

ORIGINAL RESEARCH

Role of Mannheim Peritonitis Index as a Prognostic Tool to Predict the Outcome in Patients with Hollow Viscous PerforationShubham Jaiswal¹, Kulwant Singh², Chirag S. Dausage³, Rahul Patel²¹Junior Resident, ²Associate Professor, ³Assistant Professor, Department of General Surgery, Peoples College of Medical Sciences and Research Center, Bhopal**Corresponding Author**Dr Rahul Patel
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ABSTRACT**Background-** MPI is a perforation specific score which allow prognostication of patients with hollow viscous perforation peritonitis. We aimed to study the role of Mannheim Peritonitis Index to predict the outcome in patients with hollow viscous perforation and to evaluate the prognostic value Of MPI score in patients with hollow viscous perforation.**Methodology-** This study was conducted as a prospective cohort study on Patients with peritonitis due to hollow viscous perforation at Department of Surgery, People's Hospital Bhopal, during the study period of 18 months. MPI score was calculated for each patient and patients were followed till their hospital stay and outcome was assessed in terms of Mortality and morbidity.**Results-** This study was conducted on a total of 50 patients with mean age of 40.02±12.964years and we reported male predominance in our study for peritonitis with male: female ratio of 2.13:1.

Mean Mannheim peritonitis index (MPI) score was suggestive of mild, moderate and severe peritonitis in 46%, 42% and 12% cases respectively. We observed a statistically significant association of severe peritonitis with shock, acute renal failure and mortality (p<0.05). The area under the curve (0.806; 95% CI- 0.625-0.987) showed MPI to be a good predictor of outcome (p<0.05).

Conclusions-Mannheim Peritonitis Index is a simple, rapid and cost effective tool based upon the clinical and preoperative parameters, which helps in predicting the mortality in perforation peritonitis with good accuracy. MPI is sensitive and specific indicator of mortality with few false positive and false negative cases. Increase in MPI helps in not only stratification of patients as mild, moderate and severe peritonitis but also predict the mortality in such cases.

Keywords- MPI, peritonitis, outcome, mortality, morbidity, complications.

INTRODUCTIONPeritonitis is described as an inflammation of peritoneal cavity, which may be categorized based upon the underlying cause (primary or secondary), presence of infection (septic or non-septic) or extent of the involvement (generalized or localized).^[1] Peritonitis secondary to perforation of hollow viscera is one of the most common emergency encountered in surgical

practice.^[2] It is potentially a life threatening condition and hence should be managed immediately.^[3] Depending upon the cause, the mean age of presentation of patients with hollow viscous perforation is 45 to 60 years globally, however, the age at presentation is usually earlier in India. Often, the patients present late when the peritonitis is generalized and become contaminated with fecal or purulent material.^[2] The patients are managed conservatively or surgically depending upon the cause of hollow viscus perforation. The accurate diagnosis and its management is still challenging for the treating surgeon.^[3] Despite the introduction of new antibiotics, advancement in medical and surgical techniques, the mortality associated with perforation peritonitis remains high.^[4]

The outcome as well as prognosis of patients following hollow viscous perforation peritonitis depend upon multiple factors, which may be patient related (such as age, sex etc.); or disease related factors (septic/aseptic, malignancy, organ failure etc.); condition of the patient at the time of presentation, availability of diagnostic and therapeutic interventions etc.^[3] Early identification and immediate management of patients presenting with perforation peritonitis helps in providing them aggressive surgical approach.^[5-8] To prognosticate the patients based on outcome, it is essential to categorize the patients into different risk groups.^[3] The risk stratification have helped in decision making and improving the management of severely ill patients with hollow viscous perforation peritonitis.^[9]

Various scoring systems have been proposed to assess the prognosis and outcome in cases with perforation peritonitis, which can be broadly divided into disease independent scores and peritonitis specific score. Disease specific scores include acute physiological and chronic health evaluation score (APACHE II), the physiological and operative severity score for enumeration of mortality and morbidity (POSSUM), sepsis score, simplified acute physiology score (SAPS II).^[3,10] The individual scoring systems have their own advantages and their limitations.^[3] Their main disadvantage is that these score are complex to use and used in assessing the prognosis in critically ill patients admitted in ICU. These methods evaluate prognosis and outcome based upon the laboratory parameters of seven organ systems.^[3,10]

Peritonitis-specific scores include the peritonitis index altona (PIA) II and Mannheim peritonitis index (MPI).^[3,10] The MPI was developed by Wacha et al in 1987 after retrospectively analyzing the data from 1253 patients with perforation peritonitis. The score utilize 8 parameters to determine the prognosis and evaluate the outcome. It is an easy to use, simple, specific, quantitative and reproducible scoring system, which allow prognostication of patients with hollow viscous perforation peritonitis.^[11] Literature suggest that utilization of these scoring system may help in salvaging the life of critically ill patients and counselling of patients and relatives with respect to prognosis.^[12] The scoring system is validated scale with the sensitivity and specificity of this scoring system for predicting death at threshold index score of 26 has been documented to be 86% and 74% respectively with diagnostic accuracy of 83%.^[3] The scale is less time consuming, practical, does not require the use of any sophisticated equipment and can be used even in primary health care settings. Thus, it is an ideal scoring system to evaluate the prognosis of this life threatening condition in resource poor settings in low middle income countries like India.^[3] Majority of previous studies have been done in Western countries. Literature assessing the utility of MPI in India is scarce. The present study was therefore conducted at tertiary care centre to study the role of Mannheim Peritonitis Index to predict the outcome in patients with hollow viscous perforation and to evaluate the prognostic value Of MPI score in patients with hollow viscous perforation.

METHODOLOGY

This study was conducted as a prospective cohort study on Patients with peritonitis due to hollow viscous perforation at Department of Surgery, People's College of Medical Sciences

and Research Centre and associated People's Hospital Bhopal, during the study period of 18 months i.e. from 1st December 2020 to 30th May 2022. All Patients with peritonitis due to hollow viscous perforation who are operated, belonged to more than 12 years of age and presented with isolated hollow viscous perforation due to trauma were included in the study. However, patient of hollow viscous perforation who are not operated, who discontinue the treatment at any stage; with Primary bacterial Peritonitis and colonic perforation and patients with Traumatic hollow viscous perforation with associated other solid organ injuries were excluded.

This study was approved from Institute's ethical committee. All the patients fulfilling inclusion criteria were enrolled and informed consent in the language best understood by them was obtained. Detailed data regarding sociodemographic variables and clinical history was obtained from all the study participants and documented. The patients were then subjected to detailed general clinical and systemic examination.

Further, the patients were subjected to following blood investigations such as Complete blood picture with ESR, Renal function tests, Random blood glucose, Serum amylase/ lipase, Serum electrolytes (Na/K/Cl), Arterial blood gas analysis, Blood culture etc. Abdominal Paracentesis was done and it was subjected to Morphological Appearance (Clear/ Purulent/ Feculent) and culture & Sensitivity. Apart from this, X-ray Erect Abdomen, X-ray Chest and USG abdomen was also done in few cases. Based upon the clinical findings and findings of the investigations, diagnosis was established and patients were managed surgically after initial stabilization. In immediate post operative period, MPI score was calculated for each patient.^[11] MPI score ranged from 0 to 47 and based on the condition, patients were stratified into three groups

- MPI < 21 = Mild Peritonitis
- MPI 21-29 = Moderate Peritonitis
- MPI >29 = Severe Peritonitis

Patients were followed till their hospital stay and outcome was assessed in terms of Mortality/ survival (discharge), Morbidity, duration of ICU stay and Duration of Hospital Morbidity was assessed in terms of postoperative complications such as Wound infection, Wound Dehiscence, Suture/ Anastomotic leak, Intraabdominal collection, Pulmonary Complications, Acute renal failure and Septic Shock.

STATISTICAL ANALYSIS

Data was compiled with the help of MsExcel and analyzed using IBM SPSS software version 20. Continuous data was represented as mean and Standard deviation whereas categorical data was expressed as frequency and proportions. Association of outcome with various factors was assessed using Chi square test (for categorical data) and independent t test or ANOVA (for continuous data). Correlation of outcome with various factors was assessed using Pearson correlation coefficient. Area under the curve and ROC analysis was done to identify the cutoff and utility of MPI for determining outcome. P value of less than 0.05 was considered statistically significant.

RESULTS

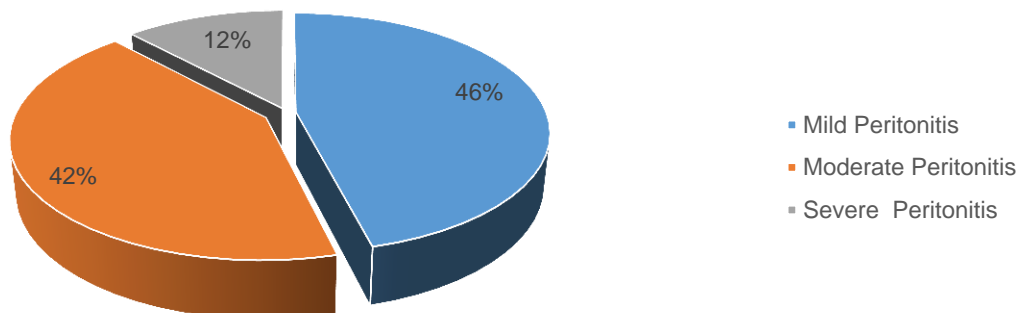
This study was conducted on a total of 50 patients presenting with peritonitis due to hollow viscous perforation with mean age of 40.02±12.964years and mean time of presentation after onset of symptoms was 2.08±1.209 day.

Table 1- Distribution of patients according to baseline variables

Baseline variables		Frequency(n=50)	Percentage
Age	<20	4	8.0
	21-30	9	18.0
	31-40	13	26.0
	41-50	14	28.0
	>50	10	20.0
Sex	Male	34	68.0
	Female	16	32.0
Clinical features	Pain abdomen	50	100.0
	Vomiting	31	62.0
	Fever	15	30.0
	Abdominal Distention	10	20.0
	Diarrhea	4	8.0
	Constipation	4	8.0
	Tenderness	50	100.0
	Rigidity	49	98.0
	Obliteration of liver dullness	44	88.0
	Bowel Sounds absent	3	6.0
Site of obstruction	Gastric	2	4.0
	Duodenal	26	52.0
	Jejunal	2	4.0
	Ileal	12	24.0
	Appendix	6	12.0
	Colonic	2	4.0

Majority of patients belonged to 41 to 50 years of age (28%), and we reported male predominance in our study for peritonitis with male: female ratio of 2.13:1. All the patients with hollow viscous perforation presented with pain in abdomen and tenderness. However, rigidity was noted in 98% cases and 88% presented with Obliteration of liver dullness. Bowel sound were absent in 6% cases in our study population. The most common site of hollow viscous perforation was duodenum (52%), followed by ileal perforation in 24% and perforated appendix (12%).

Figure 1- Distribution of patients according to Mannheim peritonitis index



Mean Mannheim peritonitis index (MPI) score in patients with hollow viscous perforation peritonitis was 21.88 ± 7.556 . Based upon this scale, mild, moderate and severe peritonitis was present in 46%, 42% and 12% cases respectively.

Table 2- Association of Mannheim peritonitis index with complications, length of stay and outcome

Complications, length of stay and outcome			Mannheim peritonitis index						P value
			Mild Peritonitis		Moderate Peritonitis		Severe Peritonitis		
			n	%	n	%	n	%	
Complications	Pulmonary Complication	B/L lower lobe consolidation to ARDS	0	0.0	0	0.0	1	16.7	0.062
		Bronchopneumonia	0	0.0	1	4.8	0	0.0	
		Pleural effusion	2	8.7	5	23.8	0	0.0	
	SSI		3	13.0	5	23.8	0	0.0	0.33
	Intra-abdominal abscess		0	0.0	1	4.8	0	0.0	0.49
	Wound dehiscence		0	0.0	2	9.5	0	0.0	0.24
	Shock		0	0.0	1	4.8	2	33.3	0.009
	ARF		0	0.0	0	0.0	1	16.7	0.024
No complication		18	78.3	10	47.6	3	50.0	0.09	
Length of hospital stay	<7 days		2	8.7	1	4.8	2	33.3	0.06
	8-14 days		16	69.6	7	33.3	1	16.7	
	15-21 days		3	13.0	7	33.3	2	33.3	
	22-28 days		2	8.7	3	14.3	1	16.7	
	>28 days		0	0.0	3	14.3	0	0.0	
	Mean \pm SD		12.04 \pm 5.2		17.3 \pm 9.4		11.2 \pm 8.1		
Outcome	Cured		22	95.7	18	85.7	3	50.0	0.016
	Death		1	4.3	3	14.3	3	50.0	

In present study, we observed a statistically significant association of severe peritonitis with shock and acute renal failure ($p < 0.05$). We observed no significant association of MPI with

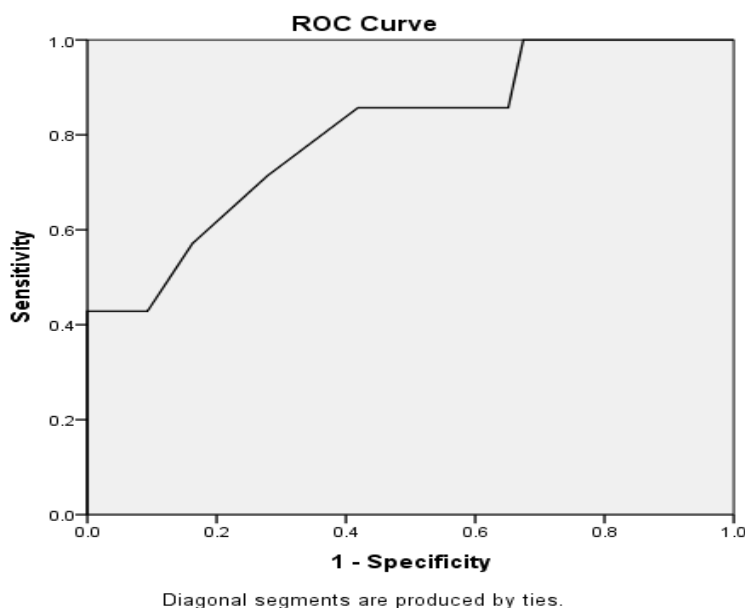
length of hospital stay ($p>0.05$). Mortality was noted in significantly higher proportions of patients with severe peritonitis as per MPI ($p<0.05$).

Table 3- Area under the curve for determining outcome

Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval		Cutoff	Sensitivity	Specificity
			Lower Bound	Upper Bound			
.806	.092	.010	.625	.987	25.5	71.4	72.1

The area under the curve (0.806; 95% CI- 0.625-0.987) showed MPI to be a good predictor of outcome ($p<0.05$). The cutoff of MPI for predicting mortality was 25.5, at which the sensitivity was 71.4% and specificity was 72.1%.

Figure 2- ROC curve for determining outcome



DISCUSSIONS

Peritonitis due to perforation of hollow viscera is one of the most common emergency condition, which is potentially life threatening requiring immediate management.^[2,3] The outcome in case of perforation peritonitis depend upon multiple factors such as age, sepsis, comorbidities, availability of diagnostic and therapeutic interventions etc.^[3] To determine the prognosis and outcome in cases following perforation peritonitis, various scoring system have been used.^[3,10] The present study was conducted to study the role of Mannheim Peritonitis Index, a peritonitis specific scoring system to predict the outcome in patients with hollow viscous perforation. This tool was developed by Wacha et al in 1987 and the score utilizes 8 parameters to determine the prognosis and evaluate the outcome.^[11] This scoring system help in salvaging the life of critically ill patients as it determine the prognosis and may be helpful in predicting the outcome.^[12] This is a validated scoring system, which is based upon 8 clinical parameters. The reported sensitivity of MPI is 86% whereas specificity is 74% at the cut off of 26.^[3] In present study, the score depicted mild, moderate and severe peritonitis was present in 46%, 42% and 12% cases respectively with mean MPI score of 21.88 ± 7.556 . Age and sex are considered as important prognostic factor in determining the outcome of the patients following hollow viscous perforation peritonitis.^[3]

According to Dani et al, the mean age of patients may vary from 45 to 60 years depending upon the cause, however, the mean age at presentation is reported to earlier in India as compared to Western World.^[2] In our study, the mean age of patients with perforation

peritonitis due to hollow viscous perforation was 40.02 ± 12.96 years and majority of patients belonged to 41 to 50 years of age (28%). About 68% patients were males suggesting male predominance for hollow viscous perforation with male: female ratio of 2.13:1.

Perforation peritonitis if managed timely may save life of the patients. In our study, mean duration of hospital stay was 14.16 ± 7.898 days and though the length of hospital stay was higher in patients with moderate and severe peritonitis, the observed difference was statistically insignificant ($p > 0.05$). No association between length of hospital stay and MPI could be due to early mortality of patients with severe perforation peritonitis claiming spurious relation between the two. However, Ramaswamy et al documented higher MPI to be significantly associated with higher ICU stays.^[13] Stephen et al also reported MPI to be good predictor of mortality and it was strongly associated with prolonged ICU stay ($p = 0.004$).^[14] Pandit et al also reported MPI severity to be significantly associated with prolonged ICU stay.^[15]

MPI helps in determining the prognosis of patients with perforation peritonitis. It is a peritonitis specific index developed based upon the clinical factors. In our study mortality was noted in 7 cases and the cause of death was cardiogenic shock and septicemic shock in 2 cases each whereas the cause was Sepsis with ARDS, Septic shock and Septic shock with ARF in 1 case each. MPI was significantly helpful in determining the mortality ($p < 0.05$). The area under the curve (0.806; 95% CI- 0.625-0.987) showed MPI to be a good predictor of outcome ($p < 0.05$). The sensitivity and specificity of MPI was 71.4% and 72.1% respectively at the cut off of 25.5. The findings of present study was supported by findings of Subramani et al in which the authors found MPI to be helpful in predicting outcome and guiding management.^[16] Neri et al reported mortality in 25.2% cases and at the cut off of 21, the sensitivity and specificity of MPI in determining mortality was 86% and 59% respectively.^[17] Nachiappan et al documented AUC of MPI to be 0.95 and at the cut off of 29. MPI had accuracy of 82.8%.^[12] In another study by Sharma et al, the authors documented significant increase in mortality with increase in MPI and at the cut off of MPI of 27, sensitivity was 66.67% and specificity was 100%.^[18] Stephen et al reported the sensitivity of 90% and specificity of 57% at $MPI \geq 27$.^[14] Kamalraj et al reported AUC of MPI for predicting mortality as 0.973 with sensitivity and specificity of 88.5%, and 91.70% respectively at the cut off of 27.^[19]

CONCLUSIONS

Mannheim Peritonitis Index is a simple, rapid and cost effective tool based upon the clinical and preoperative parameters, which helps in predicting the mortality in perforation peritonitis with good accuracy. The cut off of MPI for predicting mortality is 25.5, and at this cut off, the MPI is sensitive and specific indicator of mortality with few false positive and false negative cases. Increase in MPI helps in not only stratification of patients as mild, moderate and severe peritonitis but also predict the mortality in such cases. However, MPI is not useful in determining the length of hospital stay.

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