, which is not available or not affordable at the peripheral hospitals.

Presence of Malignancy

In our study 1 patient (2.9 %) had malignancy. In a study by M.M. Correia *et al.*, [18] 27 patients with cancer were studied. Among them 8 were preoperative and all other were postoperative. In our study 1 patient who died had malignancy thus placing the mortality rate in presence of malignancy to a whopping 100 %.

Origin of Sepsis

In our study 3 patients i.e. 8.6 % had colonic origin of sepsis while in the rest 32 patients the origin of sepsis was non colonic. In the study by Rudolf L *et al.*, [13] 12.64% of patient's had colonic origin of sepsis. Colonic perforation presents with faecal peritonitis and are more prone for sepsis and multi organ failure.

Type of Peritonitis

In our study patients 33 i.e. 94.3% presented with a diffuse form of peritonitis while the remaining 2 i.e. 5.7% presented with localized peritonitis. Diffuse peritonitis is associated with a severe inflammatory reaction and development of sepsis and multi organ failure.

Localization of peritonitis is body's defence mechanism and will lead to formation of abscess, usually seen in perforated appendicitis. In our study 33 patients had diffuse peritonitis and 2 patients had localized peritonitis. There was no mortality in patients with localized peritonitis while in patients with diffuse peritonitis there were 2 deaths with a mortality of 6.1%.

Nature of Exudates

In our study 23 patients i.e. 20 % had purulent exudates, 7 patient's i.e. 20% had clear exudates and 5 patients i.e. 14.3% had faecal exudates. In 1983 Killingback *et al.*, [19] reported a mortality rate of over 70% in case of faecal peritonitis complicating diverticular disease. Purulent and faecal exudates are associated with delayed presentation and presence of varying degree of septicaemia. In our study among 3 patients with fecal exudates 2 died, showing significance of this variable in outcome.

Distribution of Patients as Per MPI Cut off Points

6 (17.1%) patients had MPI score of less than 21. 18 (51.4%) patients had MPI score between 21 to 29. 11 (31.4%) patients had MPI score greater than 29.

In our study there was no death in patients with MPI score less than 21, 1 in MPI score between 21 to 29 the mortality was 5.6%, while 1 in patients with MPI score greater than 29 the mortality was 9.1%.

A Billing *et al.*, [19] in their study of 2003 patients of perforation peritonitis found out a mortality rate of 2.3% in MPI score < 21, in MPI score between 21 and 29 the mortality was 22.5% & it was 51.1% for MPI score greater than 29 Abrar Maqbool Qureshi *et al.*, [20] in their study found out that for MPI score of less than 21 the mortality was 1.9%, for scores in between 21 - 29 it was 21.9% & for scores 30 or more it was 21.8%.

In our study since the mortality is 2 the statistical significance of MPI could not be ascertained.

Outcome

Among the 35 patients studied by us 2 patients died thus placing the mortality at

5.7%. The mortality was found in the scores 21- 29 and score >29. Abrar Maqbool Qureshi *et al.*, [20] in this study death was the main outcome measure against which the MPI score was analysed under 2 categories i) <26 or ≥ 26 ii) <21, 21-29, > 29.

For MPI score ≥ 26 the mortality was 28.1% while it was 4.3% for scores less than 26, for a score less than 21 the mortality was 1.8% for scores between 21 and 29 it was 21.9% and for score of 30 or more it was 28%. Atsushi Hourichi *et al.*, [21] in their study of perforation peritonitis had a mortality of 23.1%.

Koperna T *et al.*, [21] in their study of secondary bacterial peritonitis had an average total mortality rate of 18.5%. In 6(17.1 %) patients total MPI score was < 21 while 18 (51.4%) patients' total score was 21-29 & it was > 29 in 11 (31.4%) patients.

In contrast many of previous studies show the mortality rate of perforation peritonitis ranging between 20 to 30%. In our study less mortality may be attributed to early detection and aggressive resuscitation and prompt postoperative ICU care. Thus with the improvement in the medical management, availability of new broad spectrum antibiotics and vast development in the field of intensive care the mortality from perforation peritonitis will still reduce in the future. Development of organ failure and sepsis are important determinants of mortality. Therefore future studies and research should be directed in the understanding of pathogenesis and evolution of these factors so that new and more effective treatment strategies could be evolved. In our study out of 35 patients 2 had mortality and both patients did not

have any comorbidity. And the 5 patients who had comorbidities recovered well.

Conclusion

The Mannheim's peritonitis index was a very useful tool for prognosis of the morbidity and mortality of patients with peritonitis. Though our study had very less mortality (only 2) it had led to understand that advances in medicine, surgery and ICU care has been very helpful in reducing mortality. MPI score allows the clinician to counsel the patient's attendant with greater perspective. A similar multi – institutional study involving more number of cases is recommended with including comorbid illness and postoperative morbidity. Also a study including longterm complications in these patients is recommended.

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