

## EFFECTIVENESS OF THE MANNHEIM INDEX IN PREDICTING MORBIDITY AND MORTALITY OF PATIENTS WITH PERFORATIVE PERITONITIS

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### Abstract

**Background:** Peritonitis is an inflammation of the peritoneal cavity caused by various pathogens and is associated with a high morbidity and death rate. The study aims to predict the prognosis of patients with perforation peritonitis and assess the impact of the MPI score in identifying high-risk cases. **Materials and Methods:** This prospective observational study was conducted at Tirunelveli Medical College and Hospital from September 2019 to August 2021. One hundred fifty patients with peritonitis due to hollow viscous perforation were included in the study. Informed consent was obtained from all patients, and ethical approval was obtained before the study started. Diagnosis of peritonitis due to hollow viscous perforation was made by history and clinical examination, and standard operative procedures were followed. Mortality and morbidity were assessed for post-operative complications. **Result:** Most patients were male, with 122 (81.3%) and 28 (18.7%) female. The most common age group was > 61 years 36 (24%). Most of the patients were observed with Duodenal perforations 78 (52%), gastric 32 (21.3%), and Ileal perforation 20 (13.3%). Patients with MPI values between 21 and 29 were the most common. 24 (16%) having ARDS complications, 140 (93.3%) secreting cloudy exudates, and 9 (6%) mortality. MPI score is associated with morbidity, post-operative complications, and mortality in patients with ARDS post-operative complications. Only cloudy exudates were observed with mortal patients 9 (6.4%). **Conclusion:** Mannheim Peritonitis Index is useful for assessing adverse outcomes in patients with peritonitis.

## INTRODUCTION

From the beginning, peritonitis was known as a universally lethal ailment. Peritonitis is an inflammation of the peritoneal cavity caused by various pathogens, including bacteria, fungi, viruses, chemical irritants, and foreign substances.<sup>[1]</sup> It is associated with a high morbidity and death rate across all age categories but is most prevalent in the middle and late age groups.<sup>[2]</sup> Primary peritonitis is a peritoneal cavity infection not caused by other intra-abdominal disorders. The majority of cases are caused by bacterial infection. The most frequent peritonitis is secondary peritonitis, caused by an intra-peritoneal source, generally perforation of hollow viscera.<sup>[3]</sup>

Secondary peritonitis is a life-threatening surgical disease that is the most prevalent surgical emergency in the majority of general surgical units across the globe. It is often linked to high rates of morbidity and death. Tertiary peritonitis is a later

stage of the illness in which clinical peritonitis and systemic indications of sepsis linger after treating secondary peritonitis.<sup>[4]</sup> Despite advancements in diagnosis and care, the prognosis for peritonitis remains dismal. Early detection of severe peritonitis may aid in selecting patients for a more aggressive surgical strategy.<sup>[5]</sup> The ability to grade the severity of acute peritonitis has aided decision-making and improved treatment in the care of critically sick patients. Empirically based risk assessment for major clinical events has shown to be tremendously valuable in assessing novel medicines, monitoring resource use, and improving care quality.<sup>[6]</sup>

The prognosis and outcome of peritonitis have been assessed using various grading methods. For the enumeration of mortality and morbidity, the Mannheim peritonitis index (MPI) (1983), the acute physiological and chronic health assessment score (APACHE II) (1985), the Peritonitis Index Altona (PIA), the sepsis severity score (1983), and the physiological and operative severity score

(POSSUM).<sup>[7]</sup> To define risk, the MPI combined information and discriminant analysis of 17 probable risk variables such as age, gender, organ failure, malignancy, length of peritonitis, colon involvement, amount of dissemination inside the peritoneum, and peritoneal fluid character. Eight of these were predictive and are now frequently used to predict death from peritonitis. The MPI is a peritonitis prognostic indicator with good accuracy in individual prediction and is extremely easy to record.<sup>[8]</sup> The study aims to predict the prognosis of patients with perforation peritonitis and assess the impact of the MPI score in identifying high-risk cases.

## MATERIALS AND METHODS

This prospective observational study was conducted at Tirunelveli Medical College and Hospital from September 2019 to August 2021. One hundred fifty patients with peritonitis due to hollow viscous perforation were included in the study. Informed consent was obtained from all patients, and ethical approval was obtained before the study started.

### Inclusion Criteria

Patients with clinical suspicion and investigatory support for diagnosing peritonitis due to hollow viscous perforation later confirmed by intra-op findings were included.

### Exclusion Criteria

Patients with hollow viscous perforation due to trauma and any other significant illness likely to affect the outcome more than the disease in the study were excluded.

Diagnosis of peritonitis due to hollow viscous perforation was made by history and clinical examination. X-ray chest PA view with both domes of the diaphragm shows air under the diaphragm. A detailed history of presenting illness and history suggestive of chronic health disorders such as cardiac, renal, and hepatic conditions was noted. All biochemical investigations were done on admission, and relevant clinical details were recorded.

Standard operative procedures were followed for different causes of perforative peritonitis, perforation closure in duodenal and gastric perforation, appendectomy due to ruptured appendix, and limited resection and resection and end-to-end anastomosis in perforation of small and the large intestine. Mortality was defined as any death occurring during the hospital stay. Morbidity was assessed regarding post-operative complications such as pneumonia, wound sepsis or infection, acute respiratory distress syndrome, intra-abdominal collection, acute renal failure, and shock.

Data analyses were employed using standard clinical and statistical methods. A chi-square test for consolidated data to test the significance of the difference between variables. A p-value <0.05 is considered significant.

## RESULTS

In the present study, a total of 150 patients were enrolled. Most patients were male, 122 (81.3%), and 28 (18.7%) were female. The maximum number of patients were age group of more than 61 years 36 (24%), followed by the age group of 51 to 60 years 32 (21.3%), 41 to 50 years 28 (18.7%) and 31 to 40 years 26 (17.3%). The last patients were reported in the age group of less than 20 years 12 (8.0%) [Table 1].

Most of the patients were observed with Duodenal perforations 78 (52%), gastric 32 (21.3%), and Ileal perforation 20 (13.3%). A maximum number of patients, 71 (47.3%), showed an MPI value of less than 21, 47 (31.3%) patients with MPI value between 21 to 29 and the least patients, 32 (21.3%) patients with MPI value of more than 29.

24 (16%) recorded ARDs complications, whereas most 126 (84%) did not show any ARDS or other respiratory complications. The maximum number of patients, 140 (93.3%), secrete cloudy exudates, followed by clear exudates 6 (4%) and only 4 (2.7%) patients with feculent exudates. 9 (6%) mortality was reported, whereas 141 (94%) patients survived [Table 1].

**Table 1: Demographic data of the study**

		Frequency	Percent
Sex	Male	122	81.3%
	Female	28	18.7%
Age group	<20	12	8.0%
	21-30	16	10.7%
	31-40	26	17.3%
	41-50	28	18.7%
	51-60	32	21.3%
	>61	36	24%
Diagnosis	Appendicular	14	9.3%
	Cecal	1	0.7%
	Duodenal	78	52%
	Gastric	32	21.3%
	Ileal	20	13.3%
	Jejunal	2	1.3%
MPI	Sigmoid	3	2%
	<21	71	47.3%
	21-29	47	31.3%

	>29	32	21.3%
Post op complications	ARDS	24	16%
	NIL	126	84%
Exudates	Clear	6	4%
	Cloudy	140	93.3%
	Feculent	4	2.7%
Mortality	No	141	94%
	Yes	9	6%

**Table 2: Comparison of diagnosis, post-op complications, and mortality with MPI**

		MPI			P-value
		<21	21-29	>29	
Diagnosis	Appendicular	11 (78.6%)	2 (14.3%)	1 (7.1%)	0.038
	Cecal	0	100.0%	0	
	Duodenal	43 (55.1%)	20 (25.6%)	15 (19.2%)	
	Gastric	9 (28.1%)	19 (43.8%)	9 (28.1%)	
	Ileal	7 (35%)	9 (45%)	4 (20%)	
	Jejunal	1 (50%)	0	1 (50%)	
	Sigmoid	0	1 (33.3%)	2 (66.7%)	
Post op complication	Yes	5 (20.8%)	10 (41.7%)	9 (37.5%)	0.013
	No	66 (52.4%)	37 (29.4%)	23 (18.3%)	
Mortality	Yes	2 (22.2%)	2 (22.2%)	5 (55.6%)	0.034
	No	69 (48.9%)	45 (31.9%)	27 (19.1%)	

The correlation of morbidity and MPI value for all patients was statistically significant (0.038), with duodenal, gastric, and Ileal perforations having the highest MPL value. MPI score is associated with post-operative complications in all patients with ARDS post-operative complications (0.013).

The mortality in patients was also correlated with the MPI score (p=0.034). Most motile patients, 5 (55.6%), were observed with MPI scores of more than 29, followed by MPI scores of 21 to 29 and less than 21, each with 2 (22.2%) patients [Table 2].

**Table 3: Comparison of exudate with mortality**

Exudate	Mortality		P-value
	Yes	No	
Clear	0	6 (100%)	0.710
Cloudy	9 (6.4%)	131 (93.6%)	
Feculent	0	4 (100%)	

The type of exudates was correlated with the mortality, and it was reported that only cloudy exudates were observed with mortal patients 9 (6.4%). Clear and feculent exudates were not found in motile patients [Table 3].

## DISCUSSION

The death rate in patients with peritonitis is still very high, with the mean being 19.5% and reaching up to 60% in some studies.<sup>[9,10]</sup> Few other studies confirmed age as a decisive factor related to mortality. However, this study does not show any statistical significance. In other studies, patients with generalized peritonitis range from 30–66%.<sup>[11]</sup> In the present study, generalized peritonitis was present in about 62% of the patients. 150 perforative peritonitis patients participated, of which the proportion of the male sex was 81.3% (n=122) while that in the female sex was 18.7% (n=28). The major proportion of males in our study agrees with other findings in the literature.<sup>[12,13]</sup>

The age range was from 12 years to 85 years. The Maximum number of patients was in the age group of more than 60 years, 36 (24%). The increased prevalence of the perforation in the age group of more than 60 years in our study can be attributed to

the fact that gastro duodenal perforations due to peptic ulcer disease is a major cause of perforation peritonitis in our study and the increased prevalence of the etiological risk factors such as smoking, alcoholism and NSAID abuse in this age group. Similar findings have also been reported in previous studies.<sup>[14,15]</sup>

All the participating patients were evaluated for their morbidities, and it was observed that a maximum patient, 78 (58%), showed duodenal perforations, followed by gastric 32 (21.3%) and ileal 20 (13.3%) perforations. The least morbidity observed was Cecal 1% (0.7%). Of all the morbidities, the duodenal problem showed the highest number of patients, 15 with more than 29 MPI values, followed by gastric with nine and ileal perforation with four patients. The duodenal, gastric and Ileal perforations are reported to be associated with perforative peritonitis. The findings in our study follow earlier reported studies.<sup>[16]</sup>

Of all patients, 71 (47.3%) patients had MPI scores of less than 21, 47 (31.3%) patients had MPI scores between 21 to 29 and 32 (21.3%) patients had MPI scores greater than 29. Among the 150 patients studied by us, nine patients died, thus placing the mortality at 6%. The study done by Hourichi et al,<sup>[17]</sup> reported a mortality of 23.1%, and Koperma et

al,<sup>[18]</sup> reported a mortality rate of 18.5%. However, some studies also reported similar findings as per our study. Of all nine died patients, 77.8% were observed with an MPI value of 21 or more, and only 22.2% died patients were reported with an MPI value of below 21.

Post-operative complications like acute respiratory distress syndrome (ARDS) were also evaluated in all participating patients. Of all 150 patients, only 24 (16%) were observed with ARDS, whereas 126 (84%) patients showed no post-operative ARDS complications. Patil VA et al. found that the high-risk group (MPI>29) has more respiratory complications than the intermediate (MPI 21 to 29) and low-risk group (MPI <21). Of all 24 patients with post-operative ARDS complications, 37.5 % were observed with an MPI score of more than 29, and 37.5% reported MPI between 21 and 29. However, only 20.8% of patients were observed with an MPI score of less than 21. These findings in our study contradict the findings of Agrawal et al,<sup>[19]</sup> who reported 42.85% of patients with post-operative respiratory complications from all patients with post-operative illness.

The maximum number of patients discharged with cloudy exudates was 140 (93.3%), followed by clear exudates 6 (4%) and feculent exudates 4 (2.7%). When mortality was evaluated in association with the type of exudates, the present study reports no mortality reported with clear and feculent exudates. However, 9 (6.4%) mortality was reported in patients with cloudy exudates. In a study by Yadav et al,<sup>[20]</sup> 20% mortality rate was reported with cloudy exudates patients, and feculent exudates were recorded with a 68% mortality rate. A similar observation was also reported by Krishna et al,<sup>[21]</sup> where 60.6% mortality was observed with cloudy exudates and feculent exudates noted with 75% of mortality.

Analysis of the collected material revealed that the division of patients based on the obtained MPI score might help assesses the risk of developing severe disturbances of the general condition in the post-operative period and the necessity of continued treatment of the patient in an intensive care unit. Sensible use of the score will facilitate identifying patients in the high-risk group, thus raising awareness of their increased risk of post-operative complications, such as cardio-respiratory failure, acidosis, electrolyte disorders and post-operative wound complications.<sup>[22]</sup>

Although the Mannheim score is easy to use and effective in predicting mortality, it cannot be used as a preoperative system used at admission to stratify patients based on the risk of death since it requires consideration of intraoperative assessment, such as the nature of the fluid in the peritoneal cavity and anatomical exit site as well as histopathological examination (a cause of neoplastic or non-neoplastic origin). Another disadvantage of the score is that it does not consider chronic diseases and major

systemic disorders, which are very important risk factors for death and serious complications.<sup>[23,24]</sup>

Despite all efforts, this study had some limitations. As the sample size is quite small, a larger sample size may give more findings.

## CONCLUSION

In conclusion, Mannheim Peritonitis Index is a useful method to determine study group outcomes in patients with peritonitis. Mortality rates were found to be higher in patients with cloudy exudates. All the MPI variables of adverse outcome named, presence of organ failure; preoperative duration >24 hours; the presence of malignancy; age >50 years, female sex; generalized extension of peritonitis and type of exudates behaved as expected, except the non-colonic origin of sepsis in peritonitis.

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