Section: General Surgery

Original Research Article

TO STUDY THE ROLE OF MANNHEIM PERITONITIS INDEX IN PREDICTING PROGNOSIS OF PERFORATION PERITONITIS IN A TERTIARY CARE HOSPITAL OF NORTH INDIA

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ABSTRACT

Background: Various scoring systems have been devised throughout the years to determine the gravity of patients' ailments or their prognosis. Our inquiry delved into the effectiveness of the Mannheim Prognostic Index (MPI) in predicting mortality risk, complications, extended hospital stays, and the need for intensive care unit (ICU) admission among all patients presenting with secondary peritonitis. Furthermore, we aimed to ascertain the practicality, convenience, and simplicity of this assessment as a tool for integration into the clinical practices of surgeons and critical care physicians.

Materials and Methods: A retrospective, comparative, observational and analytical study was conducted. One hundred patients diagnosed with secondary peritonitis presenting to the general surgery department were assessed and Manheim peritonitis index and APACHE II scores were calculated and compared.

Results: The efficacy of the MPI was contrasted with that of another commonly utilized mortality prediction system, such as Apache II, involving a cohort of 100 patients from a tertiary care centre of north india. The predictive accuracies were determined to be 93.3% and 86.9%, respectively.

Conclusion: Although Mannheim offers a commendable response in predicting mortality, its evaluation is not foolproof as it overlooks certain factors; thus, a patient deemed to have a low mortality risk may, in fact, succumb.

Keywords: Secondary peritonitis, acute abdomen, abdominal cavity, intra-abdominal infection, abdominal pain.

INTRODUCTION

Secondary peritonitis is an infection or inflammation of the peritoneum (the lining of the abdominal cavity) caused by an underlying condition, such as a perforated organ or injury, leading to contamination of the peritoneal space.[1] Most cases of peritonitis occur due to invasion of the peritoneal cavity by bacteria from the gut.[2] Currently, fatality stemming from this cause can escalate to as high as 80%.[3] Early prognostic evaluation of abdominal sepsis is desirable to select high-risk patients for more aggressive therapeutic procedures. Treatment is primarily surgical. Different scoring are used to predict the outcome in patients with peritonitis. In the last 3 decades, multiple scoring systems have been developed which include the Mannheim peritonitis index (MPI) (1983), the acute physiological and chronic health evaluation score (APACHE II) (1985), the peritonitis index altona (PIA), the sepsis severity score (1983) and the physiological and operative severity score for enumeration of mortality and morbidity (POSSUM) to determine the severity of peritonitis, especially for those with a septic component.[4] The MPI is a prognostic index for peritonitis with high accuracy in individual prognosis and that it is also very easily documented.[5] MPI is the first severity scoring system designed to assess and provide prognosis for individual postoperative

mortality in patients with peritonitis, who can receive surgical treatment.[6] MPI can be rapidly applied and is based on the assessment of clinical parameters and intraoperative findings, with which we can estimate the severity of the disease and carry out an appropriate and early therapeutic intervention.[7]

Relevance of this study is that early identification of peritonitis severity can help in offering multidisciplinary and appropriate therapeutic strategies for the management of local and systemic complications. Ultimately resulting in reduced morbidity and mortality.

MPI score is easy to use and can be quickly applied in patients admitted in emergency ward. It is a specific index for peritonitis. It has a low cost and can be performed at the patient's bedside.[8]

MPI is a simple score that allows the surgeon to determine soon and early the risk of an unfavorable outcome in patients with perforation peritonitis.[8]

Thus its helps in initiating quick and aggressive therapeutic intervention hence saving precious lives.

MATERIALS AND METHODS

This was an observational, retrospective, comparative and analytical study.

One hundred patients presenting to and diagnosed with secondary peritonitis Department of General surgery at Guru Gobind Singh Medical College and Hospital, Faridkot, between October 2024 and April 2025 were identified. Patients presenting here usually belong to Faridkot and nearby districts such as Ferozepur, Moga, Bathinda, Fazilka, Malout.

Study tool used were questionnaire and interviews.

Inclusion Criteria

- Patients ≥16 years old
- Diagnosis of abdominal sepsis due to secondary peritonitis
- C) Primary surgery performed at GGSMCH faridkot, Punjab

Exclusion Criteria

- Patients who will not be able to take full treatment (due to financial or other constraints)
- b) Cases of primary peritonitis.
- c) Cases refused or unfit for surgery

MPI measures different parameters: age equal to or greater than 50 years (5 points); female sex (5 points); multiorgan failure (7 points); malignancy (4 points); preoperative duration of peritonitis > 24 hours (4 points); sepsis of non-colonic origin (4 points); generalized peritonitis (6 points); and type of exudate (clear 0 points, purulent 6 points., fecal 12 points). Following evaluation using a predesigned performa, MPI score was calculated for each patient and the patients were followed-up till death or discharge from the hospital. Death was the main outcome measure against which the MPI scores were analyzed. The MPI scores were divided under three categories; scores <15 (category1), scores 16-25 (category 2), scores > 25 (category 3).

To calculate the APACHE II score, physiological variables, age, and chronic health status were assessed and then the points assigned to each category were added up. The physiological variables were Temperature, Heart rate, Respiratory rate, Mean arterial blood pressure, Oxygenation (PaO2/FiO2), Arterial pH or HCO3, Serum sodium, potassium, and creatinine, Hematocrit, White blood cell (WBC) count and Glasgow Coma Scale (GCS). Each variable was assigned points based on its value, with higher points assigned to more abnormal values. Age was assigned points based on the following categories: < 44 years: 0 points, 45-54 years: 2 points, 55-64 years: 3 points, 65-74 years: 5 points, ≥ 75 years: 6 points. Chronic health status was assessed, and points were assigned based on the presence of certain conditions: Severe organ system insufficiency (e.g., liver cirrhosis, NYHA class IV heart failure) or immunocompromised status: Non-operative or emergency postoperative patients: 5 points and Elective postoperative patients: 2 points

APACHE II Score Calculation: The APACHE II score was calculated by adding up the points from the Acute Physiology Score (APS), age points, and chronic health points.

Formula: APACHE II score = APS + Age points + Chronic Health points

The score ranged from 0 to 14, with higher scores indicating greater illness severity.

Data collection and statistics

The data was collected and entered into the personal computer. Statistical analysis was done using Statistical Package for Social Sciences (SPSS/version 21) software. For the categorical variables, the frequency and percentages were calculated. Differences in categorical variables between cases and controls were analyzed by the x 2 test. Differences between medians were analyzed by Mann–Whitney U test. The data wherever found skewed and not normally distributed was presented as median values and otherwise as mean values. Odds ratio is used to measure the association between an exposure and its outcome. Receiver operating characteristics (ROC) curves were generated for the study samples to assess the efficacy of the MPI and APACHE scoring systems in the assessment of patients with secondary perforation peritonitis in predicting outcomes.

RESULTS

A total of 100 patients treated in the emergency department underwent surgery for acute abdominal conditions. Among them, 49% (n = 49) were in the age range of 16 to 40 years, 25% (n = 25) were between 41 and 63 years old, and 26% (n = 26) were over 64 years old. In terms of gender distribution, 47% (n = 47) were male, while 53% (n = 53) were female.

Hospitalization ranged from 1 to 15 days for 81% of patients (n = 86), spanning 16 to 30 days for 11% of

patients (n = 11), and surpassing 30 days for 3% (n = 3). The most prevailing diagnosis was small bowel perforation (distal ileum) in 62% of patients (n = 62), succeeded by acute Gastric perforation in 21.8% (n = 21), large gut perforation 6%(n =6) Oncological pathology 5% (n =5), appendicular perforation in 3% (n = 3) Complicated hernias 2% (n =2), Acute cholecystitis (n =1) and Uterine perforation (n=1)in decreasing order of frequency among the patients.

Table 1: Most frequent pathologies

	Frequence (n)	Percentage (%)
1	Small bowel perforation (n = 62)	62%
2	Gastric perforation in (n = 21)	21%
3	Large gut perforation (n = 6)	6%
4	Oncological pathology (n =4)	4%
5	Appendicular perforationb (n =3)	3%
6	Complicated hernias (n =2)	2%
7	Acute cholecystitis (n =1)	1%
8	Uterine perforation (n=1)	1%

Surgical site infection exhibited the highest prevalence at 10% (n = 10), followed by pneumonia at 6% (n = 6), and organ failure at 4% (n = 4); whereas the majority, constituting 80% (n = 80), remained devoid of any complications.

Table 2: Complications

Complications		
	Frequency (n)	Percentage (%)
Surgical site infection	6	6
Pneumonia	3	3
Multiorganic failure	1	1.4
Intraabdominal abscess	1	1.1
Others	15	15
None	74	74
Total	100	

For the duration of hospitalization, the mean length was recorded at 11 days, with a standard error of ± 10.62. The median stay was 5.5 days. This variation in data can be attributed to the heterogeneous nature of hospital stays, which can span anywhere from 1 day to over 30 days. Therefore, the mode serves as a key reference point, indicating the most frequently observed duration of hospital stays with the highest concentration of patients.

The overall percentage of patients necessitating admission to the Intensive Care Unit (ICU) for postoperative care was 26% (n = 11), leaving the remaining 74% (n = 74) not requiring such specialized medical attention. This data highlights the low proportion of patients in need of intensive medical care.

82% (n = 82) of individuals were discharged from the hospital in a stable condition, while 18% (n = 18) of patients had unfortunately passed away.

Considering the intraoperative and preoperative findings, there was limited agreement and notable disparities between the MPI and APACHE II score. The Receiver Operating Characteristic (ROC) curve was utilized to ascertain the efficacy of each score and to evaluate patient mortality in an urgent surgical procedure for acute abdomen in the context of secondary peritonitis. It was deduced that as the index increases, so does the mortality rate. The ROC curve analysis encompassed specificity, sensitivity, and relative risk for both scoring systems. The MPI demonstrated an area under the curve of 0.933 (95% CI:), indicating the substantial predictive value of the area under the curve for sensitivity (91.3%) and specificity (92.6%) with a threshold of 23.5 points.

Mortality rate for patients who scored <23 points on MPI was 6% (n = 1), and survival rate was 86% (n = 70). In contrast, in patients with a > 23- point score, a 94% (n = 17) mortality rate and a 14% (n = 12) survival rate was observed. Based on this, it can be concluded that MPI is more effective as a mortality predictor.

Table 3: MPI mortality rate

			Survival rate	Mortality rate
MPI Score	> 23	N	12	17
		% within patient mortality	14%	94%
	< 23	N	70	1
		% within patient mortality	86%	6%
Total		N	82	18

The ROC curve was constructed to analyze specificity, sensitivity, and relative risk across all scales. In the case of the APACHE II score, a sensitivity of 84.6% and specificity of 73.3% were observed at a threshold of 14.50 points. Among patients scoring below 14 points, 16% (n = 3) succumbed, while 63% (n = 52) survived. Conversely, those scoring above 14 points exhibited an 83% mortality rate (n = 15) and a 36% survival rate (n = 30). Consequently, it can be inferred that the

predictive efficacy of the APACHE II score in mortality prediction falls short compared to the MPI.

Table 4: APACHE II score mortality rate

			Survival rate	Mortality rate
	> 14	N	30	15
		% within patient mortality	36%	83%
	< 14	N	52	3
		% within patient mortality	63%	16%
Total		N	82	18

DISCUSSION

Secondary peritonitis remains a significant contributor to mortality in numerous patients, notwithstanding advancements in surgical methodologies, potent antimicrobial treatments, and the evolution of intensive care units. Presently, it afflicts 13% of individuals under surgical care, with fatality rates ranging from 35 to 80%. Addressing this issue necessitates an understanding of the determinants influencing its prognosis. Timely assessment is imperative to formulate an appropriate therapeutic approach, identify high-risk patients warranting more aggressive interventions, and utilize available scoring systems to gauge disease severity, thereby diminishing morbidity and mortality rates.[9] Multiple studies have validated the (MPI) in countries with diverse socioeconomic, cultural, and ethnic characteristics. However, the applicability of this test for determining the prognosis of patients with secondary peritonitis in our specific context was imperative. In this regard, it was discovered that the MPI serves as a highly beneficial and straightforward mortality predictor. It effectively integrates clinical variables and surgical findings with a notable level of sensitivity and specificity. The predominant demographic in this study comprised of female patients with a mean age of 35 years similar to study conducted by Marlon San Martin-Riera et al.[4] The most common underlying cause of secondary peritonitis was small bowel perforation, followed by gastric perforation differing from study conducted by.[4,10] Scores were applied to patients prior to the surgical intervention, which allowed a time frame to evaluate the evolution of the patients. After the surgery, however, it should be noted that the complications that occurred at the time of the surgical procedure fed the assessment scores and allowed changing the previous criteria. It is important to indicate that these values could only be compared against the real result, that is,
after patient assessment; although MPI had an advantage due to its high sensitivity and specificity. The opportunity to estimate postoperative risk through a pre-surgical assessment is very useful to implement an appropriate therapeutic strategy.[11] The ease of the MPI in terms of assessment of its parameters and utility in prediction of mortality (sensitivity (91.3%) and specificity (92.6%)), showed superiority versus APACHE II score (sensitivity of 84.6% and specificity of 73.3%) ; also, direct correlation of MPI with the mortality of our sample was demonstrated.[12,13] Despite diagnostic advances and predictive scores, mortality associated with bacterial peritonitis in our study was 18%, above the mortality found Marlon San Martin-Riera et al.[14,15] In this research, the main limitation was the large number of patients, as acute abdominal pathology is very frequent.[13] The lack of comprehensive patient information hinders the outcomes, attributed to their limited educational attainment.[16] Another cause of exclusion was already being surgically intervened in another health home, very frequent due to the health care level of the center. Follow-up was challenging to conduct at our hospital as it is a tertiary care facility, necessitating postoperative consultations to be carried out at the patient's originating primary hospital; additionally, many patients do not live in the same city, coming from different cities, which further complicates continuing medical control. Finally, other limitation was related to the surgical findings about the exudate sample, which are not always well detailed; the sample is sent to the laboratory and the laboratory only details the origin of the exudate but not its characteristics.

CONCLUSION

The prevailing pathology observed was small bowel perforation, with the primary complication being surgical site infection. The (MPI) exhibited superior sensitivity (91.3%) and specificity (92.6%) in contrast to the APACHE II score, which displayed a sensitivity of 84.6% and specificity of 73.3%, accompanied by a 95% confidence interval and standard error of 0.031. Mortality was defined based on an MPI threshold of 23 points: the higher the score surpassing this threshold, the lower the patient's likelihood of survival; whereas the APACHE II score indicated a heightened risk of death with a threshold exceeding 14 points. The MPI excelled in predicting postoperative risk by directly evaluating surgical outcomes and exudate characteristics, facilitating its practical application for surgeons in emergency scenarios. In contrast, the APACHE II score relies more on clinical parameters that can significantly impact the timing of sample collection and the accuracy of laboratory handling. Although the MPI proves to be a reliable mortality predictor, it is not foolproof as it may overlook certain factors, potentially leading to the unfortunate demise of a patient categorized as low-risk.

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