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Original Research Article

EVALUATION OF MANNHEIM PERITONITIS INDEX (MPI) SCORING SYSTEM IN PROGNOSIS OF PATIENTS WITH PERITONITIS IN TERTIARY CARE CENTRE CHENNAI

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Abstract

Background: Acute generalised peritonitis resulting from perforation of a hollow viscus inside the gastrointestinal tract is a medical illness that poses a significant risk to the patient's life.The MPI is a specialised scoring system designed to aid in the early detection of individuals with severe peritonitis, enabling a more proactive surgical approach and ultimately leading to improved patient outcomes. The aim is to assess the effectiveness of the Mannheim Peritonitis Index (MPI) scoring system in predicting the prognosis of patients with peritonitis in a tertiary care hospital in Chennai. **Materials and Methods:** This research covered all patients who were diagnosed with peritonitis resulting from hollow viscous perforation. The patients were categorised into two groups: survivors and non-survivors. A comparison of scores was conducted between both groups. All patients were monitored until their discharge from the hospital, and they had daily examinations. The efficacy of each rating system was evaluated in predicting the prognosis of the patients. The location of the hole will be determined based on the details provided in the operational process. **Result:** The mortality rate in our study is found to be 13%. The area under the sensitivity curve and specificity curve was put under roc curve that showed sensitivity of MPI scoring system in the prognosis of the patients with peritonitis is 100% and the scoring system is 90% specific in the prognosis of patients with perforation peritonitis. The MPI has 61.5% Positive Predictive Value and it has Negative Predictive Value of 100% in ruling out the patient with perforation peritonitis. **Conclusion:** The MPI scoring system is a disease specific and easy accessible scoring system for the surgeon to assess the outcome of the patient. It can be used in our day to day surgical prognosis in patients with perforation peritonitis. In our study the sensitivity and specificity of the patients with Mannheim Peritonitis Index has greater than 90% hence it is a good tool against the patients with secondary peritonitis due to perforation.

INTRODUCTION

Peritonitis is defined as the inflammation of the serosal membrane that lines the abdominal cavity and other organs that contained it. The peritoneum, which is an otherwise sterile environment reacts to various pathologic stimuli with a fairly uniform inflammatory response.[1] Depending on the underlying pathology the resultant peritonitis may be infectious or sterile. The abdomen is the second most common source of sepsis and secondary peritonitis. In most cases peritonitis results in the invasion of the peritoneal cavity by the bacteria, hence the term peritonitis indicates acute bacterial peritonitis.[2] Primary peritonitis results in invasion of abdominal cavity of the patients with pre existing ascites and secondary peritonitis is due to the invasion of

peritoneal cavity by organisms from the perforation of hollow viscus in the abdomen.[3] There is no single, easily available laboratory test that predicts severity or prognosis in patients with peritonitis.[4] Randomised controlled clinical trials are the preferred methods for comparing clinical efficacy of treatment strategies. They remain a vital bridge between advances in basic science on one hand and improvement in health care on the other.[5] Therefore all measures should be undertaken to perform clinical trials with a high quality in this field. Secondary peritonitis due to perforation of hollow viscus is the most common surgical emergency encountered in operation theatre and the most common age group involved in this disease is the young age group as compared to the western population whose mean age of perforation peritonitis is between 40-60 years of

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age.[6] In our country the presentation of secondary peritonitis is late only after the setting of generalized peritonitis with septicaemia. With the arrival of improved surgical methods and modern diagnostic devices early diagnosis and treatment for secondary peritonitis will reduce the mortality to less than 10%.[7] Numerous scoring systems have been suggested to ascertain the predicted risk variables associated with mortality caused by perforative peritonitis. However, these scores often exhibit complexities in their calculation or limitations in their applicability outside the confines of critical care units. The primary score systems that have been documented include the Acute Physiology and Chronic Health Evaluation score (APACHE II), Simplified Acute Physiology Score (SAPS), Sepsis Severity Score (WSES), Ranson Score, Peritonitis Index Altona (PIA), Sepsis Score, and Physiological and Operative Severity Score for Enumeration of Mortality and Morbidity (POSSUM), as well as the Mannheim Peritonitis Index (MPI).[8,9]

The APACHE score is widely regarded as the most effective scoring system for prognostic assessment. The use of this method is prevalent in emergency medicine, since it exhibits a strong association with fatality rates in cases of perforative peritonitis. The evaluation does not include an assessment of the specific kind of peritonitis or the underlying aetiology of the perforation. The use of this intervention is recommended during a 24-hour timeframe after the occurrence of the damage.[10-12] MPI, or the Modified Physiologic Index, has been shown to excel in terms of dependability when it comes to evaluating risks. It enables the accurate prediction of individual prognosis for patients diagnosed with peritonitis.[13,14]

The retrospective research was conducted in Germany during the 1980s and subsequently underwent validation. The collection of data from clinical examinations and surgical evidence is useful in predicting the appropriate timing for implementing "aggressive treatment" and intensive care monitoring. In the context of MPI, eight factors are considered: age, sex, organ failure, diagnosis of malignancy, preoperative length of peritonitis, origin of sepsis, peritonitis extension, and features of exudates.[14,15]

MATERIALS AND METHODS

The present research was undertaken at the government-affiliated Stanley Medical College and Hospital, spanning from March 2021 to November 2021. This research covered all patients who were diagnosed with peritonitis resulting from hollow viscous perforation.

Inclusion Criteria
Patients with Clinical suspicion and investigatory support for the diagnosis of peritonitis due to hollow viscous perforation who are later confirmed by intra op findings.

Exclusion Criteria
Patients with hollow viscous perforation due to trauma, Patients with associated injuries to other organs.

Methodology
The patients were categorised into two groups: survivors and non-survivors. A comparison of scores was conducted between both groups. All patients were monitored until their discharge from the hospital, and they had daily examinations. The efficacy of each rating system was evaluated in predicting the prognosis of the patients. The location of the hole will be determined based on the details provided in the operational process.

Statistical Analysis
The study was conducted using SPSS 25.0 software for the Windows operating system. The statistical analysis used the Pearson's chi-square test for qualitative data and the student's t-test for quantitative data. The sensitivity was plotted against 1-specificity to generate the receiver operating characteristic (ROC) curves.

RESULTS

In the study comprising of 60 patients of 44 male and 16 female, patients with younger age group has better prognosis when compared to patients with elderly age. Patients with female sex had poor prognosis compared to the male patients. The significant parameters helping in the better prognosis of the patient are hemodynamic stability, organ failure at the time of presentation, pre operative duration of the patient at time of presentation, intestinal paralysis, site of perforation, total score of the patient during the time of admission and mean cut off score in the evaluation of the course if disease. All these parameters has high significance value of <0.05. Thus providing a better tool in the outcome of patients with peritonitis prognosis. Patient with shock has higher mortality 62.5% when compared to other organs. Intestinal paralysis during the time of exploration as a result of delayed presentation has 40% more risk of death in patients without intestinal paralysis. Upper GI perforation results in early spread of peritonitis accounts for 66% of death in patients with peritonitis. The mean score for the MPI was 25 which shows patients with score > 25 has poorer prognosis as the score tends to go up the mortality of the patient rises. In our study patient with gastrectomy with jejuno jejunal anastamosis died on the 5th post operative day, Laparotomy with cellen jones procedure died in 3rd post operative day. There is no death in patient with appendicitis as the appendicitis patients has sterile exudate from the ileum and proximal caecum and the procedure is little time consuming compared to the laparotomy. Out of three patient had renal failure among them 2 patients(67%) of the patient died. And out of 8 patients 5 patients(63%) died because of septic shock due to peritonitis and 1 patient(2%) without any

organ failure succumbed to peritonitis denoting the progression of the disease if the treatment is delayed. The comparison between total score and patient status. Based on the finding and taking the mean score of 25. Patients with score above 25 had 62 percent and patient with score <25 had good prognosis. Thus MPI score was best in predicting the outcome of the patient. The area under the sensitivity curve and specificity curve was put under roc curve that showed sensitivity of MPI scoring system in the prognosis of the patients with peritonitis is 100% and the scoring system is 90% specific in the prognosis of patients with perforation peritonitis. The MPI has 61.5% Positive Predictive Value and it has Negative Predictive Value of 100% in ruling out the patient with perforation peritonitis.

Table 1: The mannheim peritonitis index.

Risk Factor	Score
Age>50 years	5
Female sex	5
Organ failure*	7
Malignancy	4
Preoperative duration of peritonitis>24h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, Purulent	6
Fecal	12
Kidney	Creatinine level >117 µmol/L, Urea level >167 mmol/L, Oliguria <20 ml/h
Lung	PO2 <50 mmHg, PCO2 >50 mmHg
Shock	Hypodynamic or Hyperdynamic
Intestinal obstruction	Paralysis >24 h or complete mechanical obstruction

Table 2: Age of the patients

	Frequency	Percent	Valid Percent	Cumulative Percent
< 30 Years	26	43.3	43.3	43.3
31-50 Years	21	35.0	35.0	78.3
>50 Years	13	21.7	21.7	100
Total	60	100	100	100

Table 3: Gender of the patients

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	44	73.3	73.3	73.3
Female	16	26.7	26.7	100
Total	60	100	100	100

Table 4: Based on site of perforation

	Frequency	Percent	Valid Percent	Cumulative Percent
Appendix	19	31.7	31.7	31.7
Duodenum	8	13.3	13.3	45
Ileum	19	31.7	31.7	76.7
Jejunum	2	3.3	3.3	80
Stomach	12	20.0	20.0	100
Total	60	100	100	100

Table 5: Based on generalised peritonitis

	Patient status		
Generalized Peritonitis	Dead	Survived	Total
Yes			
Count	8	38	46
% With Generalized Peritonitis	17.4%	82.6%	100.0%
No			
Count	0	14	14
% With Generalized Peritonitis	.0%	100.0%	100.0%
Total			
Count	8	52	60
% With Generalized Peritonitis	13.3%	86.7%	100.0%

Table 6: Based on organ failure

	Patient status		
Organ failure	Dead	Survived	Total
Renal failure			
Count	2	1	3
% within organ failure	66.7%	33.3%	100.0%

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Intestinal failure			
Count	0	2	2
% within organ failure	0.0%	100.0%	100.0%
Shock			
Count	5	3	8
% within organ failure	62.5%	37.5%	100.0%
No organ failure			
Count	1	46	47
% within organ failure	2.1%	97.9%	100.0%
Total			
Count	8	52	60
% within organ failure	13.3%	86.7%	100.0%

Table 7: Based on exudates

	Patient's status		
Exudates	Dead	Survived	Total
Purulent			
Count	8	36	44
% within Exudates	18.2%	81.8%	100.0%
Clear			
Count	0	16	16
% within Exudates	0.0%	100.0%	100.0%
Total			
Count	8	52	60
% within Exudates	13.3%	86.7%	100.0%

Table 8: Based on site of perforation

	Patient status		
Site of Perforation	Dead	Survived	Total
Appendix			
Count	0	19	19
% within site of perforation	0.0%	100.0%	100.0%
Duodenum			
Count	0	8	8
% within site of perforation	0.0%	100.0%	100.0%
Ileum			
Count	0	19	19
% within site of perforation	0.0%	100.0%	100.0%
Jejunum			
Count	0	2	2
% within site of perforation	0.0%	100.0%	100.0%
Stomach			
Count	8	4	12
% within site of perforation	66.7%	33.3%	100.0%
Total			
Count	8	52	60
% within site of perforation	13.3%	86.7%	100.0%

Table 9: Based on intestinal paralysis

	Patient status		
Intestinal paralysis	Dead	Survived	Total
Yes			
Count	8	12	20
% within Intestinal paralysis	40.0%	60.0%	100.0%
No			
Count	0	40	40
% within Intestinal paralysis	0.0%	100.0%	100.0%
Total			
Count	8	52	60
% within Intestinal paralysis	13.3%	86.7%	100.0%

Table 10: Based on Preoperative duration

	Patient status		
Preoperative duration >24 HRS	Dead	Survived	Total
Yes			
Count	7	25	32
% within Preoperative duration >24 HRS	21.9%	78.1%	100.0%
No			
Count	1	27	28
% within Preoperative duration >24 HRS	3.6%	96.4%	100.0%
Total			

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		8	52	60
Count		8	52	60
% within Preoperative duration >24 HRS		13.3%	86.7%	100.0%

Table 11: Based on Comparison between total score and patient status

| Total score | Patient status | | Total |
	Dead	Survived	
<20			
Count	0	29	29
% within Total score	0.0%	100.0%	100.0%
20-30			
Count	0	20	20
% within Total score	0.0	100.0%	100.0%
>30			
Count	8	3	11
% within Total score	72.7%	27.3%	100.0%
Total			
Count	8	52	60
% within Total score	13.3%	86.7%	100.0%
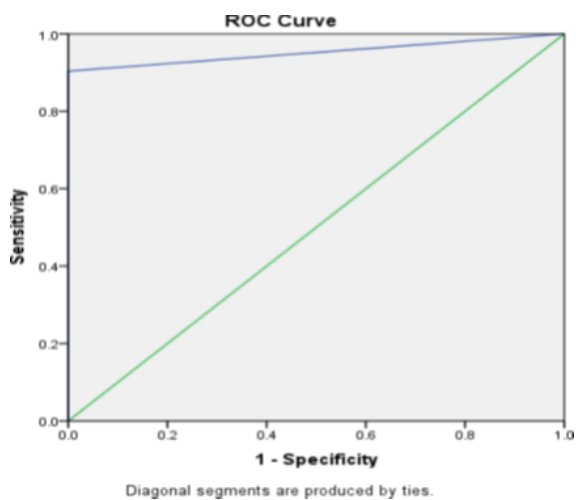
Figure 1: ROC analysis

DISCUSSION

In our study the patients with upper gi symptoms were presented early and resulted in better outcome of the patients care. Since the patients were taken up for surgery soon after the admission and respective procedures carried out. Mean arterial pressures (MAP) were calculated by systolic and diastolic blood pressure measurements using a sphygmomanometer. It is computed using the formula "Diastolic pressure + 1/3(Pulse pressure)". Pulse pressure is the difference between systolic and diastolic blood pressures. The MAP ranges in our study is between 65- 155 mm Hg, with a mean value of 98.5 mm Hg. Low values were observed with a case of shock consequent to stab injury to the abdomen (65 mm Hg) and with another case of colonic malignant perforation with septic shock (68 mm Hg).The mortality rate in our study is found to be 13%. Various trials have estimated the mortality rate to be between 10-60% and the average mortality is 19.5% which is close to the value noted with our study. The mortality rates are influenced by disease specific as well as patient related factors.

In a prospective study was conducted by Correia MM et al.16 over a period of 10 years 1994-2004 (n=267), overall mortality was 20% and mean hospital stay was 20 days. In our study, a Manheim's score of 25 was found to predict mortality which was statistically significant. This is in accordance with previous studies where a score of 26 was found to predict mortality. In a study by Billing et al,[12] mortality rate in patients with a score of less than 21 was found to be 2.3% and above this score a mortality rate of 60-80% was observed. The mortality rate was found to rise proportionately beyond this score. Demmel et al.19 evaluated the usage of MPI in acute peritonitis (n=438). Analysis revealed the MPI to have a sensitivity of 87% and a specificity of 77% for a score of 26. In our study, the cut off score of 25 had a sensitivity of 100% and a specificity of 90%. The MPI has 61.5% Positive Predictive Value and it has Negative Predictive Value of 100% in ruling out the patient with perforation peritonitis.

In a retrospective analysis conducted by Correia et al,[16] data from 89 instances of perforation peritonitis were examined. The study revealed that the average MPI score was 26.6 points, ranging from 5 to 47. The sensitivity of the MPI score was determined to be 87.3%, while the specificity was found to be 41.2%. The highest level of accuracy, which was 69.7%, was achieved when the score was set at 21. In a prospective study conducted by Notash et al,[17] a total of 80 consecutive instances of perforation peritonitis were examined. The researchers sought to compare the MPI score with the multiple organ failure score. The area under the AUC-ROC for the MPI was determined to be 0.972. The sensitivity of the MPI of 21 was found to be 100%, indicating that it correctly identified all individuals with the condition of interest. Additionally, the specificity of the MPI of 21 was shown to be 79%, suggesting that it accurately ruled out the presence of the condition in 79% of individuals without the condition. The sensitivity and specificity of the MPI, with a value of 29, were determined to be 79% and 96%, respectively. The results obtained were similar to the ones seen in our investigation.

In a cross-sectional research conducted by Batra et al,[18] the MPI score was generated for 160 patients with perforation peritonitis. The objective of the study was to assess the effectiveness of the MPI

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scoring system in determining patient prognosis and to improve patient care and treatment. The threshold value used to determine the cut-off point on the ROC curve was 26. The sensitivity and specificity of MPI in the prediction of death were determined to be 100% and 65.54%, respectively. The mortality rate observed was 5.7%. This research conducted in India aimed to apply the MPI scoring system to patients diagnosed with perforated peritonitis in a rural hospital, marking a significant advancement in the field. The findings of our investigation demonstrated comparability, and the observed correlation between higher MPI scores and increased mortality suggests that the MPI score is a valuable predictive tool for assessing mortality in peritonitis patients. Nevertheless, the validity outcomes of MPI in this investigation did not exhibit comparability with the findings of Demmel et al,[19] Ohmann et al,[20] and Delibegovic et al,[21,22] despite the similarity in the area under the curve (AUC) of the ROC curves. This discrepancy might perhaps be attributed to differences in sample sizes and cut-off values. Demmel et al,[19] conducted a prospective study including 108 instances of severe intraabdominal infections that were treated with open therapy.

CONCLUSION

The MPI scoring system is a disease specific and easy accessible scoring system for the surgeon to assess the outcome of the patient. It can be used in our day to day surgical prognosis in patients with perforation peritonitis. In our study the sensitivity and specificity of the patients with Mannheim Peritonitis Index has greater than 90% hence it is a good tool against the patients with secondary peritonitis due to perforation.

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