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Original Research Article

Evaluation of Mannheim peritonitis index to predict outcome of patients with hollow viscus perforation

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ABSTRACT

Background: Acute generalized peritonitis from gastrointestinal hollow viscus perforation is a potentially life-threatening condition. Mannheim peritonitis index (MPI) is a specific scoring system that facilitates early identification of patients with severe peritonitis for aggressive surgical approach and improved outcomes.
Methods: A prospective observational study in 60 patients attending surgical emergency unit with perforation peritonitis was conducted to analyse the predictive capacity of MPI. MPI score was categorized into 3 groups: <21, 21 to 29 and >29. Data was compared for predicting mortality and morbidity. P value, chi square test and 95% CI were used as statistical tools.
Results: Two thirds of 60 patients studied were younger than 50 years of age. Prognosis was poorer in patients above 50 years with age. 80% presented after 24 hours. Ileal perforation was the commonest etiology. Morbidity and mortality were worst in patients with MPI score >29.
Conclusions: Mannheim peritonitis index is disease specific, easy to apply and effective scoring system predicting the outcome in perforation peritonitis, with increasing MPI score being directly proportional to higher mortality and morbidity of the patient.

Keywords: Mannheim peritonitis index, Hollow viscus perforation, Peritonitis

INTRODUCTION

Peritonitis is an inflammation of the peritoneum, the thin tissue that lines the inner wall of the abdomen and covers most of the abdominal organs. Peritonitis may be localized or generalized, and may result from infection or from a non-infectious process.

Peritonitis due to hollow viscus perforation continues to be one of the most common surgical emergencies and a potentially life-threatening condition attended by a surgeon on emergency duty. It can be attributed to various risk factors like *Helicobacter pylori* infection, NSAIDs use, enteric fever and several others. Causes vary from the one requiring immediate surgical intervention in selected cases to that requiring conservative management in others. Its accurate diagnosis and management is still a challenge to every surgeon.

The prognosis and outcome of peritonitis depend upon the interaction of many factors, including patient-related factors, disease-specific factors, and diagnostic and therapeutic interventions. Categorizing patients into different risk groups would help prognosticate the outcome, select patients for intensive care and determine operative risk, thereby helping to choose the nature of the operative procedure, e.g. damage control versus definitive procedure.

Various scoring systems have been used to assess the prognosis and outcome of peritonitis. These systems can be broadly divided into two groups.

Disease-independent scores: for evaluation of serious patients requiring care in the intensive care unit (ICU) such as the acute physiological and chronic health evaluation score (APACHE II), simplified acute physiology score (SAPS II), the sepsis score, and the physiological and operative severity score for enumeration of mortality and morbidity (POSSUM).

Peritonitis-specific scores: such as the Mannheim peritonitis index (MPI) and the peritonitis index altona (PIA) II.[1]

Utilization of scoring systems would be of great help in salvaging a priceless life of a patient by risk stratification with preferential care and by surgical audit.

Even when all these elaborate and sophisticated scoring systems exist, they all have drawbacks and limitations of varying degree. In general, the statistical analysis underpinning the variables selected, and the relative weights given, often come from studying large American databases of patients treated in the early 1980s. These may not be entirely applicable to the Indian population.

Mannheim peritonitis index (MPI) was developed by Wacha et al.[2] It was developed based on the retrospective analysis of data from 1253 patients with peritonitis, utilizing 8 parameters of prognostic relevance.

Detailed study of MPI was done by Billing et al in 7 different centers and their data was compared. Billing et al conducted a study of 2003 patients from seven centers in three European countries to assess the reliability of the MPI and its predictive power for different populations. The prevalence of risk factors varied considerably between the groups. For a threshold index score of 26, the sensitivity was 86% (range 54 to 98), specificity 74% (range 58 to 97) and accuracy 83% (range 70 to 94) in predicting death. For patients with a score <21 the mean mortality rate was 2.3% (range 0 to 11), for score 21 to 29 (22.5%) (range 10.6 to 50) and for score >29 (59.1%) (range 41 to 87).[3]

MPI appears to be more practical than other scoring systems, with an acceptable specificity and sensitivity. It is less time consuming and cost efficient, compared to other scoring systems. It does not require use of any sophisticated investigations or diagnostic equipment, making it an ideal scoring index that can be used even at the level of a primary health care setup. MPI is ideal for use in a country like India, where most of the critical care measures are meagerly available and unaffordable by the majority of citizens.

The purpose of this study is to evaluate MPI as a clinical tool in stratifying patients with peritonitis due to hollow viscous perforation according to individual surgical risk and identification of high risk patients, and to predict the risk of mortality and morbidity in these patients.

METHODS

The study was conducted in Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar on 60 patients who visited surgical emergency unit between February 2018 and January 2019, aged above 15 years, with clinical suspicion and investigatory support for the diagnosis of peritonitis due to atraumatic spontaneous hollow viscus perforation who were later confirmed by intra operative findings were included. The study was clinical, prospective and observational.

Initial preoperative work up and resuscitation with intravenous fluids, antibiotics, analgesics, and nasogastric decompression was done in all the cases. A detailed history, thorough clinical examination, necessary investigations and surgical procedures were performed in each case with proper informed and written consent as appropriate. All patients underwent complete routine hematological and biochemical work-up and radiological assessment. Diagnostic peritoneal aspiration was done by four quadrant method and the fluid was sent for culture and sensitivity and microscopic examination. Foley's catheterization was done to measure the urine output hourly. Site of peritonitis secondary to hollow viscus perforation was diagnosed during surgery and was dealt with appropriate surgical procedure and post-operative or ICU care, as necessary. The MPI was applied along with other clinical and biochemical parameters recorded. MPI score prediction was categorized into 3 groups: <21, 21 to 29 and >29. Patients were followed up postoperatively till the outcome i.e. mortality, morbidity and discharge.

The following parameters were recorded carefully for the calculation of the MPI.[2]

Table 1: MPI score.

Study variable	Adverse factor	Points	Favorable factor	Points
Age (in years)	≥50	5	<50	0
Sex	Female	5	Male	0
Organ failure	Present	7	Absent	0
Malignancy	Present	4	Absent	0
Evolution time (hours)	>24	4	<24	0
Origin of sepsis	Non colonic	4	Colonic	0

Continued.

Study variable	Adverse factor	Points	Favorable factor	Points
Extension of peritonitis	Generalized	6	Localized	0
Character of exudate	Purulent	6	Clear	0
	Fecal	12		

Definition of organ failure: kidney: creatinine level >177 umol/l, urea level >167 mmol/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 obstruction.

The data regarding patient particulars, diagnosis, investigations, and surgical procedures was collected and subjected to statistical methods like mean, standard deviation, proportion, and percentage and chi square test for proportion. Observations made by the MPI scoring system were interpreted to draw conclusions.

RESULTS

In the study population of 60 subjects, 39 patients (65%) were younger than 50 years of age and 21 patients were 50 years of age and older. Prognosis is poorer in patients with age above 50 years. 14 patients were females and 46 were male.

Of the total 60 patients, 12 presented with duration of peritonitis <24 hours and 48 presented with evolution time ≥24 hours (Figure 1). Prognosis is poorer in patients presenting after an onset period of 24 hours, most of whom already having features of organ failure at the time of presentation to the hospital. 27 patients presented with features of organ failure at the time of admission.

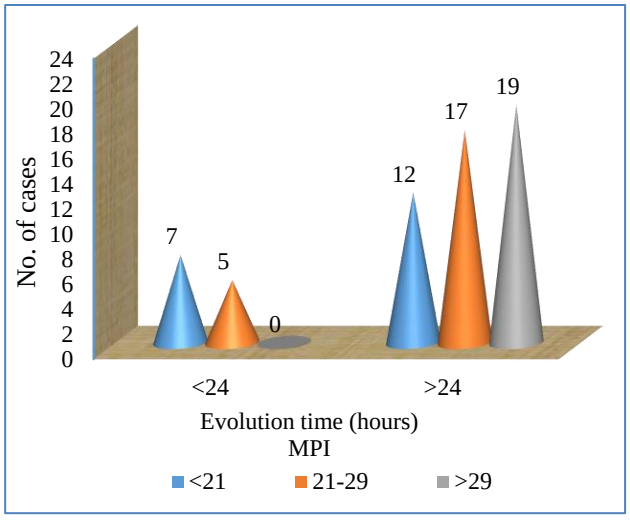

Figure 1: Distribution of patients according to evolution time and MPI score.

58 patients had benign pathology while only 2 had active malignancy and MPI >29. Ileal perforation was the commonest etiology of peritonitis (48.3%), followed by gastric (33.33%), colonic (10%), jejunal (6.67%) and duodenal (1.67%) perforation.

42 patients out of the total study population suffered from generalized peritonitis; 18 patients presented with localized peritonitis. Of these, 11 patients had clear peritoneal fluid, while 2 had cloudy, purulent and 25 had feculent exudates as evident on diagnostic peritoneal aspiration (Figure 2).

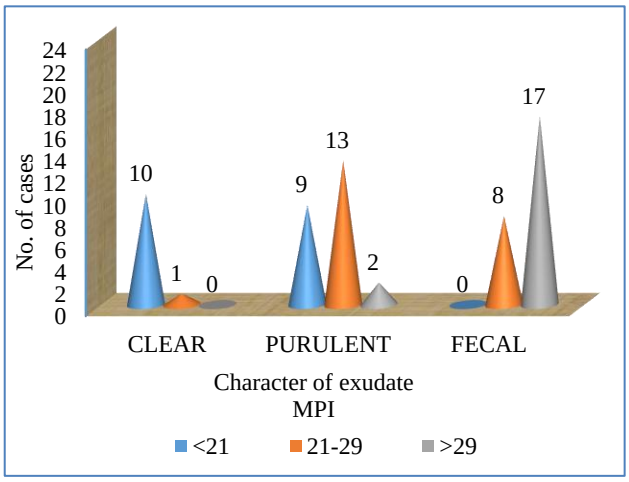

Figure 2: Distribution of patients according to character of exudate and MPI score.

Emergency laparotomy and primary repair of the hollow viscus perforation is effective in 51.67% of patient population, with the rest (48.33%) undergoing damage control or palliative procedures (Figure 3).

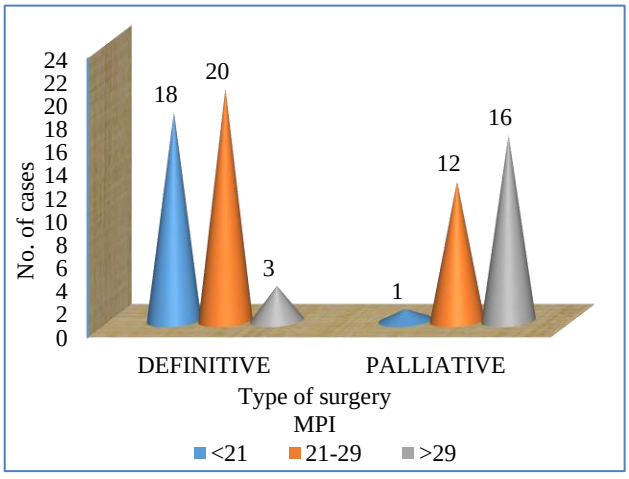

Figure 3: Distribution of patients according to type of surgery and MPI score.

Morbidity and mortality were worse in patients with higher MPI score. Overall, 60% of the total study population had complications (of which 50% expired),

while 40% of the total patients had no complications. Among those who had complications 5.56% had MPI <21, 41.67% had MPI 21-29 and 52.77% had MPI >29. Among those without any complications, 70.83% had MPI <21, 29.17% had MPI 21-29 and none had MPI >29 (Figure 4).

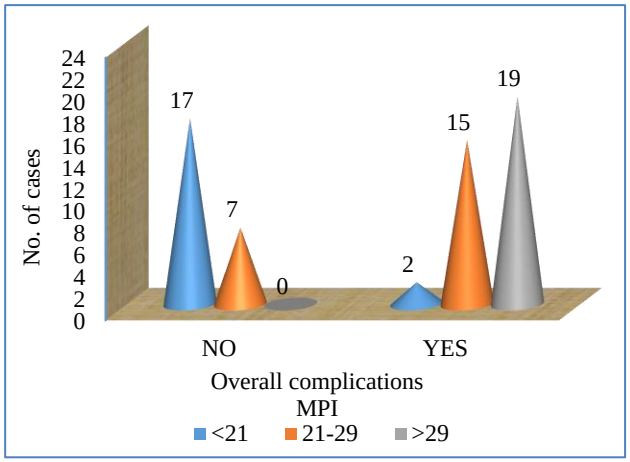

Figure 4: Distribution of patients according to overall complications and MPI score.

Among the total study population, 70% of the patients were discharged with or without any complications, while 30% of the patients had expired. Among those who expired, there was no patient with MPI <21, while 27.78% had MPI 21-29 and 72.22% had MPI >29. Among those who were discharged, 45.24% had MPI <21, 40.48% had MPI 21-29 and 14.28% had MPI >29 (Figure 5).

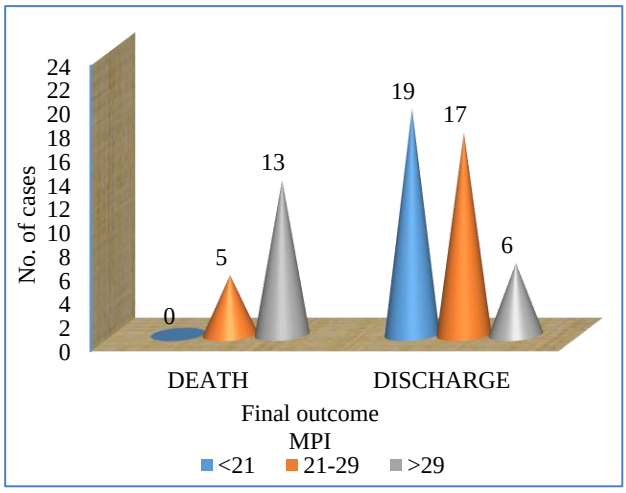

Figure 5: Distribution of patients according to final outcome and MPI score.

DISCUSSION

Peritonitis due to hollow viscus perforation is associated with high mortality rate. Peritonitis remains a hot spot for the surgeons despite advancements in surgical technique and intensive care treatment. The classic clinical features of peritonitis are fever, abdominal pain, nausea, vomiting, rebound tenderness, guarding and rigidity and paralytic ileus. Typical pathophysiologic finding in perforation peritonitis is an exudate high in granulocytes, which may be diffuse or localized. Systemically, there is paralysis of the bowel peristalsis, hemoconcentration occurs, and alterations of the cardiac output due to the shift of fluids and later acidosis. Intrapulmonary shunting, hypoxemia, hypo- or hypercapnia, progressive azotemia, acute tubular injury, weight loss by protein consumption, hypothermia, loss of heat production, and physical exhaustion are other complications that may lead to the death of the patient, if the vicious process is not halted.[4]

Various factors like age, sex, duration, site of perforation, extent of peritonitis and delay in surgical intervention are associated with morbidity and mortality. Despite the surgical treatment and sophisticated ICU care, newer generation antibiotics and an improved understanding of pathophysiology of peritonitis, mortality rate are still very high even in good institutions. A successful outcome depends upon early prognostic evaluation of high-risk patients for more aggressive therapeutic procedures such as radical debridement and source control, extensive intraoperative peritoneal lavage, open management, and planned reoperations.

In our study, 60 patients of hollow viscus perforation peritonitis who got admitted in surgical emergency department were enrolled. Most patients presented with history of abdominal pain, abdominal distension and fever with varying duration. MPI scoring system done in all patients depending on preoperative and intra-operative findings, and patients were categorized into three categories of MPI score those with <21, 21 to 29, >29. Majority (36.6%) of patients had MPI between 21 to 29. 47.3% of patients with MPI score less than 21 developed complications. Complications also developed in 59% of patients with MPI score 21-27 and 63% of patients with MPI score more than 29. Complications include minor (wound infection, paralytic ileus) and major (respiratory, renal, circulatory, post-operative leak) categories.

Ohmann et al reported duodenal ulcer perforation as the comonest cause of peritonitis in their study, while Kachroo et al reported appendicular perforation as the commonest cause in their study. In our study, the most common etiology of peritonitis was ileal perforation seen in 48.33% of patients, followed by gastric (33.33%), colonic (10%), jejunal (6.67%) and duodenal perforation (1.67%).[5,6]

Wacha et al reported that patients who obtained MPI score <21 had a mortality rate of 6% and those with MPI score more than 29 had a mortality rate of 50%.[2] Függer et al reported no mortality below MPI score of 21, between 21 and 29, mortality was 29%, and 100% mortality in patients with MPI score more than 29.[7] Studies showed mortality among patients who obtained

<21 points varied between 0% and 2.3%, in the 21 to 29 point group between 3.85% and 60%, and in patients with score of >29 between 15% and 100%.[8-12] Billing's meta-analysis showed the following mean mortality rates in the groups with <21 points, between 21 and 29 points, and above 29 points: 2.3% (0-11%), 22.5% (10.6-50%), and 59.1% (41-87%), respectively.[3] Other studies have also shown statistically significant relation of morbidity and mortality with increasing MPI score.[13-17] Many studies used different cutoff points for better prediction of mortality. Kusumoto et al showed patients with MPI score of 26 or less have mortality of 3.8%, whereas score of 26 or more had mortality of 41%.[13] Bosscha et al. showed 100% mortality above MPI of 27.[1] Such difference in cutoff values might be due to different demographics and therapeutic options offered to patients at different institutions. In comparison to these studies, our study showed no mortality in patients with MPI less than 21, whereas those patients with MPI score more than 29 had the highest mortality rate of 21.67%. Patient with MPI score ranging from 21 to 29 had mortality rate of 8.33%. Similarly, in our study, morbidity rate for patients with a score <21, 21 to 29, and >29 was 10.53%, 68.18%, and 100%, respectively. The predictions resulting from MPI were reliable, indicating stratification of risk groups can be done by probability intervals.

Qureshi et al studied 126 patients of perforation peritonitis and reported that pre-operative duration of peritonitis >24 hours was significantly associated with poorer outcome.[11] In our study, a total of 80% cases presented after 24 hours of perforation. This delayed presentation can be because of illiteracy among the study population, lack of proper referral services or diagnostic dilemmas due to unavailability of sophisticated investigations at peripheral hospitals. This also explains the high rate of organ dysfunction at the time of admission.

Riquelme et al conducted a study in 176 patients with features of peritonitis. Survival curves of the three subgroups (<21, 21 to 29, and >29) had differences that were statistically significant (p<0.0001). In their study, generalized peritonitis corresponded to 34%. As expected, extension of peritoneal inflammatory process was related with mortality rate. Among survivors, local peritonitis was found more frequently than generalized peritonitis (68% vs 32%), while in non-survivors, the relationship between localized peritonitis and generalized peritonitis was inverted (27% vs 73%).[12] In our study, 42 patients (70%) out of the total study population suffered from generalized peritonitis; 18 patients (30%) presented with localized peritonitis. Among those with generalized peritonitis, 11.9% had MPI <21, 47.62% had MPI 21 to 29 and 40.48% had MPI >29, and those with localized peritonitis, 77.78% had MPI <21, 11.11% had MPI 21 to 29 and 11.11% had MPI >29. Generalized extension of peritonitis correlated with higher MPI scores and higher morbidity and mortality in our study as well.

Malik et al conducted a prospective study involving 101 consecutive patients having generalized peritonitis over a two-year period, and reported that 36 patients had complications, giving an overall morbidity of 36.64%.[14] In contrast, our study showed an overall complication rate of 60%.

The judicious implementation of MPI score may help in stratification of patients and may serve to facilitate identification of high-risk patients requiring damage control surgery, intensive post-operative care treatment as well as to sensitize the treating clinician with the risk of postoperative complication in the patient. This study proves that MPI scoring system is a simple and effective tool for assessing the morbidity and mortality in patients with perforation peritonitis. The outcome of the study is statistically significant by chi-square test with p value <0.001. Duration of pain >24 hours, organ failure on admission, female sex, and feculent exudate were found to be independently significant factors contributing towards poor patient outcome. The assessment of MPI score takes into consideration pre-operative clinical parameters of the patients along with intraoperative confirmation of site of perforation for risk stratification and prediction of morbidity and mortality. However the score does not take into account the risks associated with comorbidities such as chronic illnesses and major systemic disorders which can be considered as limitation of the MPI system.

CONCLUSION

Peritonitis remains a hot spot for the surgeons despite advancements in surgical technique and intensive care treatment. Various factors like age, sex, duration, site of perforation, extent of peritonitis and delay in surgical intervention are associated with morbidity and mortality.

In the management of patients with peritonitis due to hollow viscus perforation, scoring the patients into various risk groups can be beneficial. MPI scoring system is easy score to apply, greatly helpful and convenient in determining the prognosis in such patients and anticipating risks during operation, using which the operating surgeon can predict the possible outcome and the appropriate management can be decided. MPI is much more effective scoring system in predicting the morbidity and mortality in peritonitis due to hollow viscous perforation compared to other available scoring systems. Thus, MPI should be routinely used in prognosticating patients of peritonitis due to hollow viscus perforation.

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