Section: General Surgery

Original Research Article

A COMPARATIVE STUDY BETWEEN THE MANNHEIM PERITONITIS SCORE AND POSSUM SCORING SYSTEM IN PREDICTING THE PROGNOSIS OF PATIENTS WITH PERFORATION PERITONITIS

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Abstract

Background: Peritonitis remains a significant infection challenge for surgeons. To assess risk and predict postoperative outcomes, various scoring systems, including the Mannheim Peritonitis Index (MPI), Physiological and Operative Severity Score for the Enumeration of Mortality (POSSUM), and the Morbidity and Sepsis Score developed by Stoner and Elebute, have been devised. This study aimed to evaluate the prognosis of patients with perforative peritonitis using the Mannheim and P-Possum indices to evaluate adverse outcomes regarding mortality, prolonged hospital stay, and MODS. **Materials and Methods:** This prospective study included 50 patients with established peritonitis at Government Rajaji Hospital, Madurai, from January 2020 to June 2021. The Mannheim Peritonitis Index (MPI) and the P-Possum scores were calculated postoperatively. All biochemical investigations were performed on admission, and relevant clinical details were noted. The patients were followed up until discharge or death. **Result:** The study cohort, predominantly comprising males (78%) with a mean age of 20–40 years, exhibited comorbidities in 42% of the cases. The most common site of perforation was the stomach (46%). The sensitivity and specificity of MPI for predicting mortality were 62.5% and 85.7%, respectively. The P-Possum score demonstrated 100% sensitivity and specificity in predicting mortality. For prolonged hospital stays, the sensitivity and specificity of MPI were 50% and 89%, respectively, while the P-Possum scores showed 57% sensitivity and 100% specificity. **Conclusion:** The P-Possum score has emerged as a superior prognostic tool for predicting mortality. Despite its complexity and consideration of multiple parameters, the holistic approach of the P-Possum score underscores its clinical utility.

INTRODUCTION

Secondary peritonitis and complicated intra-abdominal infections represent frequent etiologies for emergency surgical admissions globally, giving rise to notable mortality and morbidity rates.[1-3] Mortality rates exhibit a range of 12-41%, and predominant management typically necessitates source control through surgical intervention.[4,5] Disease demographics manifest substantial disparities between developed and developing nations, with older individuals exhibiting a higher prevalence in the Western context,[3,6,7] while a more heterogeneous age distribution is observed in developing countries.[8,9]

Perforative peritonitis remains a significant challenge for surgeons owing to its complex management and poor prognosis. Early and accurate assessment of disease severity is crucial for selecting appropriate treatment strategies.[10] Several scoring systems have been developed to objectify patient evaluation, including the Acute Physiology and Chronic Health Evaluation (APACHE) II score, Simplified Acute Physiology Score (SAPS), Sepsis Severity Score (SSS), Ranson score, Imrie score, and Mannheim Peritonitis Index (MPI).[11]

Most of these scoring systems are burdensome to measure and require the most recent diagnostic examinations, which are not always readily available in countries with limited resources. In addition, these systems require numerous measurements of many different factors. It is important to note that all the scoring systems developed are from Western countries, and their usefulness must be assessed in the context of diverse populations in developing countries before being applied universally.

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Established scoring systems widely accepted in recent years do not consider intraoperative findings, such as the nature of the exudate or contamination or the location and degree of perforation, which can significantly impact the outcomes of such cases.[12,13] Among these, MPI is widely accepted because of its simplicity and reliance on preoperative and intraoperative clinical data. It incorporates eight key risk factors: age, sex, organ failure, cancer, duration of peritonitis, colon involvement, extent of spread, and characteristics of peritoneal fluid. The Multiple Organ Failure Score (MOF) also provides a three-point grading system to assess organ dysfunction and failure in sepsis patients.[14,15] Several studies have reported an effective use of MPI for assessing morbidity and mortality in patients with peritonitis.[11,14] Additionally, using MPI and MOF together has been shown to predict clinical outcomes in patients with peritonitis.15 By combining these scoring systems, clinicians can better understand patient severity and make informed decisions regarding treatment options.

Aims and Objectives

This study aimed to evaluate the prognosis of patients with perforative peritonitis using the Mannheim and P-Possum indices to evaluate adverse outcomes regarding mortality, prolonged hospital stay, and MODS.

MATERIALS AND METHODS

This prospective study was conducted on 50 patients at Government Rajaji Hospital, Madurai, from January 2020 to June 2021. Ethical committee approval and informed consent were obtained before the commencement of the study.

Inclusion Criteria

Patients presenting with established peritonitis following hollow viscus perforation were included

Exclusion Criteria

Patients younger than 13 years of age, those undergoing emergency exploratory laparotomy due to other causes, and those with primary peritonitis were excluded.

Diagnosis of perforative peritonitis was based on a detailed history of presenting illness and a history suggestive of chronic health disorders such as cardiac, renal, and hepatic conditions. X-ray chest PA view with both domes of the diaphragm showing air under the diaphragm and ultrasonography of the abdomen. All biochemical investigations were performed on admission, and relevant clinical details were noted.

Standard operative procedures were followed for different causes of perforative peritonitis. Mannheim's peritonitis index and P-Possum scores were calculated during the immediate postoperative period. Laboratory investigations were performed to evaluate postoperative organ failure. The patients were followed up until death or discharge.

Mortality was defined as any death occurring during the hospital stay, and morbidity was assessed in terms of postoperative complications, ranging from wound infection to organ failure and prolonged hospital stay.

Statistical Analysis

All statistical analyses were performed using the SPSS software version 22. Frequency was calculated for each study variable. The chi-squared test was used for inter-group comparisons, and a p-value of < 0.05 was considered statistically significant.

RESULTS

Among 50 patients, the mean patient age was 20–40 years. The sex distribution showed that most patients were male (78%). Associated comorbid illnesses were noted in 21 out of 50 cases (42%), of which hypertension and diabetes were the most common illnesses. However, they did not significantly affect the outcome of the disease studied. The stomach was the most common perforation site (46%), and duodenal perforation was noted in 24% of the patients.

Only 30% of the patients presented with a history of < 24 h of symptom duration. The perforation size varied from 0.5 cm to 2 cm, and a larger perforation was noted in the ileum. Cloudy or purulent exudate was the most common type during surgery (50%) out of 50 cases [Table 1].

The most common procedure performed during the study was live omental patch repair. Postoperative complications occurred in 19 (38%) of the 50 cases. The most common complications are wound infections and AKI. Most patients stayed in the hospital for < 10 days (72%), and mortality was noted in 8 (16%) cases [Table 2].

Comparison of MPI between outcomes showed five deaths and six survivors with MPI >26. Three deaths and 36 survivors with an MPI <26. Comparison of MPI between duration of stay showed seven deaths and four survivors' patients with a hospital stay >11 days. Seven deaths and 32 survivors had a hospital stay of less than ten days.

Comparison of P-Possum scores between outcomes showed eight deaths and no survivors with a P-Possum score >60. There were no deaths, and 42 survivors had a P-Possum score of <60. A comparison of P-Possum scores between the duration of stay showed eight deaths and no survivors' hospital stay of >11 days. Six deaths and 36 survivors had a hospital stay of less than ten days [Table 3].

The sensitivity and specificity of MPI for predicting mortality were 62.5% and 85.7%, respectively, and the P-Possum score was 100%/100%. In predicting prolonged hospital stay, the sensitivity and specificity of the MPI and P-Possum scores were 50%/89% and 57%/100%, respectively [Table 4].

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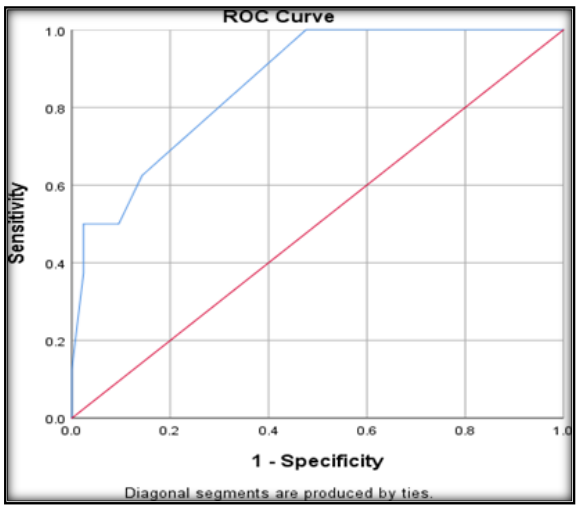

Figure 1. ROC curve of MPI between outcomes

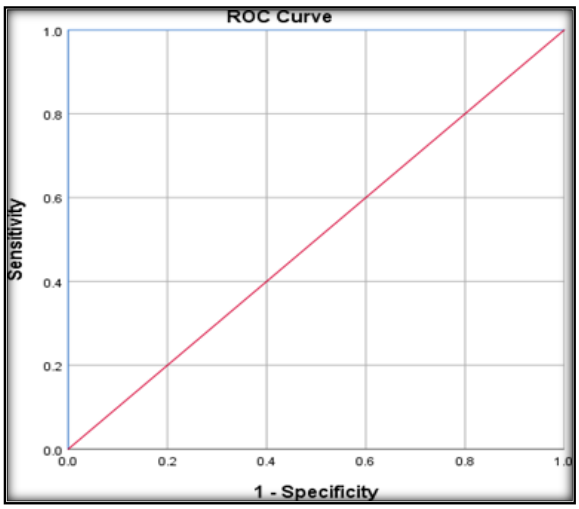

Figure 2. ROC curve of P-Possum between outcomes

Table 1: Demographic data of the study

		Frequency	Percentage
Sex	Female	11	22
	Male	39	78
Age	<30	8	16
	31-40	15	30
	41-50	9	18
	51-60	7	14
	>60	11	22
Comorbidities	Absent	29	58
	CAD	2	4
	CKD	2	4
	COPD	2	4
	DM	8	16
	HTN	8	16
	Hypothyroid	1	2
	PTB	1	2
Site of perforation	Colon	7	14
	Duodenum	12	24
	Ileum	7	14
	Jejunum	1	2
	Stomach	23	46
Type of exudate	Bilious	18	36
	Feculent	7	14
	Purulent	25	50

Table 2: Distribution of procedure, duration, post-op complication, duration of stay, and outcome

		Frequency	Percentage
Procedure	OPR	33	66
	PC	7	14
	RA	8	16
	RES & COL	2	4
Duration	1	15	30
	2	23	46
	3	7	14
	4	3	6
	5	2	4
Post op complication	Absent	31	62
	AKI	6	12
	ARDS	3	6
	DKA	4	8
	Pneumonia	2	4
	PUL oedema	1	2
	RF	1	2
	Uncontrolled DM	2	4
Duration of stay	<10	36	72
	>11	14	28
Outcome	Died	8	16
	Alive	42	84

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Table 3: Cross-tabulation of Mannheim's peritonitis index and P-Possum score with outcome and duration of stay

		Outcome		Duration of stay	
		Died	Alive	>11	<10
MPI	>26	5	6	7	4
	<26	3	36	7	32
P-Possum score	>60	8	0	8	0
	<60	0	42	6	36

Table 4: Cross-tabulation of Mannheim's peritonitis index and Possum score with outcome and duration of stay

	Outcome		Duration of stay	
	MPI	P-Possum	MPI	P-Possum
Cut-off	26	60	26	60
Sensitivity	62.50%	100%	50%	57.14%
Specificity	85.71%	100%	88.89%	100%
PPV	45.45%	100%	63.64%	100%
NPV	92.31%	100%	82.05%	85.71%
Accuracy	82%	100%	82%	88%

Table 5: Comparative validity assessment of MPI scores predicting prognosis of peritonitis

Study	Sample size	Sensitivity (%)	Specificity (%)	AUC
Batra et al. 2013,[16]	50	100	65.54	0.89
Sharma R et al.[17]	100	92	78	0.90
Present study	50	62.5	85.7	-

DISCUSSION

Several studies have established the usefulness of MPI as an independent prognostic scoring system for predicting the outcomes of secondary peritonitis. The findings of our study were compared to those of previous studies [Table 5].

The study cohort mainly comprised young to middle-aged individuals, with an average age of 20–40 years. Interestingly, males made up the majority of the cases, accounting for 78% of them. Almost half of the patients had comorbidities, with hypertension and diabetes being the most common comorbidities. Similar demographic findings were reported by Sharma R et al., where 82 patients were males and 18 were females.[17]

This study examined the predictive capabilities of MPI and P-Possum scores for mortality and a prolonged hospital stay. The results demonstrated that both scoring systems had high specificity in predicting mortality, with the P-Possum score achieving 100% sensitivity. However, the sensitivity for predicting a prolonged hospital stay was lower. Nachiappan M et al. reported a variation in the sensitivity and specificity of MPI and P-Possum score, where the MPI score 29 was 82.8%. For a sepsis score of 22, MPI accuracy was 95.9%. This indicates that the MPI score can predict high-mortality patients with better accuracy. However, the study also reported that the P-Possum score was superior in predicting mortality compared to MPI, with minimal differences.[10] The effectiveness of MPI was also stated by several other studies where MPI scores could predict the mortality and morbidity of patients with peritonitis.[15,18]

Correia et al. conducted a retrospective analysis encompassing 89 cases of perforation peritonitis. Their findings revealed a mean MPI score of 26.6 points (range: 5-47), demonstrating a sensitivity of 87.3% and a specificity of 41.2%. Optimal accuracy, reaching 69.7%, was attained at an MPI score of 21.[19] Nevertheless, the validity outcomes of the Mannheim Peritonitis Index (MPI) in the current investigation did not align with those reported by Delibegovic et al,[20] despite the similar AUC of ROC curves. This discrepancy could be attributed to differences in the sample size and chosen cut-off values across these studies.

In conclusion, this study provides valuable information for understanding secondary peritonitis and complicated intra-abdominal infections. The observed trends in demographics, perforation characteristics, and utility of predictive scoring systems offer clinicians insights to inform decision-making and improve outcomes in this patient population. Further research, ideally through prospective studies with larger cohorts, is required to validate and build upon these findings.

Limitations of the study

It is important to acknowledge certain limitations of this study, such as its retrospective nature and potential selection bias. Additionally, the sample size may have influenced the generalisability of the findings. Despite these limitations, this study provided valuable insights into the demographics, perforation characteristics, and outcomes of patients with secondary peritonitis.

CONCLUSION

In our study, the P-possum score had a better prognostic value for predicting mortality and morbidity. Although cumbersome, the superiority of the P-Possum score was evident, as the sensitivity for mortality was 100%. This prognostic advantage of the score may be attributed to the use of multiple clinical, biochemical, and radiological parameters. Therefore, the P-Possum score is a more holistic

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prognostic indicator than MPI. Clinical studies are warranted to emphasise the importance of such scoring systems as reliable clinical prognostic tools.

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