

Study of Mannheim peritonitis index for predicting morbidity and mortality in patients of hollow viscous perforation: In a tertiary care hospital of Eastern India



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ABSTRACT

Background: Peritonitis is the inflammation of peritoneum, the serosal membrane that lines the abdominal cavity and organs inside. The hollow viscous perforation (HVP) is one of the most common surgical emergencies encountered by surgeons on a daily basis. Mannheim Peritonitis Index (MPI) is a simple and effective method in predicting the morbidity of patients with HVP. **Aims and Objectives:** This study attempts to evaluate the prognostic value of MPI scoring system in patients with peritonitis due to HVP. **Materials and Methods:** This is a clinical, prospective, and observational study. There were 50 patients with HVP (stomach, duodenum, ileum, and appendix) admitted in Srirama Chandra Bhanja Medical College and Hospital from March 2021 to October 2022 included in the study. Necessary data were collected; MPI score was calculated for each patient and analyzed. **Results:** The number of post-operative complications, duration of intensive care unit, and hospital stay proportionately increased with the MPI score. Out of the eight variables used in this scoring system, duration of pain, intraperitoneal fluid and organ failure on admission carried more significance in predicting the morbidity in the post-operative period than the other variables. **Conclusion:** MPI is a simple and effective method in predicting the morbidity of patients with HVP and to assess it as a clinical tool in stratifying these patients according to individual surgical risk.

Key words: Peritoneum; Mannheim Peritonitis Index score; Hollow viscus; Appendix; Morbidity

INTRODUCTION

Peritonitis is the inflammation of the serosal membrane that lines the abdominal cavity and the organs contained therein. Peritonitis due to hollow viscous perforation (HVP) is one of the most common surgical emergencies attended by a surgeon on a daily basis.¹ The spectrum of etiology varies from western countries in relation to tropical country like India. The upper gastrointestinal perforations are more common in India in contrast to lower gastrointestinal perforations in western countries.² Smoking and non-steroidal anti-inflammatory drug misuse is the

most common risk factor of abdominal viscera perforation in India and other developing countries.³ Diagnosis was made by clinical examination followed by radiographic confirmation. The presence of pneumoperitoneum is almost confirmatory for hollow viscus perforation. The mortality rate for ileal perforations remained high in spite of improved emergency surgical care.⁴

Peritonitis remains as a hot spot for surgeons despite advancements in surgical technique and intensive care treatment. Various factors such as age, sex, duration, site of perforation, the extent of peritonitis, and delay in the

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surgical intervention are associated with morbidity and mortality.⁵ There have been several attempts at creating a scoring system to predict mortality and morbidity risk after emergency surgery.⁶ Some scoring systems provide a prediction that approximates to the observed mortality rate for a cohort, but none is sufficiently accurate to rely on when considering an individual patient. This is a validation study of the Mannheim Peritonitis Index (MPI) scoring system for predicting the morbidity and mortality in patients with peritonitis due to hollow viscus perforation.⁷ It is often caused by the presence of infection in otherwise sterile peritoneal environment through perforation of gastrointestinal tract. The presence of chemically irritating material is gastric acid from a perforated ulcer. Due to various risk factors such as *Helicobacter pylori* infection, non-steroidal anti-inflammatory drugs misuse enteric fever. This condition mostly requires an emergency surgical intervention; therefore, a scoring system is required which should be able to assess the need, type, and quality of the care required for a particular patient. Hence, an urgent need was felt to devise a simple accurate scoring system in these conditions so as to evaluate the effectiveness of MPI scoring system as a tool in predicting the risk of morbidity and mortality in patients with peritonitis due to HVP.⁸

As on date, there are several other scoring systems to evaluate the patients with peritonitis due to HVP such as APS, SIS, APACHE, and BOEYS. These scoring systems are of great help in saving the life of a patient. The present study has been aimed at evaluating the effectiveness of MPI.

Aims and objectives

The present study had been aimed to modality of post-operative management and evaluates the prognostic value of MPI scoring system in patients with peritonitis due to HVP.

MATERIALS AND METHODS

This prospective and observational study was done in the Department of Surgery, S C B Medical College and Hospital, Cuttack, from March 2021 to Oct 2022.

Patients who had clinical features and investigatory support of HVP were selected. The study design was a clinical, prospective, and observational study.

Estimation of sample size

Yamane's Formula:

The sample size calculation is given by the formula:

$$n = N / \{1 + N (e)^2\}$$

$$102 / 1 + 110 (0.05 \times 0.05) = 102 / 1 + 1 = 102 / 2 = 51$$

N=1020 is the total patients evaluated

e=Is the acceptable margin of error (5%, so plug in 0.05).

n=Is the sample size in the present study.

A total of 50 patients with peritonitis due to HVP were studied with both sexes aged over 18 years and willing to participate in the study with written and informed consent.

Patients had clinical features and investigatory support of HVP was included in the study.

Patients with HVP due to trauma and female cases during pregnancy and lactation were excluded from the study.

The diagnosis of peritonitis due to HVP made by:

- A) Detailed history of presenting illness and history suggestive of chronic health disorders such as cardiac, renal, and hepatic conditions noted
- B) X-ray chest posterior anterior view with both domes of diaphragm which shows free air under diaphragm
- C) Standard operative procedures were followed for different causes of perforative peritonitis
- D) Mortality is defined as any death occurring during the hospital stay.

Morbidity is assessed in terms of post-operative complications such as:

- Pneumonia or lung atelectasis
- Wound infection
- Acute myocardial infarction or heart failure
- Intra-abdominal collection.

Acute renal failure and urinary tract infection.

Once the diagnosis of peritonitis had been determined by operative findings, the patient was enrolled in the study. Using history, clinical examination, and laboratory values, the risk factors found in MPI were classified according to the values indicated and individual variable scores were added to establish MP score. The cases were first grouped into three, as described by Billing: Those below 21 points, between 21 and 29 points, and those above 29 points.

Demographic profiles such as name, age, sex, days of hospitalization, date of surgery, and information related to illness (surgical findings, medical treatment, and evolution of illness) were documented. Patients were followed in terms of the occurrence of complications. Time elapsed from initial diagnosis to moment of event (death or discharge from hospital) was determined. Out-patient follow-up was continued for 30 days to establish perioperative morbidity and mortality. The minimum possible score was zero and maximum ranged up to 47. Analysis was done with each variable in the scoring system

as an independent predictor of morbidity or mortality and the scoring system as a whole.

Statistical analysis

The data were analyzed using SPSS software version 16.3. Each variable in the MPI score, along with other patient variables was analyzed using the Chi-square analysis with various outcomes that were noted in the study. The numbers and percentages for categorical data are presented in the table and figure. Proportions were compared using the Chi-square test of significance.

Ethical issue

The present study was approved by the Ethics Committee of the S C B Medical College, Cuttack, vide IEC No. 814 dated June 04, 2021, as per the principles of Helsinki Declaration.

RESULTS

The present study was conducted for 1-year duration. As per the history, clinical examination, laboratory, and radiological findings, the MPI scores were classified into the values indicated and individual variable scores were added to establish the MP score.

A total of 50 patients were taken for the study. Males accounted for 35 (70%) of the patients below the age group of 50 years. M: F ratio was 2.3:1. About 20 (40%) of the study group were presented with pain in the abdomen of <24-h duration. However, the most common site was in duodenum 29 (58%) followed by ileal 9 (18%) and appendicular 7 (14%), respectively. The types of peritonitis were diffused in 33 (66.67%) cases and localized in 17 (33.33%) cases (Table 1).

Table 1: The demographic profile, duration of pain, site of perforation, and types of peritonitis in the study population

Parameters	Frequency	Percent
Age <50 years	35	70
Sex:male	35	70
Duration of pain		
<24 h	20	40
1–5 days	24	48
<5 days	6	12
Site of Perforation		
Gastric	5	10
Duodenum	29	58
Ileal	9	18
Appendix	7	14
Types of peritonitis		
Localized	17	33.33
Diffused	33	66.67
Total	50	100

The cases were first grouped into three, as described by billing (Figure 1): Those below 21 points, between 21 and 29 points, and those above 29 points. In the present study, 32 (64%) of cases were in the low-risk group (scores <21), 11 (22%) cases moderate the risk group (scores 21–29), and 7 (14%) cases were in high risk (scores >29) groups, respectively (Table 1).

Scoring (>29) was accounted for the highest number 6 (12%) of pneumonia cases, acute respiratory distress syndrome 5 (10%), feculent exudates 5 (10%), inotropic supports 4 (8%), mechanical ventilation 3 (6%), and more than 10 days intensive care unit (ICU) stay 2 (4%) of cases, respectively.

Surgical site infection (SSI) was seen 5 (10%) cases in the score that ranges 21–29. There was an uneventful recovery in >80% of cases as indicated by lesser post-operative complications, comparatively less requirement of inotropes and mechanical ventilation, and lesser hospital stay (Table 1).

The duodenal, ileal, and appendicular perforations had higher rates of post-operative complications (Table 2 and Figure 1).

In the present study, the maximum percentage of perforations was seen in duodenum 29 (58%) followed by ileum 9 (18%) and appendix 7 (14%). Stomach perforations accounted for 5 (10%) cases only. There were uneventful or nil complications seen in 29 (58%) followed by one complication per case 10 (20%) and 32 per case in 11 (22%) of cases (Table 3 and Figure 2).

The study population of 20 cases presented pain within 24 h of onset had better outcome. Pain during 1–5 days was seen in maximum in 24 cases and comparatively lesser number of six cases presented pain after 5th post-operative day (Table 4).

Risk factor	Points
Age >50 years	5
Female sex	5
Organ failure	7
Malignancy	4
Pre-operative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffused generalized peritonitis	6
Exudates	0
Clear	6
Cloudy (purulent)	12
Fecal	
Kidney	Creatinine level >177 umol/l Urea >167 mmol/l
Lungs	Oliguria <20 ml/h PO ₂ <50 mmHg PCO ₂ >50 mmHg
Shock	Hypodynamic or hyperdynamic
Intestinal obstruction	Paralysis >24 h or complete mechanical obstruction

Figure 1: Mannheim Peritonitis Index

Table 2: Evaluation of the MPI scoring system in the study population

Complications	Responses	<21, n=32 (66%)	21–29, n=11 (22%)	>29, n=7 (14%)	Total, n=50
Pulmonary complications	No	29 (58%)	7 (14%)	1 (2%)	37 (74%)
	Yes	3 (6%)	4 (8%)	6 (12%)	13 (26%)
ARDS	No	32 (64%)	9 (18%)	2 (4%)	43 (86%)
	Yes	00 (00%)	2 (4%)	5 (10%)	7 (14%)
SSI	No	29 (58%)	6 (12%)	3 (6%)	38 (76%)
	Yes	3 (6%)	5 (10%)	4 (8%)	12 (24%)
Inotropic supports	No	31 (62%)	9 (18%)	3 (6%)	43 (86%)
	Yes	1 (2%)	2 (4%)	4 (8%)	7 (14%)
Mechanical ventilation	No	31 (62%)	9 (18%)	4 (8%)	44 (88%)
	Yes	1 (2%)	2 (4%)	3 (6%)	6 (12%)
ICU stay in days	<5 days	31 (62%)	8 (16%)	4 (8%)	43 (86%)
	6–10 days	1 (2%)	2 (4%)	1 (2%)	4 (8%)
	>10 days	00 (00%)	1 (2%)	2 (4%)	3 (6%)
Type of exudates	Clear	24 (48%)	1 (2%)	00 (00%)	25 (50%)
	Purulent	5 (10%)	6 (12%)	2 (4%)	13 (26%)
	Feculent	3 (6%)	4 (8%)	5 (10%)	12 (24%)

MPI: Mannheim Peritonitis Index, ICU: Intensive care unit, SSI: Surgical site infection, ARDS: Acute respiratory distress syndrome. Bold values were either remarkably high or low

Table 3: Frequency of perforation sites in the study population

Complications	Organs affected				
	Gastric	Duodenum	Ileum	Appendix	Total
0 or nil	1 (2%)	24 (48%)	2 (4%)	2 (4%)	29 (58%)
1 per case	2 (4%)	3 (6%)	2 (4%)	3 (6%)	10 (20%)
≥2 per case	2 (4%)	2 (4%)	5 (10%)	2 (4%)	11 (22%)
Total	5 (10%)	29 (58%)	9 (18%)	7 (14%)	50 (100%)

Table 4: Number of complications versus duration of pain in days in the study population

Complications	Duration of pain in days			Total
	<1	1–5	>5	
0	20	9	0	29
1	0	8	2	10
≥2	0	7	4	11
Total	20	24	6	50

DISCUSSION

Patients with organ failure on admission, longer duration of illness before the surgery, diffuse peritonitis, and feculent exudates were more likely to have higher scores and hence fall into high-risk groups than their counterparts (Table 1).⁹

The pulmonary complications in the form of post-operative pneumonia and pleural effusion which required continuous monitoring of oxygen saturation, nebulization and hence lead to longer post-operative recovery were significantly higher as the score increased above 29 points.¹⁰

The MPI score of more than 29 was required mechanical ventilation, inotropes support, mechanical ventilation, and need for intensive care. The post-operative complications of organ perforation were significantly higher in this group.

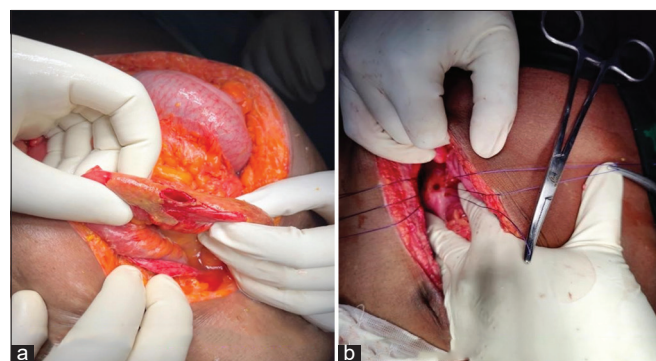


Figure 2: (a) Ileal perforation and (b) Duodenal perforation

The complications were SSIs, pulmonary infections, renal complications, and development of multi-organ failure.¹¹ There was only one death in this study, analysis did not reach significant figures.

There is a proportionate increase in the duration of stay (ICU and wards) with increase in scores.

About 88% (66%+22%) of the patients who were discharged within 10 days had a score of <29 (Table 2).¹¹ The presence of feculent or purulent exudates was reflected in higher scores. Feculent and purulent exudates were associated with significantly increased post-operative complications requiring increased hospital stay.¹²

Up to 80% of the patients with clear exudates had no post-operative complications which dropped to only 30% with the other type. However, there was no statistically significant difference between feculent and purulent exudate both having similar complication profiles.¹³

Maximum percentage of perforations were seen in duodenum 29 (58%) followed by ileum 9 (18%) and appendix 7 (14%) of patients (Table 3 and Figure 2).¹⁴ Gastric perforations were reported as lowest consistent with the previous studies.¹² There was minimal pain and subsided within 24 hours with better outcome in 20 (40%) of cases in the present study (Table 4).¹⁵

Few of the other studies confirmed age as a decisive factor related with mortality however this study does not show any statistical significance.¹³ In other studies, patients with generalized peritonitis range from 30% to 66%; in the present study, generalized peritonitis was present in about 66% of the patients.^{15,16}

The mean MPI score reported in the literature for localized peritonitis is 19 (range 0–35) and in generalized peritonitis, 26–27 points (range 11–43),⁸ which is similar to the values noted in this study.¹⁷ Duration of pain >24 h, organ failure on admission and feculent exudate were found to be independently significant factors in predicting the morbidity among the study population. However, the presence of diffuse peritonitis was not a significant factor in contrast to various other studies.^{18,19}

Limitations of the study

Small sample size, lack of awareness about the severity of disease and delayed reporting of patients from rural and tribal area were major limitations of the present study.

CONCLUSION

The results of this study prove that the MPI scoring system is a simple and effective tool for assessing this group of patients, and can be used as a guiding tool to decide on the management of the patient after the definitive procedure is done. Among the various variables of the scoring system duration of pain, organ failure on presentation, and the presence of feculent exudates had a significant hand in predicting the eventual outcome of the patient. Even if accurate pre-operative predictions of outcome were possible by estimation of a risk score, an expert surgical opinion would be required to interpret these predictions at the bedside. An experienced clinician cannot only assess prognosis but also weigh up the local facilities available, the patient's quality of life, and ethical issues, as well as considering the patient or relative's wishes. Scoring can

never replace clinical judgment. Scoring systems are generated and validated on specific populations that may be substantially different from the patients being scored in a different hospital. One potential resolution would be for each hospital to create a system specific to its own population, which is regularly revalidated.

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Authors Contribution:

PD- Definition of intellectual contents, literature survey, implementation of study protocol, data collection and data analysis. **CA-** Prepared first draft of Manuscript and submission of manuscript, concept design, clinical protocol, manuscript revision: **SRM-** Design of study, statistical analysis and interpretation, **SB-** Review of manuscript and preparation of figures. **DNM-** Final revision of manuscript coordination and manuscript Submission.

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