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ORIGINAL RESEARCH ARTICLE

Mannheim Peritonitis Index in Acute Peritonitis due to Hollow Viscus Perforation- A Prognostic Evaluation

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ABSTRACT

Introduction: Peritonitis caused by hollow viscus perforation remains a significant cause of mortality, despite advancements in surgical and medical interventions. The Mannheim peritonitis index (MPI) is a widely recognized scoring system that predicts outcomes in peritonitis cases. This study aims to evaluate the prognostic value of MPI in patients with peritonitis due to hollow viscus perforation and assess its ability to predict post-operative outcomes.

Material and Methods: This prospective observational study was conducted at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, from August 2022 to January 2024. Ethical approval was obtained prior to the study. The sample size included 50 patients aged 18 years or older who presented with peritonitis and required surgical intervention. Diagnostic and biochemical tests were conducted, and MPI scores were calculated pre-operatively. Post-operative outcomes, including discharge and mortality, were recorded. Statistical analysis was performed using chi-square tests.

Results: A patient of >50 years of age, with onset of symptoms >24 hours before surgery, with no organ failure, with malignancy, with generalized peritonitis, with clear intra-operative exudates and with higher MPI score showed higher mortality. The study's final outcome showed a mortality rate of 40% (20 patients), with 60% (30 patients) discharged. Wound infections were the most common post-operative complication (42%).

Conclusion: MPI proved to be an effective tool in predicting post-operative outcomes in hollow viscus perforation-related peritonitis. Higher MPI scores were associated with increased mortality, underscoring the importance of early risk stratification.

Keywords: Mannheim peritonitis index, Hollow viscus perforation, Peritonitis, Post-operative outcomes, Risk stratification.

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INTRODUCTION

Peritonitis, the inflammation of the peritoneum, particularly when caused by hollow viscus perforation, continues to be a serious and life-threatening condition despite advancements in medical and surgical practices. Mortality rates for patients suffering from perforation-related peritonitis remain disturbingly high, even with the development of improved surgical techniques, the availability of intensive care units, and the introduction of advanced antibiotics.[1] The ability to accurately assess and predict the prognosis of these patients is crucial to tailoring treatment strategies effectively and improving survival rates.[2]

Among the various scoring systems used to evaluate the severity of peritonitis, the Mannheim peritonitis index (MPI) stands out for its simplicity, reliability, and ease of use. Introduced in 1983 by Wacha and Linder, the MPI considers a set of clinical factors that have proven predictive value in determining the course of the disease. Unlike more complex and time-consuming tools like the APACHE II score, the MPI provides a practical approach to stratifying patients based on their risk levels, allowing for prompt decision-making in emergency settings. It has been widely validated for its effectiveness in prognosis assessment, but a focused exploration of its use in postoperative outcomes for hollow viscus perforation peritonitis is still underdeveloped.[3-7]

This study aims to fill that gap by examining the role of the MPI in predicting the prognosis of patients with peritonitis due to hollow viscus perforation. By evaluating how well this scoring system performs across a diverse patient population, particularly in regions like India where patients often present late with more severe symptoms, this research seeks to determine the MPI's utility in guiding clinical decisions. The ultimate goal is to enhance patient care by refining prognostic tools, which can lead to better treatment strategies and improved outcomes in hollow viscus perforation-related peritonitis.

MATERIAL AND METHODS

This prospective, observational study was conducted in the Department of General Surgery at Shri Ram

Murti Smarak Institute of Medical Sciences, Bareilly, from August 1, 2022, to January 31, 2024. The research aimed to evaluate the prognostic significance of the MPI in patients with peritonitis due to hollow viscus perforation. It includes 8 risk factors with total score of 47 - Age > 50-5, Female sex-5, Organ failure-7, Malignancy-4, Pre-operative duration-4, Origin of sepsis-4, Diffuse generalized peritonitis-6, and Exudate (Clear -0, cloudy -6,purulent -12) Ethical clearance was obtained from the institutional committee before the study commenced.

Study Design and Sample Size

The study was designed as a prospective observational analysis. The sample size was calculated using Cochran's formula, with a 13.24% prevalence of hollow viscus perforation among patients presenting in June 2022. The formula accounted for a 10% dropout rate, resulting in a minimum required sample size of 50 participants.

Inclusion Criteria

Age > 18 years of both sexes. All the patients with hollow viscus perforation peritonitis in whom surgical intervention is required.

Exclusion Criteria

Patients on peritoneal dialysis, abdominal injuries with associated solid organ or vascular injuries, peritonitis secondary to anastomotic leak, pregnant patient with peritonitis.

Data Collection and Treatment Protocols

Upon patient admission, comprehensive diagnostic evaluations were conducted, including haematological (hemoglobin, total and differential leukocyte counts) and biochemical tests (blood sugar, serum urea, creatinine, liver function tests). Imaging studies such as chest X-rays and abdominal X-rays (supine and erect) were used for diagnosis. Following diagnosis, prompt management included intravenous fluid resuscitation, nasogastric decompression, antibiotic therapy, and Foley catheterization to monitor urine output.

Surgical Procedures

Exploratory laparotomy was performed under general anaesthesia. Intraoperative findings such as signs of malignancy, origin of sepsis and character of exudates were documented. Biopsy samples were sent from the site of perforation and sent for histopathological examination. Definitive procedure in the form of resection and anastomosis, drainage, or primary repair with a proximal diversion stoma was done. Data from patient records, including diagnostic tests and operative findings, were systematically collected and analysed. Statistical methods like mean, standard deviation, chi-square tests, and Fischer's exact tests were applied. Patients were stratified into three risk groups based on MPI scores: less than 21, between 21 and 29, greater than 29, and the outcomes were correlated with their prognosis.

RESULTS

The data from the tables shows a higher representation of males than females (54% versus 46%) and more patients below 50 years of age (54%), than above 50 years (46%) (Table 1). A significant difference was observed in the incidence of perforation among males and females, only in the case of the ileum and IC junction (p = 0.0220) (Table 2). Absence of bowel sounds in our study was found to be statistically significant (p = 0.001). A majority of patients had no organ failure (58%) and non-colonic origin of sepsis (68%) (Table 3). Localised peritonitis was present in 58% of cases, most common exudate was clear (46%). A patient of >50 years of age, with onset of symptoms >24 hours before surgery, with no organ failure, with malignancy, with generalised peritonitis, with clear intra-operative exudates and with higher MPI score showed higher mortality (Table 4). The study's final outcome showed a mortality rate of 40% (20 patients), with 60% (30 patients) discharged

DISCUSSION

The study included 50 participants, with an average age of 41.4 years. The majority (54%) were ≤50 years old. In comparison P. Batra reported a higher mean age of 58 years, and K. Mulari (2004) documented a mean age of 68 years. A higher prevalence of gastro-duodenal perforations in younger patients due to peptic ulcer disease was consistent with UP Vaswani's findings. No significant association was noted between age and mortality (p = 0.631) [8-10]

Males constituted 54% of participants, consistent with previous studies - Rajender Singh Jhobta (2006) reported an 84% male prevalence, and Aijaz A. Memon (2008) found 70.3% males in acute abdomen cases. The predominance of males in duodenal perforations

Table 1: Distribution of study participants by age and sex

Characteristic	*Category*	*Frequency*	*Percentage (%)*
Age Group (yrs)	≤50	27	54
	>50	23	46
	Total	50	100
Sex	Male	27	54
	Female	23	46
	Total	50	100

Table 2: Distribution of study participants according to anatomical sign of perforation and symptoms and signs

Characteristic	*Category*	*Male N (%)*	*Female N (%)*	*Total N (%)*	*p-value**
Anatomical site of perforation	Duodenal	6 (46%)	7 (54%)	13 (100%)	0.0550
	Stomach	1 (25%)	3 (75%)	4 (100%)	0.0800
	Colon	9 (56%)	7 (44%)	16 (100%)	0.0970
	Ileum and I-C junction	7 (63.6%)	4 (36.4%)	11 (100%)	0.0220
	Appendix	4 (66.67%)	2 (33.33%)	6 (100%)	0.0700
	Total	27 (54%)	23 (46%)	50 (100%)	
		Present N (%)	Absent N (%)	Total N (%)	
Symptoms and signs	Abdominal pain	30 (60%)	20 (40%)	50 (100%)	0.088
	Abdominal guarding and rigidity	21 (42%)	29 (58%)	50 (100%)	0.061
	Absence of bowel sounds	20 (40%)	30 (60%)	50 (100%)	0.001
	Air under the right dome of the diaphragm	25 (50%)	25 (50%)	50 (100%)	1.000

*-Z test for two proportions

Table 3: Distribution of study participants according to according to different study parameters

Study parameter		*Frequency N*	*Percentage (%)*	*Total N (%)*
Organ failure	No	29	58	50 (100%)
	Yes	21	42	
Pre-operative duration of presentation	≤24 hours	21	42	50 (100%)
	>24 hours	29	58	
Occurrence of malignancy	Absent	46	92	
	Present	4	8	50 (100%)
Origin of sepsis	Colonic	16	32	50 (100%)
	Non-colonic	34	68	
Type of peritonitis	Localized	29	58	50 (100%)
	Generalized	21	42	
Exudates	Clear	23	46	50 (100%)
	Purulent	16	32	
	Fecal	11	22	
Total MPI score	<21	21	42	50 (100%)
	21–29	2	4	
	>29	27	54	
Post-operative outcomes	Discharged	30	60	50 (100%)
	Death	20	40	

aligns with Rajshekhar Patil's findings. No significant association was noted between sex and mortality ($p = 0.799$).[11]

The most common site of perforation was the colon (32%), followed by the duodenum (26%), ileum and ileocecal junction (22%), appendix (12%), and stomach (8%). These findings contrast with Rajender Singh Jhobta (2006), who reported duodenum as the most frequent site (57%), and Rodolf L., who documented a predominance of appendicular perforations (48.28%). Prasan Kumar Hota's research also highlighted distal gastrointestinal tract perforations as more common in developed countries, supporting our colonic findings. The difference in occurrence between males and females was found to be significant only in the case of the ileum and I-C junction.[11-15]

The most common symptom was abdominal pain (60%), while the absence of bowel sounds was the most frequent clinical sign (60%). Abdominal guarding and rigidity were observed in 42% of cases. This aligns with Shantanu Kumar Sahu's study, where abdominal pain was universal (100%), and Rajender Singh Jhobta, who documented pain in 98% of patients. A statistically significant difference ($p = 0.001$) was observed within the presence and absence of bowel sounds, underscoring its prognostic value.[11,16]

Organ failure was present in 42% of participants, consistent with MM Correia's findings (48.5%) but

Table 4: Association of post-operative status with different study parameters

Study parameter	*Category*	*Mortality (%)*	*Discharged (%)*	*Total*	*p-value**
Age group (years)	≤ 50	9 (45%)	18 (60%)	27	0.631
	> 50	11 (55%)	12 (40%)	23	
	Total	20 (100%)	30 (100%)	50	
Sex	Male	10 (50%)	17 (56.6%)	27	0.799
	Female	10 (50%)	13 (43.4%)	23	
	Total	20 (100%)	30 (100%)	50	
Organ failure	Present	7 (35%)	14 (46.6%)	21	0.393
	Absent	13 (65%)	16 (53.4%)	29	
	Total	20 (100%)	30 (100%)	50	
Duration of peritonitis	≤24 hours	9 (45%)	12 (40%)	21	0.902
	>24 hours	11 (55%)	18 (60%)	29	
	Total	20 (100%)	30 (100%)	50	
Malignancy	Absent	19 (95%)	27 (90%)	46	0.072
	Present	1 (5%)	3 (10%)	4	
	Total	20 (100%)	30 (100%)	50	
Total MPI score	<21	6 (30.0%)	15 (50.0%)	21	0.0003
	21–29	0 (0.0%)	2 (6.66%)	2	
	>29	14 (70.0%)	13 (43.34%)	27	
	Total	20 (100%)	30 (100%)	50	

*Chi-square test

higher than Bracho-Riquelme RL. (11.5%). Muralidhar V's research emphasized the progression from dysfunction to failure in peritonitis, reflecting the high organ failure rate in our study due to delayed presentation. However, no statistically significant association was found between organ failure and mortality ($p = 0.393$).[14,17,18]

Colonic sepsis accounted for 32% of cases, while non-colonic origin was more prevalent (68%). This contrasts with Bracho-Riquelme RL., where only 12.64% had a colonic origin. The difference between post-operative mortality and discharge was found to be significant only in the non-colonic origin group ($p = 0.000$). The high mortality rate (11 out of 16) in colonic sepsis aligns with Raya A's findings of higher risk associated with non-appendicular peritonitis. [14,19]

About 9 out of 21 patients who had presented within 24 hours of onset of symptoms passed away. In contrast 11 out of 29 patients who had presented after 24 hours of onset of symptoms passed away. No statistically significant correlation ($p = 0.902$) was found between preoperative duration and mortality, though early intervention was emphasized by Scapellato S.[23]

Generalized peritonitis was observed in 42%, while localized peritonitis accounted for 58%. A statistically significant difference between discharge and mortality was noted with localized peritonitis ($p = 0.000$) as well as generalised peritonitis ($p = 0.046$), but localized peritonitis had higher mortality rates compared to generalized forms, contradicting Rajender Singh Jhobta's findings.[11]

In our study, 4 out of 50 had malignancy, out of which one patient died. This is supported by Correia MM's research, where a similar finding was seen. However, no significant association was seen between malignancy and post-operative mortality ($p = 0.072$).[17]

Clear exudates were most common (46%), followed by purulent (32%) and fecal (22%). Bracho-Riquelme RL., reported clear exudates in 69.5% of cases, whereas Rajender Singh Jhobta found purulent exudates in 71%. Fecal contamination was correlated with delayed presentation and septicaemia, as noted by Danish Kumar. Only clear exudates showed a significant difference between mortality and discharges ($p = 0.000$), contrary to Rodolfo L.'s findings, where fecal exudates had higher mortality.[14,11,20]

Patients with MPI <21 had a 25% mortality rate, while those scoring >29 had a 51.8% mortality rate. This mirrors Bracho-Riquelme RL's findings, where MPI >26 correlated with >40% mortality. A significant association was seen between different MPI scores and post-operative mortality ($p = 0.0003$). Abrar Maqbool Qureshi's study also showed increasing mortality with higher MPI scores. The MPI was validated as a reliable prognostic tool in identifying high-risk patients.[14,21]

CONCLUSION

The study evaluated the MPI as a prognostic tool for patients with peritonitis due to hollow viscus perforation. Among 50 participants, the highest incidence of

perforation in males was in the colon, while females had an equal incidence of colonic and duodenal perforations. Non-colonic sepsis, clear exudates, and localized or generalized peritonitis showed significant differences between mortality and discharge outcomes. However, factors like age, sex, organ failure, preoperative duration, and malignancy showed no significant association with mortality, challenging some MPI components. Despite this, the MPI overall proved reliable for prognosis.

RECOMMENDATIONS

The MPI remains a valuable tool for managing hollow viscus perforation cases. Based on the findings of this study, it is recommended to improve referral systems and transportation to reduce delays, prevent the progression of localized to generalized peritonitis, and enable timely interventions. However, further research and development are needed for better treatment strategies in such cases.

LIMITATIONS

The study was limited to a single center, which may affect the generalizability of the findings to broader populations. Additionally, the study did not explore long-term follow-up outcomes, limiting insights into the extended recovery and prognosis of patients. Finally, there may be potential confounders not accounted for, such as variations in surgical techniques or pre-existing conditions.

CONSENT

Written informed consent was obtained from all participants and securely archived.

ETHICAL APPROVAL

The study received ethical clearance, adhering to the required institutional protocols.

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