Original Article

Evaluation Of The Mannheim Peritonitis Index In Patients With Perforation Peritonitis

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Abstract

Introduction: Perforation peritonitis is a common cause of emergency admissions in the surgery department, posing significant diagnostic and management challenges. Various scoring systems have been developed to objectively assess patients' conditions at different stages of the disease. At Nepalgunj Medical College Teaching Hospital, Kohalpur, patients with perforation peritonitis from two provinces are frequently encountered, but there has been no study on their morbidity and mortality. Recognizing the need for an accurate and straightforward assessment system, this study aimed to evaluate patients with perforation peritonitis using the Mannheim Peritonitis Index.

Methods: This clinical, prospective, observational study was conducted at Nepalgunj Medical College Teaching Hospital, Kohalpur, from May 2017 to April 2018. It involved 70 patients who underwent emergency exploratory laparotomy for perforation peritonitis. Data on patient details, diagnosis, investigations, and surgical procedures were collected using a case recording form and analyzed using statistical methods such as mean, standard deviation, proportions, percentages, and chi-square tests where applicable.

Results: This study involved 70 cases of non-traumatic hollow viscus perforation peritonitis, with a mean patient age of 45.5±15.5 years (range 17–76). Peptic ulcer perforation was the most common cause, accounting for 49% of cases. Mortality rates were 0%, 12.9%, and 40% for MPI scores of <21, 21-29, and >29, respectively. Statistically significant risk factors for mortality included organ failure (p=0.010), cause of peritonitis (p=0.008), origin of sepsis (p=0.0000), and exudate character (p=0.017). The Mannheim Peritonitis Index (MPI) showed reliable sensitivity (80%), specificity (78.3%), and accuracy (78%). Wound infection was the most common morbidity.

Conclusion: The Mannheim Peritonitis Index (MPI) is a simple and effective tool for stratifying and predicting mortality in patients with peritonitis due to hollow viscous perforation. However, the MPI score was not significant in predicting morbidity in these patients.

Keywords: Acute Physiology and Chronic Health Evaluation; Mannheim Peritonitis Index; Pertitonitis.

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Disclosures:

Ethical Clearance: Taken

Conflict of interest: None

Financial aid: None

How to cite this article:

Prajapati I, Bharti SV, Sharma A, Dhakal S. Evaluation of the Mannheim peritonitis index in patients with perforation peritonitis. J Soc Surg Nep. 2024;27(2):43-47.

DOI:

https://doi.org/10.3126/jssn.v27i2.76228

Introduction

Perforation peritonitis, caused by an abnormal opening in a hollow organ, is a common surgical emergency with high morbidity and mortality.[1] Despite advancements in surgical and intensive care support, managing perforation remains complex, and patients are at risk for multi-organ failure, which can be fatal.[2-3] Prognosis depends on several factors, including the patient's health, the nature of the infection, and the timeliness of intervention.[4] Early identification and aggressive surgical intervention are critical. The peritoneum responds to various irritants such as blood, bile, urine, pus, and feces, and severe contamination can lead to systemic complications.[5] To aid in patient prognosis and treatment decisions, scoring systems have been developed. These help categorize patients by risk, which assists in selecting appropriate treatment approaches, including whether intensive care or more aggressive surgery is needed.[6] Common scoring systems include the APACHE II score and Mannheim Peritonitis Index (MPI).[7] The MPI, developed in 1983, uses eight key risk factors—such as age, sex, duration of peritonitis, and laboratory findings like serum creatinine and blood urea levels—to assess disease severity. It has proven to be an effective tool in predicting outcomes for patients with perforation peritonitis.[8]

This study, conducted at Nepalgunj Medical College Teaching Hospital, Kohalpur, aims to evaluate the morbidity and mortality in patients with perforation peritonitis using the MPI. The study focuses on common complications such as wound infections, chest infections, renal insufficiency, and septicemia, examining how these correlate with the MPI score.

Methods

This hospital-based prospective study was conducted at Nepalgunj Medical College Teaching Hospital in Kohalpur, Nepal, for a period of 12 months after obtaining approval from institutional review board (IRB), with the aim of evaluating the morbidity and mortality in patients with perforation peritonitis using the Mannheim Peritonitis Index (MPI).

The study included 70 patients, slightly exceeding the target of 67, which was based on an estimated 23% mortality rate[9] for hollow viscus perforation peritonitis. Patients were selected if they presented with clinical signs of peritonitis, confirmed intraoperatively as due to hollow viscus perforation. Inclusion criteria required patients to be over 16 years of age and undergoing surgical intervention for perforation peritonitis, while those managed conservatively, those with trauma-related peritonitis or anastomosis leaks, and patients under 16 were excluded. The study methodology involved detailed patient history, clinical findings documentation, and informed consent. Routine investigations, including chest X-ray, renal function tests, blood tests, ultrasound (optional), and arterial blood gas analysis, were conducted. Preoperative management focused on correcting hypotension and electrolyte imbalances. During laparotomy, intra-abdominal examination was performed, and the MPI score was calculated, categorizing patients into three groups based on the score: <21, 21–29, and >29. Surgical procedures were planned according to suspected pathology, with the final decision made intraoperatively. Postoperative monitoring tracked complications such as wound infections, chest infections, renal insufficiency, and more. Morbidity was assessed based on the occurrence of complications like wound infection, chest infection, septicemia, and others, analyzed by MPI score and patient age (above or below 50 years). Data were analyzed using SPSS version 20, with statistical significance set at p-values < 0.05.

Mannheim Peritonitis Index (MPI) Scoring:[4,10-13]

The MPI includes the following risk factors, with corresponding weightings if present:

- Age >50 years: 5
- Female sex: 5
- Organ failure: 7
- Malignancy: 4
- Non-colonic origin of sepsis: 4
- Diffuse generalized peritonitis: 6
- Preoperative duration of peritonitis >24 hours: 4
- Intra-peritoneal exudates (clear: 0, cloudy/purulent: 6, fecal: 12)

Organ Failure Criteria:

- Kidney failure: Creatinine >177 µmol/L or urea >167 mmol/L, or oliguria < 20 ml/hour.
- Pulmonary insufficiency: PO2 <50 mmHg or PCO_2 >50 mmHg.
- Intestinal obstruction/paralysis >24 hours or shock.

This scoring system helps to predict both morbidity and mortality in patients with perforation peritonitis.

Results

The study included 70 patients with non-traumatic hollow viscus perforation peritonitis who underwent surgical treatment which revealed several findings regarding the characteristics, outcomes, and complications. Among them, 55 (78.5%) were male and 15 (21.4%) were female, with a mean age of 46.40 ± 15.9 years (range 17-76 years). The mean preoperative duration of symptoms was 2.24 ± 1.26 days, with the most common presentation on days 2 and 3.

Age distribution showed that 54.2% of patients were ≤50 years old, while 45.7% were >50 years old. The most common cause of perforation was peptic ulcer perforation (49%), followed by appendicular perforation (20%) and enteric fever-related ileal perforation (14%).

Generalized peritonitis was present in 81.4% of patients, while 18.5% had localized peritonitis, and the majority (60%) had cloudy exudate, with 29% presenting with fecal peritonitis. Mortality was observed in 14.23% of patients, with females exhibiting a higher mortality rate (20%) compared to males (12.7%).

Table 1. Causes of perforation with frequency

Causes of Perforation	Frequency	Percentage
Peptic ulcer perforation (Duodenal perforation)	36	49%
Appendicular Perforation	14	20%
Enteric Perforation	9	14%
Tubercular Perforation	5	7%
Carcinoma	3	4%
Perforated small bowel volvulus	2	4%
Compound volvulus (ileosigmoid knotting)	1	2%

Table 2. MPI score showing mortality in different risk group

MPI		OUTCOME	
Group (MPI score)	Frequency	Improved	Mortality
Low Risk (<21)	24 (34.3%)	24 (34.3%)	0 (0%)
Intermediate Risk (21-29)	31(44.2%)	27 (87.09%)	4 (12.9%)
High Risk (>29)	15 (21.4%)	9 (60%)	6 (40%)

The mean MPI score for non-survivors was 30.60 ± 4.64, significantly higher than the mean for survivors (20.95 ± 6.67). Mortality rates were found to increase with higher MPI scores, with no mortality in the low-risk group (MPI < 21), 12.9% mortality in the intermediate-risk group (MPI 21–29), and 40% mortality in the high-risk group (MPI > 29). The MPI score cutoff of 25 had a sensitivity of 80%, specificity of 78.38%, and accuracy of 78%.

The overall morbidity rate was 57.14%, with wound infections (45.7%) and chest infections (21.4%) being the most common complications.

Table 3. Distribution of complication seen in the perforation peritonitis patients

Complication	Number	Percent
Wound Infection	32	45.7%
Chest Infection	15	21.4%
Renal Insufficiency	12	17.1%
Septicemia	10	14%
Bed sore	10	10%
Anastomosis leak	5	7.1%
Fecal fistula	2	2%
Burst Abdomen	2	2%

Morbidity was also positively correlated with higher MPI scores, with 33.3% morbidity in the low-risk group, 64.5% in the intermediate-risk group, and 80% in the high-risk group. Additionally, septicemia was significantly more common in patients over 50 years ($p = 0.002$), though other complications such as wound infections, chest infections, and renal insufficiency were not significantly associated with age.

Table 4. MPI in relation with the morbidity

MPI		Morbidity	
Group (Score)	Frequency	Present	Absent
Low Risk (<21)	24	8	16
Intermediate Risk (21-29)	31	20	11
High Risk (>29)	15	12	3

Discussion

The study explored various factors impacting mortality and morbidity in patients with perforation peritonitis, emphasizing the importance of Mannheim Peritonitis Index (MPI) in predicting outcomes.

The study revealed several important findings regarding the characteristics and outcomes of patients with perforation peritonitis. Age-wise, 54.2% of patients were under 50 years of age, with a mean age of 45.5 ± 15.6 years. Survivors were slightly younger (44.63 ± 15.5 years) compared to non-survivors (50.7 ± 15.6 years), consistent with previous studies of Notash et al[14], Bracho-Riquelme et al[15] and Shakya et al[9] where all these suggesting that younger patients tend to have better outcomes. The study also found a significant male predominance, with 78.5% of patients being male, yielding a male-to-female ratio of 3.6:1. This aligns with regional trends similar to studies of Prasad et al[16] and Velappan et al[17] but contrasts with Western studies where gender distribution is more balanced.[18,19] The delay in presentation was another notable factor, with 87% of patients presenting more than 24 hours after symptom onset similar to Prasad et al[16], reflecting the challenges posed by limited access to healthcare and patient education. This delay in seeking medical attention was associated with higher mortality, as 9 out of 61 patients who presented late died. Organ failure was identified as the most significant cause of mortality, particularly when three or more organs failed, leading to a high mortality rate. This is consistent with previous research showing that patients with multiple organ dysfunctions face poor prognoses. The most common causes of peritonitis were duodenal perforation (49%) and appendicular perforation (20%), with 82% of patients having generalized peritonitis. These findings align with regional trends as with studies conducted by Shakya et al[9], Joshi et al[20] and Atif et al[21], where high rates of *Helicobacter pylori* infection, unhealthy diets, smoking, and alcohol use contribute to duodenal ulcers. In contrast, Western studies Seiler CA et al[19], Beilecki K et al[8] often report colonic perforations due to diverticular disease or malignancy as the leading cause. The type of exudate observed during surgery also played a role in patient outcomes, as fecal exudates were linked to higher mortality (46%), especially in high-risk MPI patients (MPI >30) similar to Prasad et al[16] and Correia et al.[22]

The mean Mannheim Peritonitis Index (MPI) score was 22.8±7.8, with higher scores correlating with increased

mortality and morbidity. Females had slightly higher MPI scores (24.4) compared to males (21.76), contributing to a higher mortality rate among females (25%) compared to males (14%) which was similar to study of Budzynski P et al.[23] There were 40% mortality with MPI score >29 and no mortality with score <21 almost matching with the study conducted by Billing et al[12] and Tukka VN et al.[25] The MPI cutoff score for predicting mortality was 25, with a sensitivity of 80% and specificity of 78.38% which was similar to study of Billing et al[12] confirming its effectiveness in predicting outcomes. Morbidity was observed in 57.14% of patients, with wound infection (45.7%) similar to Muralidhar et al[4] and chest infections (21.4%) similar to Shakya et al[9] being the most common complications. The MPI score demonstrated a clear relationship with morbidity, with 80% of high-risk patients (MPI >29) experiencing complications. Age also played a significant role, with patients over 50 years having a higher incidence of septicemia (p=0.002), as well as wound infections, chest infections, renal insufficiency, and septicemia. Finally, 12.8% of patients required ICU and ventilator support, mostly those with MPI scores >29 and multiple organ dysfunction, although the small sample size made it difficult to draw significant conclusions regarding the need for intensive care.

However, there are certain limitations in our study, since this is a single institution study and the sample size is small which would have changed the results.

Conclusion

MPI score is an important predictor of mortality in perforation peritonitis. In terms of morbidity, MPI score was not found to be a significant predictor.

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