

**Research Article**

## **MANNHEIM PERITONITIS INDEX AS AN EVALUATIVE TOOL IN PREDICTING MORTALITY IN PATIENTS OF PERFORATION PERITONITIS**

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### **ABSTRACT**

A scoring system which can compare patient populations and severity of illness, objectively predict mortality, morbidity and can help to evaluate the treatment strategy is the dire need for evaluative research of intensive care. Keeping in mind that perforation peritonitis is the commonest surgical emergency in the lower rungs of the society which we encounter in our rural hospital, this study was undertaken to evaluate Mannheim Peritonitis Index (MPI) scoring system in defining the prognosis of the patients and to be able to deliver better patient care and furnish efficient management. It was a cross-sectional study of 160 patients of perforation peritonitis who were admitted in surgery department over a period of three years. MPI score was calculated for each patient of peritonitis as per the score sheet. ROC analysis was done to identify the best cut off for MPI. The cut off from ROC curve came out to be 26. Sensitivity and specificity of MPI in predicting mortality was calculated to be 100% and 65.54 % respectively. The rate of mortality was 5.7%. This was a pioneering study in India where MPI scoring system has been applied specifically for patients of perforation peritonitis in a rural hospital setup. As there was an increase in mortality with the increment of MPI scores so we deduce that MPI score proved to be a useful tool to predict the mortality in patients of peritonitis.

**Key Words:** *MPI Score, Mortality, ROC Curve, Perforation Peritonitis*

### **INTRODUCTION**

The outcome of surgical intervention; whether death or uncomplicated survival, complications or long term morbidity is not solely dependent on the abilities of the surgeon in isolation. The patient's physiological status, the disease that requires surgical correction, the nature of the operation and the pre operative and post operative support services have a major effect on the ultimate outcome. The systematic approach to quantifying illness in critically ill patients like peritonitis is a recent phenomenon. Early and objective classification of the severity of peritonitis may help in selecting patients for aggressive surgical approach (Bohnen *et al.*, 1983; Giessler *et al.*, 2002; Schein *et al.*, 1983; Farthmann and Schoffel, 1990). The development of such systems has been specifically the need for methods to compare patient populations and severity of illness, objectively predict morbidity and mortality. Scoring systems like APACHE II, SAPS, MPI have been developed in response to an increasing emphasis on the evaluation and monitoring of health services (Notash *et al.*, 2005; Wisner, 1992). Early evaluation of severity of lesion using Mannheim Peritonitis Index (MPI) allows us to estimate the possibility of patient survival. The MPI is one of the simplest scoring systems in use that allows the surgeon to easily determine risk during initial surgery. It is a disease specific score based on easy to handle clinical parameters. The recollection of retrospective data is possible and valid, because MPI only requires information routinely found in surgical registers. It takes into account age, gender, organ failure, cancer, and duration of peritonitis, involvement of colon and extent of spread and character of peritoneal fluid. Peritonitis due to perforation of gastro intestinal viscus is the most common surgical emergency in India. Despite advances in surgical techniques, antimicrobial therapy and intensive care support, management of peritonitis continues to be highly demanding, difficult and complex and the spectrum of disease is different from that found in the western world (Jhobta *et al.*, 2006). Our hospital is located in rural India and caters to a low

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socioeconomic group of people in which perforation peritonitis is common. As there is scarcity of data in this part of the world regarding the application of MPI for predicting outcome of patients with peritonitis, this study was undertaken to evaluate MPI scoring system in defining the prognosis of the patients as well as for better patient care and management.

## MATERIAL AND METHODS

### Setting

This study was carried out in the Department of Surgery of a tertiary care hospital attached to a rural medical college.

### Study Design

This was an observational cross-sectional study.

A total of 160 patients of perforation peritonitis who were admitted in surgery department over a period of three years were included in the study. All the patients who were operated for perforation peritonitis and whose OT records were complete were included in the study. They were interviewed by the principal investigator and information was recorded and documented. After preoperative resuscitation the patient underwent exploratory laparotomy. Appropriate treatment was carried out according to the findings. Postoperatively standard care was given to all the patients. Patients were observed for complications and mortality

### Mannheim Peritonitis Index – Score Sheet

Risk factor	Score
Age > 50 years	5
Female gender	5
Organ failure*	7
Malignancy	4
Pre-operative duration of peritonitis >24 hours	4
Origin of sepsis non colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Faecal	12

### \*Definition of organ failure

- 1) Kidney
  - a) Creatinine more than 177 micromole/litre or
  - b) Urea more than 167 millimole/litre or
  - c) oliguria less than 20 ml/hour
- 2) Lung: a)  $pO_2 \leq 50$  mm of Hg b)  $pCO_2 > 50$  mm of Hg
- 3) Shock: a) Hypodynamic or b) Hyperdynamic
- 4) Intestinal obstruction (only if profound)
  - a) Paralysis of more than 24 hours or
  - b) Complete mechanical ileus

### Ethics Consideration

Prior approval of institutional ethics committee was obtained for the study. Written informed consent was obtained from all patients included in the study.

### Statistical Method

### Mannheim Peritonitis Index (MPI)

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The MPI score was calculated as per the score sheet formulated below. Patients were grouped under three categories based on severity of disease; those with MPI less than 21, between 21 to 29 and those greater than 29. Data were then analysed using SPSS software version 12.0 and rate of mortality was seen in each group.

### Statistical Analysis

ROC curve was plotted for MPI and a cutoff point was found for the scoring system. At this given score the various indices such as True Positive, False Positive, False Negative, True Negative were calculated using these values the various statistical indices such as Sensitivity, Specificity, Positive predictive value, Negative predictive value, Likelihood ratio positive, Likelihood ratio negative were calculated.

## RESULTS AND DISCUSSION

### Results

The number of patients with age less than 50 years was 101 and those with age 50 years and more were 59. The mean age of presentation was  $40.87 \pm 17.42$  yrs. There were 141 males (88.12%) as compared to 19 females (11.88 %). Male: Female ratio was 7.42: 1. The symptomatology of patients of perforation peritonitis is enumerated in Table 1.

**Table 1: Symptomatology**

Symptom	Percentage
Pain abdomen	100 %
Vomiting	52.2 %
Distension of abdomen	36.3 %
Constipation/loose stools	31.8 %
Fever	26.1 %
Oliguria	13.4 %
Cold extremities	3.8 %

*\*Some of the patients had presented with more than one symptom and the above values indicate the percentage of patients having a particular symptom amongst the total number of patients.*

### Duration of Symptoms

Out of total 160 patients 54 patients (33.8%) had presented within 24 hrs of onset of features of peritonitis and 106 (66.2 %) had presented after 24 hrs of onset of peritonitis.

### Site of Perforation

Gastroduodenal perforation was found to be the most prevalent (80.25%). Small bowel perforation (14.02%) being the second in order followed by appendicular (3.82%), colonic (1.27%) and there was one case of rectal perforation.

According to the site of perforation the treatment was individualized

### Complications

Of the 160 patients, 9 (5.62%) patients died in the post-operative period. Out of the remaining 151 patients who survived 78 patients had no complications and 73 patients had complications. Thus the complication rate in our study was 48.3 %. The various complications encountered were as follows:

Among the 73 patients who developed complications 17 (23.29 %) had fever, 14 (19.18%) had wound infection and 14 (19.18%) had wound gaping. 7 patients (9.59%) had respiratory tract infection. 7 patients (9.59%) developed a fecal fistula. Others had urinary tract infection (8.21%) and electrolyte imbalance (2.74%). 2 patients (2.74%) had burst abdomen and 1 patient (1.37 %) had pelvic abscess while 1 patient (1.37 %) had subphrenic abscess and 1 patient (1.37%) had hypotension which required inotropic support for 5 days. 1 patient (1.37%) had respiratory failure for which patient was kept on mechanical ventilatory support and was weaned off the ventilator in 8 days.

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### Observed Mortality Rate

In the present study the numbers of deaths due to perforation peritonitis were 9 and hence the mortality rate was **5.62%**.

### Mortality Predicted by MPI Score

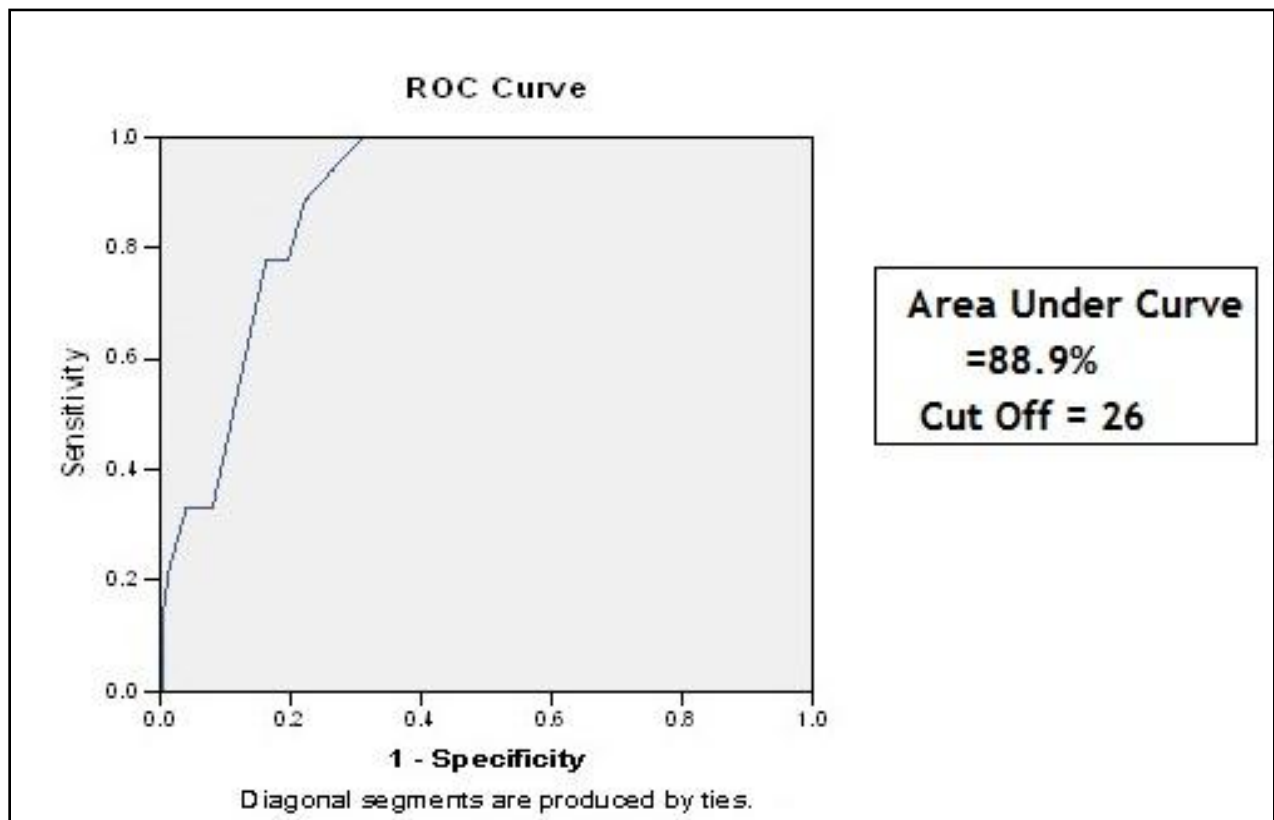
MPI score was calculated for each patient of peritonitis as per the score sheet. The mortality rate in each group is shown in Table 2

**Table 2: Mortality rate by MPI scoring system**

Score	Number of patients	Deaths	Mortality Rate
$\leq 20$	73	0	0%
21-29	52	2	3.85%
$\geq 30$	35	7	20%

### Cut Off Point for MPI

ROC analysis was done to identify the best cut off for MPI. The cut off came to be 26 for which the sensitivity and specificity was calculated to be 100% and 65.54 % respectively



**Figure 1: ROC CURVE OF MPI**

From the ROC curve, (Figure 1.) the area under the curve for MPI was calculated as 88.9% which a statistically significant finding is.

The analysis of MPI Scoring system is represented in Table 3.

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**Table 3: Analysis of MPI scoring system with cut-off of 26**

Indices	MPI
Sensitivity	100 %
Specificity	65.54%
Positive Predictive Value	0.15
Negative Predictive Value	1
Positive Likelihood Ratio	2.857
Negative Likelihood Ratio	0

This study evaluates the utility of MPI (Mannheim Peritonitis Index) as a tool to quantify the severity of peritonitis and predict the mortality as currently no ideal and generally accepted scoring system exists to determine the prognosis of peritonitis and intra abdominal sepsis (Bosscha *et al.*, 1997) The patients in the age group of less than 50 yrs was 101 (64%) in the present study while in the study done by Ohmann *et al.* (1997) the number of patients was 139(39%). There were 59(36.8%) patients of age 50 years and more in our study while it was 213(60%) in their study. Age of three patients in their study was not known. Males outnumbered females in the present study. Similar pattern of more incidence of perforation peritonitis in males was also seen in various other studies (Jhobta *et al.*, 2006; Ramchandra *et al.*, 2007; Adesunkanmi and Badmus, 2006)

The comparative account of the clinical profile in our study and that of other studies is depicted in Table 4.

**Table 4: Clinical Profile**

Symptoms	Ghooi & Panjwani (1978) N=280	Desa <i>et al.</i> (1983) N=161	Present study (N= 160)
Pain Abdomen	100%	86.96%	100 %
Distension	51.1%	52.79%	36.3 %
Constipation/loose stools	50%	30.43%	31.8 %
Vomiting	26.8%	53.42%	52.2 %
Fever	15.3%	44.10%	26.1 %
Retention of urine	-	1.86%	-
Oliguria	-	-	13.4 %
Cold extremities	-	-	3.8 %

Majority of the patients in our study has presented late i.e. after 24 hours. Similar observations were made by other authors (Ghooi and Panjwani, 1978). The commonest site of perforation in the gastrointestinal tract is gastroduodenal followed by small bowel .Other areas like colon, appendix are less common sites of perforations. Similar observations have been reported by various authors in the past (Jhobta *et al.*, 2006; Ramchandra *et al.*, 2007). Our results on site of perforation go hand in hand with the findings of earlier studies. However, there was an isolated case of rectal perforation in the present study, which was

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not reported by any other authors. Fever, wound infection and gaping were the commonest complications as observed in the present study (23.29%, 19.18% and 19.18% respectively) followed by faecal fistula and respiratory infections (9.59% each) and others. Budhraj et al., (1973) also found wound infection as commonest complication followed by wound gaping and fecal fistula (11.6% each). However none of their patients had fever, urinary tract infection or respiratory tract infections.

The overall complication rate in the present series was 48.3% which is in concordance with the rate reported by Edison et al., (2007). The rate of complication was less in the studies of other authors like it was 36.8 % by Budhraj et al., (1973) and 25 % by Agrawal et al., (2007). Of the 160 patients included in the study 9 died, thus giving an overall mortality rate of 5.62%. This is much less than the rate reported by other authors (Jhobta et al., 2006; Ramchandra et al., 2007; Agrawal et al., 2007).

When the mortality rate was calculated by MPI score for each group, it was seen that with increasing MPI score the mortality rate also increases. This is in agreement with the studies done by Ermolov et al., (1996) and Quereshi et al., (2005) where they observed that the mortality rate increased with increasing MPI scoring (Table 5).

**Table 5: Mortality rates for MPI score groups**

MPI score	Ermolov et al., (1996)	Quereshi et al., (2005)	Present study
< 21	0%	1.9%	0%
21-29	42%	21.9%	3.85%
≥ 30	100%	28.1%	20%

**Table 6: Sensitivity and Specificity of MPI**

Study	Sensitivity	Specificity
Billing et al., (1994) N=2003	86%	74%
Demmel et al., (1994) N=108	93%	16%
Correia et al., (2001) N=89	87.3%	41.2%
Notash et al., (2005) N=80	86%	74%
<b>Present study N=160</b>	100%	65.54%

In the present study the cut off score was 26 according to the ROC curve. The sensitivity and specificity of MPI were 100% and 65.54% respectively. Other authors also observed a high sensitivity and low specificity of MPI in their studies (Table 6).

## Conclusion

To conclude, ours was a pioneering study in India where MPI scoring system has been applied specifically for patients of perforation peritonitis in a rural hospital setup.

Till date no other studies have been found in the literature and on the internet data base as far as it could be traced; who have observed the potential of MPI score in Indian subcontinent for predicting the outcome in patients of peritonitis.

In our study, it was found that when MPI score increased, mortality increased so MPI score proved to be a useful tool to predict the mortality in patients of peritonitis. We propose that MPI would definitely be an effective objective aid in the hands of surgeons dealing with such patients in intensive care units.

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