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Original Article

Surgery Section

Mannheim Peritonitis Index as a Predictor of Post-operative Complications, Mortality and Duration of Hospital Stay in Patients with Peritonitis due to Hollow Viscus Perforation: A Prospective Cohort Study

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ABSTRACT

Introduction: Peritonitis due to hollow viscus perforation is a common surgical emergency and can be life-threatening. Patients who undergo surgery for peritonitis require extensive counselling to fully understand the nature of the disease, the need for surgery, post-operative complications and the duration of hospital stay. Hence, scoring systems are necessary to determine the severity of the disease to provide sufficient prognostic data.

Aim: To evaluate the Mannheim Peritonitis Index (MPI) scoring system as a predictor of post-operative complications, mortality and duration of hospital stay in patients with peritonitis due to hollow viscus perforation.

Materials and Methods: The prospective cohort study was carried out in 50 diagnosed cases of perforation peritonitis admitted at the centre during the study period from November 2017 to October 2018. MPI was calculated for each patient, following which they were stratified into three risk groups- 1, 2 and 3 with scores of ≤20, 21-29 and ≥30, respectively. Post-operative complications, mortality, and duration of hospital stay were analysed. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) software 24.0.

Results: Out of 50 patients included, 36 were male and 14 were female with a mean age of 41.14 years. A total of eight patients suffered mortality. The incidence of mortality in risk Group-1 was 0 out of 29 patients (0%), risk Group-2 was 3 out of 13 patients (23.1%) and risk Group-3 was 5 out of 8 patients (62.5%), respectively and hence MPI was a useful indicator of prediction of mortality in perforation peritonitis patients. The risk factors which had a higher significance in predicting mortality were found to be, organ failure at presentation and the nature of intra-peritoneal exudate with a p-value of 0.029 and <0.001, respectively. In 29 patients, there were no complications and 13 patients had a single complication, 8 patients had multiple complications. The incidence of multiple post-operative complications in a patient in risk Group-1, 2 and 3 were 1 (12.5%), 2 (25%) and 5 (62.5%) patients, respectively. The number of complications in a patient increased as the MPI score increases. Dispersion of duration of hospital stay in discharged patients according to MPI score using Pearsons's correlation, showed statistical significance with the value of r being 0.6214, the p-value being 0.000011. The duration of hospital stay of patients who were discharged, increased as the MPI score increased.

Conclusion: MPI was effective in predicting post-operative complications, mortality and duration of hospital stay in patients with peritonitis due to hollow viscus perforation and hence can be used as an effective tool to facilitate counseling and educate the patient and relatives regarding the expected course of the disease in that particular patient.

Keywords: Organ failure, Laparotomy, Intra-peritoneal exudate, Scoring system

INTRODUCTION

Acute generalised peritonitis due to gastrointestinal hollow viscus perforation is a common surgical condition. The prognosis of peritonitis remains poor despite intensive care treatment and antibiotics. The mortality rate due to peritonitis ranges from 6 to 27% despite recent developments in diagnosis and management [1]. Several scoring systems like Sepsis Severity Score (SSS), Acute Physiology And Chronic Health Evaluation II (APACHE II), Portsmouth-Physiological and Operative Severity Score for the enumeration of Mortality and morbidity (P-POSSUM), Peptic Ulcer Perforation (PULP) score, and Boey's score are present for the prediction of outcome in a patient of peritonitis due to hollow viscus perforation [2-6].

There is no ideal scoring system for the prediction of post-operative outcomes in patients needing emergency surgery. At present, the available scoring systems have a limitation of either having a large number of variables (e.g., SSS, APACHE II, P-POSSUM), or scoring system being specific to peptic ulceration (eg- PULP, Boey). MPI was developed by Wacha H and Linder MM in 1983 [7]. Amongst the various scoring systems, MPI is a simple scoring system with 8 variables, which can be applied to all causes of perforation peritonitis [8].

Realising the need for a simple accurate scoring system in perforation peritonitis, the present study was undertaken to evaluate the MPI scoring system as a predictor of post-operative complications, mortality and duration of hospital stay in patients with peritonitis due to hollow viscus perforation.

MATERIALS AND METHODS

The present study was a prospective cohort study conducted from November 2017 to October 2018 at the Department of Surgery, SDM College of Medical Sciences and Hospital, Sattur, Dharwad, Karnataka, India. The study protocol was approved by the Institutional Ethics Committee (No: SDMIEC:0367:2017 dated 9/11/2017). Informed consent was obtained from all the study patients.

The sample population of 50 patients comprised all consecutive patients who had perforation peritonitis meeting the inclusion criteria. All the patients were willing to be part of the study and no patients were lost to follow-up.

Inclusion criteria: All the adult patients who have undergone laparotomy with clinical suspicion and investigatory support for the diagnosis of peritonitis due to hollow viscus perforation during the study period. Patients with age between 16 years and 75 years.

Exclusion criteria: Patients with the age of <16 years and >75 years; Patients with primary peritonitis; Peritonitis due to trauma with other associated solid organ, vascular and neurological injuries; Patients who were managed without surgery; Peritonitis patients with laparotomy were done elsewhere and transferred to continue the treatment.

Procedure

Diagnosis of peritonitis due to hollow viscus perforation was made by history, clinical examination, and appropriate radiological investigations. The MPI score [Table/Fig-1] of each patient was calculated at the end of the planned surgical procedure [9]. The scoring of parameters such as the nature of intra-peritoneal exudate features of malignancy, and organ of perforation was based on intra-operative findings. Patients were categorised into three risk groups according to MPI score [Table/Fig-2]. Patients were followed up post-operatively for post-operative complications till the outcome; that is, mortality or discharge.

Risk factor	Score
Age >50 years	5
Female sex	5
Organ failure at presentation*	7
Malignancy	4
Origin of sepsis not colonic	4
Diffuse generalised peritonitis	6
Pre-operative duration of peritonitis >24 hours	4
Nature of intraperitoneal exudate	
Clear	0
Cloudy, purulent	6
Faecal	12

[Table/Fig-1]: Mannheim Peritonitis Index (MPI).
*Organ failure criteria
- Kidney: creatinine >177 µmol/L
- Urea >167 µmol/L
- Oliguria <20 ml/h
- Lung: pO_2 <50 mmHg
- pCO_2 >50 mmHg
- Shock: hypodynamic or hyperdynamic
- Intestinal obstruction: Paralysis >24 hours or complete mechanical ileus

Risk group	MPI score
1	≤20
2	21-29
3	≥30.

[Table/Fig-2]: Risk groups according to MPI score.

STATISTICAL ANALYSIS

Statistical analyses were done using SPSS Version 24.0. Armonk, NY: IBM Corp. Descriptive statistics were used and results were expressed in terms of frequency and percentages. Chi-squared test and Fisher's-exact test were used for intergroup comparisons. The level of significance was fixed at a p-value of <0.05.

RESULTS

A total of 50 patients were included in this study. A total of 35 (70%) belonged to the age group of 18-50 years, and 15 (30%) belonged to the age group of 51-75 years [Table/Fig-3]. There were 36 (72%) males and 14 (28%) females. Organ failure at presentation to the hospital was present in 15 (30%) patients. A total of 15 (30%) patients presented with localised peritonitis and 35 (70%) patients presented with generalised peritonitis. The majority of the patients had a perforation in the appendix, duodenum or ileum [Table/Fig-4]. The preoperative duration of peritonitis was >24 hours in 44 (88%) patients and ≤ 24 hours in 6 (12%) patients. Type of intraperitoneal exudate was clear in 20 (40%) patients, purulent in 20 (40%) patients and faecal in 10 (20%) patients. None of the patients in the study group had perforation due to malignancy.

	Minimum	Maximum	Mean±Sd
Age (years)	18	75	41.14±16.40
MPI score	10	38	21.18±7.54

[Table/Fig-3]: Patients' baseline and demographic characteristics.

Site of perforation	Frequency (%)	Mortality (%)
Appendix	16 (32%)	1
Duodenum	12 (24%)	1
Ileum	10 (20%)	5
Stomach	8 (16%)	0
Colon	3 (6%)	1
Jejunum	1 (2%)	0
Total	50 (100%)	8

[Table/Fig-4]: Site of perforation in patients in the study.

A total of eight patients of the study population suffered mortality. The incidence of mortality in each risk group was analysed and we concluded that MPI is a useful indicator of prediction of mortality in perforation peritonitis patients [Table/Fig-5]. The risk factors which had a higher significance in predicting mortality were found to be, organ failure at presentation and the nature of intraperitoneal exudate [Table/Fig-6].

Group	Patients (N=50)	Mortality
Group-1	29 (100%)	0 (0%)
Group-2	13 (100%)	3 (23.1%)
Group-3	8 (100%)	5 (62.5%)

[Table/Fig-5]: Prediction of mortality for each MPI risk group.

Risk factor	Number of patients N=50	Death N=8	p-value (Chi-square and Fisher's-Exact Test)
Age >50 years	15	4	0.178
Female sex	14	3	0.614
Organ failure at presentation	15	5	**0.029**
Malignancy	0	0	-
Origin of sepsis not colonic	47	7	0.398
Diffuse generalised peritonitis	35	7	0.239
Preoperative duration of peritonitis >24 hours	44	8	0.572
Nature of intraperitoneal exudate			**<0.001**
Clear	20	1	
Cloudy, purulent	20	1	
Faecal	10	6	

[Table/Fig-6]: Distribution of MPI variables among patients who had mortality.

The post-operative complications that were encountered in this study were pneumonia (n=9), Surgical Site Infection (SSI) (n=8), Acute Kidney Injury (AKI) (n=9) [Table/Fig-7]. A total of 29 patients had no complications and 13 patients had a single complication, eight patients had multiple complications. The incidence of multiple post-operative complications in a single patient increases as the MPI score increases [Table/Fig-8].

Complication	Risk Group-1 (%)	Risk Group-2 (%)	Risk Group-3 (%)	Total incidence (%)
Pneumonia	3 (37.5)	1 (12.5)	5 (33.3)	9 (29)
SSI	3 (37.5)	1 (12.5)	4 (26.6)	8 (25.8)
AKI	1 (12.5)	5 (62.5)	3 (20)	9 (29)
Fistula	0	0	2 (13.3)	2 (6.4)
Resurgery	0	1 (12.5)	0	1 (3.2)
Abdominal collection	1 (12.5)	0	0	1 (3.2)
Total number of complications	8 (100%)	8 (100%)	14 (100%)	30 (100%)

[Table/Fig-7]: Post-operative complication in each risk group.
AKI: Acute kidney Injury; SSI: Surgical site infection

Number of postoperative complication in a single patient	Number of risk Group-1 patients	Number of risk Group-2 patients	Number of risk Group-3 patients	Total patients
No complication	22	7	0	29
One complication	6	4	3	13
Two complications	1	2	4	7
Four complications	0	0	1	1
Total patients	29	13	8	50

[Table/Fig-8]: Prediction of postoperative complication for each MPI risk group.

Dispersion of duration of hospital stay according to MPI score using Pearsons's correlation, showed statistical significance with the value of r being 0.6214, the p-value being 0.001 [Table/Fig-9].

Group	Number of patients	Number of discharged patients (%)	Mean±SD (days)	p-value
Group-1	29	29 (100)	6±2.25	**0.001**
Group-2	13	10 (76.9)	11±4.71	
Group-3	8	3 (37.5)	19±6.64	

[Table/Fig-9]: Average duration of hospital stay (in days) in discharged patients for each MPI risk group.
Pearsons corelation was used

DISCUSSION

In the present study, there were eight post-operative mortalities i.e., Group-1 patients had a mortality of 0%, Group-2 patients had a mortality of 23.1%, and Group-3 patients had a mortality of 62.5%. MPI was a useful indicator of the prediction of mortality in perforation peritonitis patients. Out of the 42 recovered and discharged patients, the duration of hospital stay increased as the MPI score increased.

MPI index has been used as an effective tool for the prediction of post-operative mortality. In a prospective study of 80 patients conducted by Basavaraju SM et al., patients with MPI scores of <21 had 0% mortality, scores with 21-29 had 3.7% mortality and scores >29 had 42% mortality. Age >50 years (p-value 0.02) and organ failure at admission pre-operatively (p-value <0.001) were found to be statistically significant in predicting mortality [10]. The findings of this study corroborate the findings of the present study.

In a prospective study conducted by Rongpi R et al., No mortality was seen with MPI less than 21, patients with MPI scores 21 to 29 had a mortality rate of 40% whereas with MPI score more than 29 mortality rate was of 60%. The mean days of hospitalisation for those who survived were 12.43±7.1 days. Preoperative duration of peritonitis, diffuse generalised peritonitis, organ failure on admission the origin of sepsis not colonic and intraperitoneal exudate (cloudy/purulent, feculent) carried more significance in predicting both morbidity and mortality in the post-operative period than the other variables [11].

In a longitudinal observational cohort retrospectively study, conducted by Gueiros LDS et al., including 75 patients, the mortality percentage was 14.67%. They found that older than 50 years, those with the presence of malignancy and patients with organ dysfunction had statistical significance for mortality, with p<0.05 in their study [12].

In a prospective study of 125 patients done by Karki OB et al., the overall mortality rate was 9% and morbidity was 43%. MPI score of ≤ 20 had no mortality, 21-29 had 14% mortality and ≥ 30 had a mortality of 46%. Among all the variables of MPI, generalised peritonitis, organ failure at the time of admission, and type of intra-peritoneal exudate was more significant in predicting mortality and morbidity [13].

Muralidhar VA et al., conducted a prospective study of 50 patients with an overall mortality of 14% and morbidity of 38%. MPI scores of ≤20, 21-29, and ≥30 had a mortality of 5%, 14%, and 50%, respectively. Patients with an MPI score of >25 were associated with a 6.45 times higher risk of mortality (p=0.03), and a 5.72 times higher risk of morbidity (p=0.005) when compared to patients with a score of ≤ 25 [14].

A total of 50 patients with peritonitis participated in a prospective observational study conducted by Patil VA et al., and found that the mortality rate was 40% with MPI score >29. The mortality rate was 5.26 % in MPI 21-29. There was no mortality when the MPI score was <21. The SSI was the common morbidity in patients with MPI <21 and respiratory complications were seen commonly in MPI >21 [15].

The above studies have similar results to the present study concerning mortality, post-operative complications and duration of hospital stay. Common results in all studies are that the mortality rate is >40% when the MPI score of the patient is >29. Out of the eight components of MPI, organ failure at admission is found to carry more significance in predicting mortality [9-15].

MPI can be used to guide clinical decision-making in patients with peritonitis by assessing the severity of peritonitis, identifying high-risk patients, and guiding treatment decisions including the choice of antibiotics and the duration of hospital stay. Hence, it should be used routinely in clinical practice.

Limitation(s)

As this study was conducted in a tertiary care hospital, which is a referral centre for the surrounding districts, the sample population may not depict the target population. MPI may not be appropriate for all patients with peritonitis, particularly those with atypical presentations or underlying medical conditions that may confound the interpretation of the score.

CONCLUSION(S)

The MPI scoring system is a simple and effective tool for predicting post-operative complications, mortality and duration of hospital stay for that individual patient at presentation to the hospital. Higher the MPI score, the higher the post-operative complications, mortality and duration of hospital stay. MPI scoring system therefore can be used as an effective tool to facilitate counselling the patient and relatives.

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