A PROSPECTIVE OBSERVATIONAL STUDY ON THE EFFECTIVENESS OF THE MANNHEIM PERITONITIS INDEX IN PREDICTING MORTALITY AMONG PATIENTS WITH GASTRODUODENAL PERFORATION PERITONITIS

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INTRODUCTION

Peritonitis is a life-threatening inflammatory condition of the peritoneum or peritoneal cavity, most commonly arising from localised or generalised infection and frequently associated with gastrointestinal perforation. [1]

Its diagnosis is largely clinical, relying on a detailed patient history and comprehensive physical examination, although radiological and laboratory investigations may provide supportive evidence. [2]

The prognosis of perforation peritonitis is influenced by a complex interplay of host factors, disease severity, and the timeliness of therapeutic intervention. Early recognition and prompt surgical management are critical, as delays often result in rapid progression to sepsis, intra-abdominal contamination, and ultimately multiorgan dysfunction. [3]

Despite advancements in surgical techniques, including radical peritoneal debridement, extensive lavage systems, planned re-exploration strategies, and open abdomen management, the morbidity and mortality associated with secondary peritonitis remain substantial, particularly when complicated by organ failure. Given this persistent clinical challenge, objective tools that accurately stratify disease severity and predict patient outcomes have become indispensable in optimising management strategies for critically ill patients. [4][5][6]

Several prognostic scoring systems have been developed to assess the severity of intra-abdominal infection and estimate mortality risk, such as the Mannheim Peritonitis Index (MPI), Peritonitis Index Altona (PIA), Sepsis Score, the Acute Physiology and Chronic Health Evaluation II (APACHE II), and the Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity (POSSUM). [7]

Among these, the MPI, introduced by Wacha and Linder in 1983 after the analysis of 1,253 patients with peritonitis, has gained prominence due to its simplicity, reproducibility, and reliance on only eight independently significant prognostic variables. The index demonstrates reliable sensitivity and specificity and is particularly advantageous in resource-limited settings where access to advanced diagnostic modalities is constrained. Its ease of application and strong prognostic accuracy make the MPI a practical and widely accepted tool for guiding clinical decision-making in patients with secondary peritonitis, including those with gastroduodenal perforations. [8][9]

AIM AND OBJECTIVES

This study aimed to evaluate the effectiveness of the Mannheim Peritonitis Index in determining mortality among patients presenting with gastroduodenal perforation peritonitis.

MATERIALS AND METHODS

This prospective observational study was conducted at the Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, from March 2023 to February 2024. Patients (>18 years) presenting with an acute abdomen were assessed clinically and radiologically, supplemented by appropriate laboratory investigations, diagnosed with peritonitis secondary to gastroduodenal perforation, and underwent emergency exploratory laparotomy.

Data collected included preoperative demographic characteristics, intraoperative findings such as perforation location and size, and the nature of peritoneal exudate. Tissue from the perforation site was sent for histopathological evaluation. The MPI score was calculated for each patient. Postoperative outcomes, hospitalisation duration, intensive care unit (ICU) stay, and complications were documented. Patients were followed until discharge or death.

Statistical analysis included the calculation of the mean and standard deviation. Receiver operating characteristic (ROC) curves were generated, plotting sensitivity against 1-specificity. A p-value <0.05 was considered statistically significant.
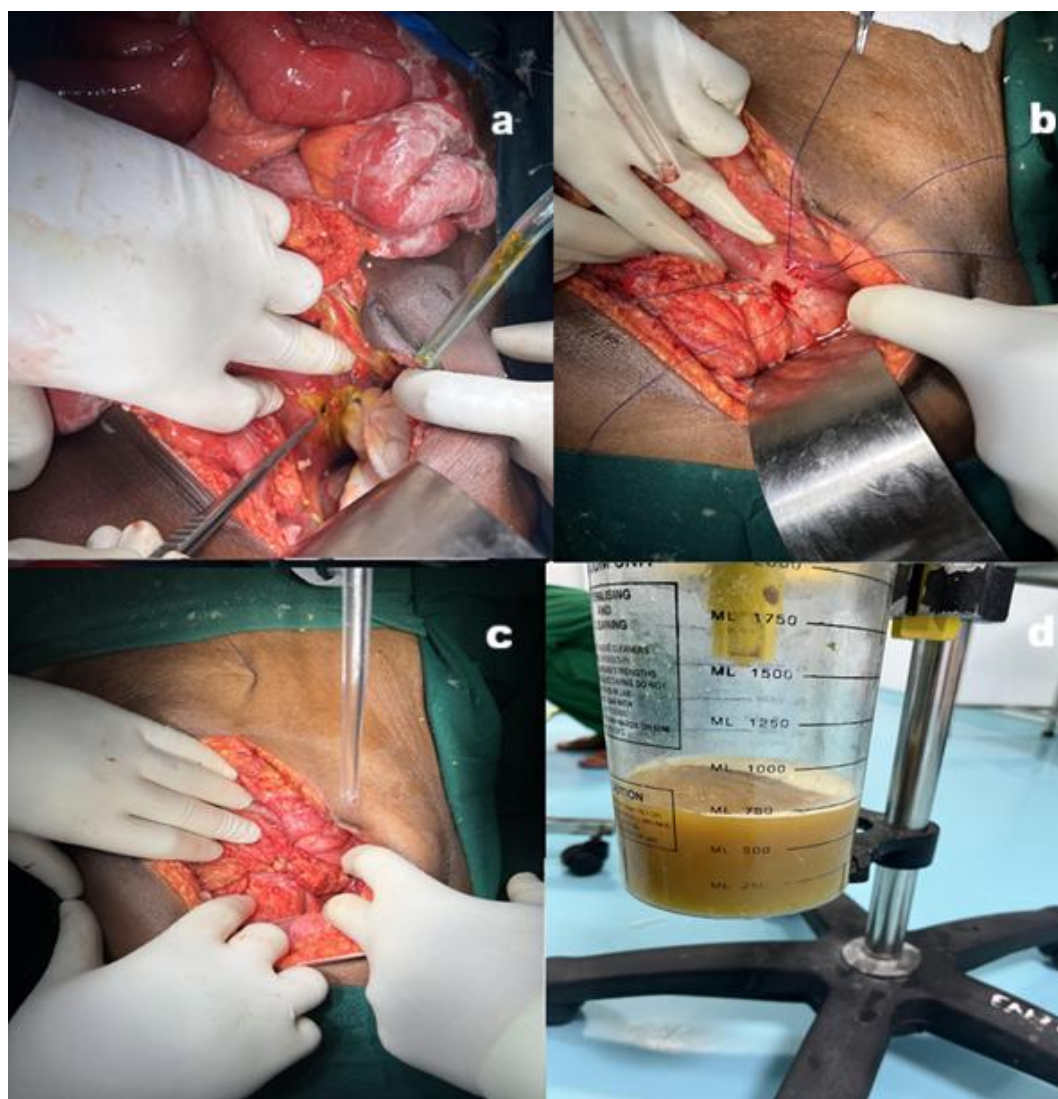

Figure 1: Images showing a. Prepyloric perforation, b-c. Graham's patch repair, d. exudate

RESULTS
Distribution of MPI Variables
The mean age of the study population was **56.63 ± 18.16 years**, with the highest incidence (45.46%; n=15) in those aged >50 years. A male predominance was noted with a male-to-female ratio of 4.5:1. Coronary artery disease was the most frequent comorbidity (21.21%; n=7), followed by hypertension, diabetes mellitus, and chronic kidney disease.

Gastric perforation accounted for 69.70% (n=23) of cases, while duodenal perforation accounted for 30.30% (n=10). The mean hospital stay was **6.75 ± 3.58 days**, and the mean ICU stay was **3.87 ± 2.27 days**.

MPI variables		Number	Percentage	p-value	Mortality
Age > 50 years		25	75.75%	0.028	8
Female gender		6	18.18%	<0.001	3
Organ failure		10	30.30%	0.011	5
Malignancy		1	3.03%	0.51	1
Pre-operative duration of peritonitis for > 24 hours		17	51.51%	0.005	7
Non-colonic origin of sepsis		33	100%	-	9
Diffuse generalized peritonitis		33	100%	0.976	9
Exudate	**Clear**	10	30.30%	0.0258	2
	Cloudy/purulent	23	69.69%		7
	Feculent	0	0%		-

Table 1: MPI variables

Based on MPI scoring:

MPI groups	Grade	n	Mortality
< 21	I	16	0
21-29	II	8	4
> 29	III	9	5

Table 2: MPI groups and grades

After the MPI score was calculated, all the patients were categorised into 3 groups: I, II and III with MPI scores of < 21 in 48.48% (n=16), 21-29 in 24.24% (n=8) and > 29 in 27.27% (n=9).
The overall mortality rate was **27.27% (n=9)**.
A total of 75.75% (n = 25) of the study population were older than 50 years. Females accounted for 18.18% (n = 6) of the cohort, and notably, all female patients (100%, n = 6) had MPI scores more than 29. Organ failure at presentation was documented in 30.30% (n = 10) of participants. Only 3.03% (n = 1) had perforation attributable to an underlying malignancy. More than half of the patients, 51.51% (n = 17), presented with peritonitis of greater than 24 hours duration. Since the study included exclusively gastroduodenal perforations, all patients (100%, n = 33) exhibited sepsis originating from a non-colonic source and demonstrated diffuse generalised peritonitis.
Regarding the nature of peritoneal contamination, 30.30% (n = 10) had clear exudate, whereas 69.70% (n = 23) had cloudy or purulent exudate; none revealed feculent contamination. Among the variables analysed, age >50 years, female gender, and a preoperative peritonitis duration exceeding 24 hours demonstrated statistically significant associations with mortality (p-value < 0.05).

DISCUSSION

This study assessed mortality outcomes in relation to MPI scores among patients with peritonitis secondary to gastroduodenal perforation. The mean patient age was higher compared to studies by Rongpi R et al., [3] Basavaraju S. M. et al., [4] Gueiros L. D. S. et al., [10] and Muralidhar V. A. et al., [8] where most patients were below 40 years.

Mortality in this study predominantly occurred among individuals older than 50 years, consistent with findings by Basavaraju S. M. et al. [4] and Yadav et al. [6]

Males constituted the majority of both study participants and mortality cases, mirroring trends observed in earlier studies. The stomach was the most frequent perforation site, in agreement with studies by Yadav S. et al. [6] and Bamrah J.S. et al. [7]

Organ failure at presentation was observed in 30.30% (n=10), all of whom had MPI >21, a finding in line with outcomes reported by Basavaraju S. M. et al. [4] and Bamrah J. S. et al. [7]. Patients presenting with peritonitis exceeding 24 hours preoperatively demonstrated significantly higher mortality, consistent with the literature.

The MPI cut-off value of 21 yielded 100% sensitivity, 66.67% specificity, 52.94% PPV and 100% NPV. Studies adopting the same cut-off similarly concluded that the MPI is an excellent predictive tool with high diagnostic accuracy.

CONCLUSION

The Mannheim Peritonitis Index, using a threshold score of 21, proved to be a reliable prognostic indicator for gastroduodenal perforation peritonitis in this study. Factors such as advanced age (>50 years), female sex, presence of organ failure at admission, delayed presentation (>24 hours), and purulent exudate were significantly associated with increased mortality.

Diffuse peritonitis and the perforation site had comparatively limited prognostic significance. Although gastric perforations formed the majority, extended hospital and ICU care were associated with improved survival. An MPI score ≥21 demonstrated excellent sensitivity and negative predictive value, confirming its utility as a dependable bedside tool for identifying high-risk patients and stratifying mortality risk.

STRENGTHS AND LIMITATIONS

This study was limited by its single-centre design, relatively short duration, and modest sample size, which may restrict the generalizability of findings. Additionally, only patients with gastroduodenal perforation peritonitis were included, and results may not apply to other etiologies of secondary peritonitis

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