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DIAGNOSTIC ACCURACY OF MANNHEIM PERITONITIS INDEX IN PREDICTING OUTCOME AS 30-DAY MORTALITY IN PATIENTS WITH SECONDARY PERITONITIS- A PROSPECTIVE HOSPITAL-BASED STUDY.

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Abstract:

Introduction: Secondary peritonitis develops as a result of GI rupture. Secondary peritonitis is one of the common causes of emergency surgical admissions with significant associated mortality and morbidity. The mortality rates vary from 12 to 41% and the primary treatment in most cases requires source control with surgical intervention. Previous studies in Indian population stated that MPI based system is often advantageous over other scoring systems for better management of the disease, patient segregation, prognostic reliability and specificity. Hence, we set out to assess and compare the discriminative ability of Mannheim peritonitis index (MPI) for in-hospital mortality of patients diagnosed with secondary peritonitis in a tertiary centre.

Methodology: A hospital-based prospective study was done in 100 adult patients, diagnosed with secondary peritonitis during September 2021 to September 2022. Institutional ethical committee clearance and patients informed consent was obtained. The patients will be allotted points according to MPI scoring systems which is an 8-parameter scale, outcome assessed was 30-day mortality. An analysis was performed using SPSS version 22, Chi-square statistic was used. The receiver operating characteristic (ROC) curves were plotted

with sensitivity against 1-specificity and diagnostic accuracy of MPI to assess 30-day mortality was calculated. P <0.05 was considered as significant statistically.

Results: Majority belonged to the age group of 21-30years (35%), followed by 41- 50 years (28%). Commonest site of perforation was duodenum in 42% followed by ileum in 27%. 30-day mortality was seen in 8% patients. The risk of mortality was highest in patients with MPI score >29(22.2%) when compared to patients with MPI score 21-29 (10%) and <21 (1.9%) and this difference was significant statistically.

Conclusion: A bimodal distribution was noted with peaks in age groups of 21–30 (35%) and 41–50 (28%). Most common in males (77%). Commonest site of perforation was duodenum in 42% followed by ileum in 27%. Mortality was seen in 8%. The AUC for MPI score to assess mortality was 0.917 which shows an excellent performance in predicting mortality with score >29 as cut off. Sensitivity and specificity of MPI score with 29 as cutoff in predicting mortality was 82.3% and 76.5% with diagnostic accuracy of 85.1%.

Keywords: Mannheim peritonitis index score, secondary peritonitis, 30-day mortality, ROC curve, Diagnostic accuracy.

INTRODUCTION

Peritonitis is inflammation of the peritoneum and/or peritoneal cavity due to localized or generalized infections[1]. Primary peritonitis is caused by bacterial, chlamydial, fungal, or mycobacterial infection. Secondary peritonitis develops as a result of GI rupture [2]. Secondary peritonitis is one of the common causes of emergency surgical admissions with significant associated mortality and morbidity [3,4,5,6]. The mortality rates vary from 12 to 41% [7,8] and the primary treatment in most cases requires source control with surgical intervention.

Early identification and stratification of patients with peritonitis may help in selecting patients for aggressive surgical management and selective intensive care approach, especially in resource-poor countries like India [9].

Several prognostic scoring systems both specific and nonspecific were assessed for use in peritonitis such as the Mannheim Peritonitis Index (MPI) [9], The World Society of Emergency Surgery Sepsis Severity Score (WSESSSS) [10], the Predisposition, Infection Response Organ dysfunction score for Intra-Abdominal sepsis (PIRO-IAS) [11], the

APACHE II score [12,13,14] and the QSOFA[15].These scoring systems can be a good tool to predict and hence to monitor the priority of treatment for better care in case of peritonitis.

Previous studies in Indian population stated that MPI based system is often advantageous over other scoring systems for better management of the disease, patient segregation, prognostic reliability and specificity[16].The predictive ability of these tools for in-hospital mortality of peritonitis in our setting is yet to be assessed and compared. We set out to assess and compare the discriminative ability of Mannheim peritonitis index for in-hospital mortality of patients diagnosed with secondary peritonitis in a tertiary centre.

METHODOLOGY

A hospital-based prospective study was done in 100 adult patients, diagnosed with secondary peritonitis during September 2021 to September 2022. Institutional ethical committee clearance was obtained. Patients of either sex >18 years, finding suggestive of secondary peritonitis were included. Patient not willing to give informed consent, cases of primary peritonitis, cases unfit for surgery were excluded. Patients were selected by purposive sampling method and were followed up till death or discharge from hospital up to 30 days, final outcome was 30-day mortality. A case of peritonitis was defined as clinical symptoms and signs (abdominal tenderness, guarding, and/or rigidity with or without imaging signs) suggestive of peritonitis, and evidence of peritoneal contamination confirmed intraoperatively by the primary surgeon.

After obtaining written informed consent from patients, detail history, physical examination, basic preoperative investigations and radiological imaging was done. All the patients were kept nil by mouth (NBM), and resuscitation was done with intravenous fluid, antibiotics and analgesics, correction of electrolyte imbalance (if any), abdominal decompression by putting nasogastric tube and Foley's catheterisation. Patients who were fit for surgery were managed by exploratory laparotomy for peritoneal toileting and repair of perforation. Intra-operative finding of perforation in a patient with peritonitis were taken as gold standard for secondary peritonitis. Post-operatively, all of the patients were followed to assess 30-day mortality. The patients will be allotted points according to MPI scoring systems which is an 8-parameter scale. Based on MPI based studies by Ghosh A et al, we speculate the risk category of peritonitis patients with MPI score as <21 (low risk), 21-29 (moderate risk) and >29 (high risk) as a better assessment parameter to predict treatment modalities and outcomes [16].

Table 1: Mannheim peritonitis index [17]

Risk Factor	Weightage, if any
Age >50 years	5
Female Gender	5
Organ Failure*	7
Malignancy	4
Preoperative duration of peritonitis >24 hours	4
Origin of sepsis not colonic	4
Diffuse generalised peritonitis	6
Exudates	
Clear	0
Cloudy, Purulent	6
Faecal	12

*Definitions of organ failure: Kidney: creatinine >177 μmol/L, urea >167 μmol/L, oliguria <20 ml/h; Lung: pO2 <50 mmHg, pCO2 >50 mmHg; Shock: hypodynamic or hyperdynamic; Intestinal obstruction (only if profound): Paralysis >24 h or complete mechanical ileus

Statistical analysis

An analysis was performed using SPSS version 22. Data was examined using descriptive statistical methods, and all information is presented as Mean, SD, Percentages, Tables, and Graphs as needed. Chi-square statistic was used. The receiver operating characteristic (ROC) curves were plotted with sensitivity against 1-specificity and diagnostic accuracy of MPI to assess 30-day mortality was calculated. P <0.05 was considered as significant statistically.

RESULTS

Majority belonged to the age group of 21-30years (35%), followed by 41- 50 years (28%). Patients in the age group of 31-40 years were 19% and < 20 years were 5%. Patients in the age range of 61-70 years and 71-80 years were 3% and 1% respectively. Mean age was 35.25 with range 18 – 78 years. Males were 77% and females were 23%. Comorbidities include

diabetes mellitus in 12%, hypertension in 13 %, tuberculosis in 5%, inflammatory bowel disease in6% and others in 4% (includes malignancy in 2, typhoid in 1 and post COVID in 1). (table 2)

Table 2: Distribution of patients as per variables assessed

PARAMETERS	Sub- group	Frequency	Percentage
Age in years	< 20 years	5	5
	21– 30 years	35	35
	31 - 40 years	19	19
	41- 50 years	28	28
	51 -60 years	9	9
	61 – 70 years	3	3
	71 – 80 years	1	1
Age (years) Mean±SD/ range		35.25 ± 15.3 years/ 18-78 years	
Sex	Female	23	23
	Male	77	77
Comorbidities	Diabetes Mellitus	12	12
	Hypertension	13	13
	Tuberculosis	5	5
	Inflammatory bowel disease	6	6
	Others	4	4

Duration of hospital stay was 0 – 48hours in 12%, 48-96 hours in 36% and >96 hours in 52%. Commonest site of perforation was duodenum in 42% followed by ileum in 27%. Other sites identified were appendix in 14%, stomach in 7%, jejunum, colon and rectum 5%each. Mortality risk as per MPI score was mild moderate and high in 52%, 30% and 18% respectively.30-day mortality was seen in 8% patients. (table 3)

Table 3: Distribution of patients as per disease characters assessed

PARAMETERS	Sub- group	Frequency	Percentage
Duration of hospital stay	0 – 48hours	12	12
	48-96 hours	36	36
	>96 hours	52	52

Site of perforation	Stomach	7	7
	Duodenum	42	42
	Jejunum	5	5
	Ileum	27	27
	Appendix	14	14
	Colon and rectum	5	5
Mortality risk as per MPI score	Mild risk < 21	52	52
	Moderate risk 21-29	30	30
	High risk >29	18	18
30 Day mortality	Yes	8	8
	No	92	92

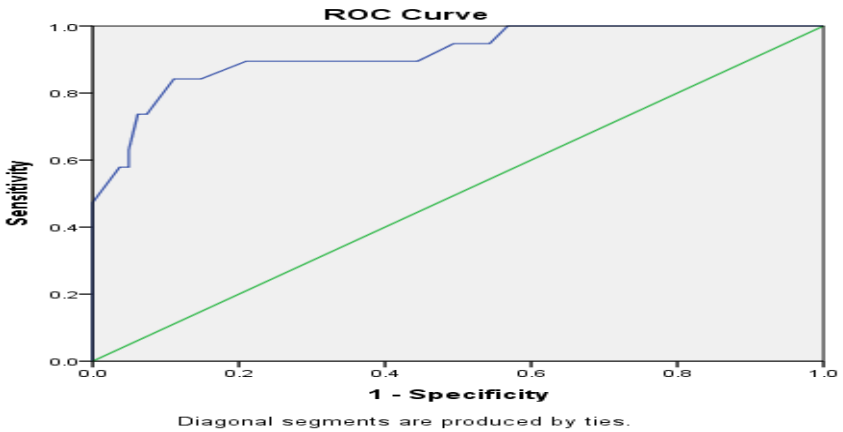
The risk of mortality was highest in patients with MPI score >29(22.2%) when compared to patients with MPI score 21-29 (10%) and <21 (1.9%) and this difference was significant statistically. (table 4)

Table 4: MPI score versus mortality

MPI score	**Dead (8)**	**Alive (92)**	**Chi square test/ P value**
< 21	1(1.9%)	51 (98.9%)	7.719/0.021
21-29	3 (10%)	27 (90%)	
>29	4 (22.2%)	14 (78.8%)	

The AUC for MPI score to assess mortality was 0.917 which shows an excellent performance in predicting mortality with score >29 as cut off. (figure1)

Figure 1: ROC curve of MPI in predicting mortality



Sensitivity and specificity of MPI score with 29 as cutoff in predicting mortality was 82.3% and 76.5% with diagnostic accuracy of 85.1%. (table 5)

Table 5: Diagnostic accuracy of MPI score in predicting mortality

MPI score in predicting mortality	Values
Sensitivity (95 CI)	82.3% (53.9%-89%)
Specificity (95 CI)	76.5% (53.4%-89.7%)
Positive predictive value (95 CI)	75% (72.9%-77%)
Negative predictive value (95 CI)	84.2% (67%-87%)
Diagnostic accuracy (95 CI)	85.1% (79.1%-89.7%)

DISCUSSION

Peritonitis secondary to hollow viscus perforation is one of the commonest reasons for emergency surgery done even today. Effective preoperative management, timely surgery and proper post-operative care will decide the outcome.

Current study was done in 100 patients diagnosed with secondary peritonitis. In this study majority belonged to the age group of 21-30years (35%), followed by 41- 50 years (28%). Patients in the age group of 31-40 years were 19% and < 20 years were 5%. Mean age was 35.25 and range 18 – 78 years. In study by Sharma R et al, mean patient age was 37.96 ± 17.49 years.[1] In study by Sreedath M et al One-hundred and seventy-five cases of secondary peritonitis were included with ages ranging from 14 to 82 years. A bimodal distribution was noted with peaks in age groups of 20–30 (20.6%) and 50–60 (19.4%) which was similar to our study.[18]Study by Muralidhar V A et al mean age was 43.8 (± 15.8) years (range 18–85).[17]

In this study males were 77% and females were 23%. In study by Sharma R et al,82 males and 18 females presenting with secondary peritonitis were included (male: female ratio 4.56:1).[1] Instudy by Sreedath M et al, 71% of patients were males and females constituted the rest. Male-to-female ratio was 2.4:1.[18] Study by Sreedath M et alperitonitis was generalised in 116 (66.33%) and localised in 59 (33.7%).[18]

In this study commonest site of perforation was duodenum in 42% followed by ileum in 27%. Other sites identified were appendix in 14%, stomach in 7%, jejunum, colon and rectum 5% each. Study by Sreedath M et alAmong 175 patients, the majority had appendicular perforation (66%–37.7%), followed by stomach (54%–30.9%), duodenum (32%–18.3%), colon (13%–7.4%), ileum (6%–3.4%) and rectum and jejunum each contributing 2 (1.1%).[18]

In this study mortality was seen in 8% of patients. In study by Muralidhar V A et al there were seven deaths (14%) five patients died of multiple organ dysfunction and two patients died of cardiogenic shock.[17]

In this study mortality risk as per MPI score was mild, moderate and high in 42%, 30% and 28% respectively. Similarly in study by Sreedath M et alpatients with score <21 comprised 130 patients (74.3%), patients with score 21–29 had 22 patients (12.6%) and patients with score >29 had 23 patients (13.1%).[18]

In this study the risk of mortality was highest in patients with MPI score >29(22.2%) when compared to patients with MPI score 21-29 (10%) and <21 (1.9%) and this difference was significant statistically Study by Sreedath M et alAssociating MPI score with mortality showed that 130 patients with MPI score <21 had 0% mortality, 22 with a score of 21–29 had 1 (4.5%) mortality and23 with a score of >29 had 20 mortality (87%). The results showed a statistically significant association between MPI score and mortality ($P < 0.001$)

In this study the AUC for MPI score to assess mortality was 0.917 which shows an excellent performance in predicting mortality with score >29 as cut off. Sensitivity and specificity of MPI score with 21 as cutoff in predicting mortality was 82.3% and 76.5% with diagnostic accuracy of 85.1%.In study by Sharma R et al, on plotting the ROC curve, the sensitivity was 92%, and specificity was 78% with area under curve (AUC) being 0.9 at a cut-off of 21 MPI score.[1] Findings of study by Sreedath M et al based on, receiver operating characteristic curve analysis of MPI prediction of mortality showed that area under the curve 0.03 with a

standard error of 0.023, 95% confidence interval (0.016–0.075) and P < 0.001. For the MPI score of 25, sensitivity was 78% and specificity was 84.86%, with a positive likelihood ratio of 7.93 and a negative likelihood ratio of 0.303 for predicting mortality.[18]

In study by Muralidhar V A et al MPI score was analysed with the mortality shows highest sensitivity of 72.09% and specificity of 71.43% when MPI score of 25 was taken as a threshold value for dichotomous analysis using ROC curve. MPI score of 26 and more were associated with 29.4% mortality compared to patients with MPI score of 25 and less which was 6.1% mortality and was statistically significant (p=0.03).

CONCLUSION

A bimodal distribution was noted with peaks in age groups of 21–30 (35%) and 41–50 (28%). Most common in males (77%). Commonest site of perforation was duodenum in 42% followed by ileum in 27%. Mortality was seen in 8%. The AUC for MPI score to assess mortality was 0.917 which shows an excellent performance in predicting mortality with score >29 as cut off. Sensitivity and specificity of MPI score with 29 as cutoff in predicting mortality was 82.3% and 76.5% with diagnostic accuracy of 85.1%.

Recommendations: Further multicentric studies should be done to arrive at the MPI score cutoff, as the cutoff used by different studies were different.

Limitations: Single centre study.

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