

Evaluation of Mannheim Peritonitis Index for Predicting Outcome in Emergency Exploratory Laparotomy for acute peritonitis

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Abstract

Introduction: Exploratory laparotomy is one of the commonest emergency procedure performed by general surgeons in daily practice. Due to heterogeneity of conditions requiring exploratory laparotomy, the outcome is too variable. It is often difficult to predict outcome of such patients several scoring systems are available to predict outcome of patients undergoing exploratory laparotomy for acute peritonitis. The aim of this study is to evaluate the role of Mannheim Peritonitis Index (MPI) score in predicting the outcome of patients who need exploratory laparotomy for acute peritonitis.

Methods: This is a prospective analysis of 86 patients who underwent emergency exploratory laparotomy over past 2 years. The mean age of patient was 41 years and 29 (33.7%) were female. All the patients had presented to the emergency with features of peritonitis. Two patients presented with shock. Hollow viscus perforation was present in 37 patients, intestinal obstruction in 31 patients and 18 patients had various other pathologies. There were total 29 complications including 10 mortalities. The mean MPI score was $21.2 \pm 8(4-39)$. There was significant correlation of MPI with mortality ($p < 0.05$).

Conclusion: The MPI score can provide simple and objective means to predict the outcome of patients with peritonitis

Key words: Exploratory Laparotomy, MPI score, Outcome, Peritonitis

Introduction

The term ‘emergency laparotomy’ describes an exploratory procedure for which the clinical presentation, underlying pathology, anatomical site of surgery, and perioperative management vary considerably.¹ The total number of surgical procedures that can be coded within this emergency laparotomy population exceeds 400, reflecting the diverse nature of this surgical cohort.² There is a scarcity of outcome data concerning postoperative mortality rates after emergency laparotomy. Despite the surgical treatment, sophisticated intensive care units, last generation antibiotics and a better understanding of pathophysiology, the mortality rates are still high.³ The outcome of an abdominal infection depends on the complex interaction of many different factors and early specific therapeutic procedures. It may also depend upon exact recognition of the seriousness of the disease and an accurate assessment and classification of the patient’s risks.

Many score systems have been created for assessing patient risks of death during an event of peritonitis, nevertheless equal results have been achieved with the Mannheim Peritonitis Index (MPI) which was developed by Wacha and Linder in 1983.⁴ It was developed based on the retrospective analysis of data from 1,253 patients with peritonitis, in which 20 possible risk factors were considered. Of these only 8 proved to be of prognostic relevance and were entered into the MPI, classified according to their predictive power. Patients with a score exceeding 26 were defined as having a high mortality rate. Some authors did not find significant difference in prognostic value between MPI and APACHE II scores systems and others suggested a combination of these two scores to enhance the efficiency.⁵

Reproducible scoring systems are essential to: 1) ratify the effectiveness of different treatment regimens, 2) scientifically compare surgical intensive care units, 3) help to select aggressive surgical approach and 4) be able to inform patient's relatives with greater objectivity.⁶ In the past 30 years, many prognostic scoring systems have been developed for critical patients.⁷ Despite their design for general application, some have proven specifically useful in septic patients.⁸ The results of treatment for peritonitis are especially difficult to evaluate because these patients may correspond to various etiologies, treatments differ, and there is a lack of universally valid criteria and definitions.⁹

Presently, one of the most accepted scores is APACHE II, which integrates various physiologic variables during the first 24 h within the intensive care unit (ICU) with age and chronic health status of the patient. This initial stratification of risk factors and a predicative equation estimate patient outcome. They are, however, both complex and time consuming.^{10,11} The MPI is one of the most simple scoring systems in use that allows the surgeon to easily determine outcome risk during initial surgery. The recollection of retrospective data is possible and valid, because MPI only requires information routinely found in surgical registers. This study was carried out to evaluate Mannheim Peritonitis Index (MPI) for predicting morbidity, mortality and outcome in patients undergoing emergency exploratory laparotomy at our institute.

Methods

This study was performed in the Department of Surgery, Nepal Medical College and Teaching Hospital. This is an analysis of prospectively maintained database over a period of two years. All the demographic variables and clinical parameters of 86 patients who underwent emergency exploratory laparotomy for acute abdomen were evaluated. Mannheim Peritonitis Index was calculated for each patient using preoperative and intraoperative findings. Mortality and complications were correlated with Mannheim Peritonitis Index.

Results

Total 86 patients who underwent emergency exploratory laparotomy for acute peritonitis were included in the study. Mean age of the patients was 41 ± 19.8 (9-820) years. Mean duration of symptoms was 61 ± 65.1 (12 -360) hours and mean hospital stay was 13.9 ± 9.5 (3-46) days. The frequency of MPI parameters was, age > 50 years: 31 (36%), female sex :29 (33.7%), organ failure: 16 (18.6%), malignancy :7 (8.1%), duration > 24 hours: 62 (72%), origin not colonic :75 (87.2%) generalized peritonitis: 84 (97.6%) and colour of exudates clear: 36 (41.8%), purulent :36 (41.8%) ,fecal: 14 (16.3%) (Table 1) .

Table 1. Mannheim Peritonitis Index

Risk factors	Scores	Patients with positive factor
Age > 50 years	5	31 (36%)
Female sex	5	29 (33.7%)
Organ failure*	7	16 (18.6%)
Malignancy	4	7 (8.1%)
Preoperative duration of peritonitis > 24hours	4	62 (72 %)
Origin of sepsis not colonic	4	75 (87.2%)
Diffuse generalized peritonitis	6	84 (97.6 %)
Exudates		
Clear	0	36 (41.8%)
Cloudy, purulent	6	
Fecal	12	

*Kidney failure = creatinine level > 177 μ mol/L or urea level > 167mmol/L or oliguria < 20ml/hour; pulmonary insufficiency = PaO₂ < 50 mmHg or PaCO₂ > 50 mmHg; intestinal obstruction/paralysis > 24hours or complete mechanical ileus, shock

Among the total 86 patients, 38(44%) patients had perforation, 33(38%) had obstruction 15(18%) patients had various other pathologies (Figure 1) .

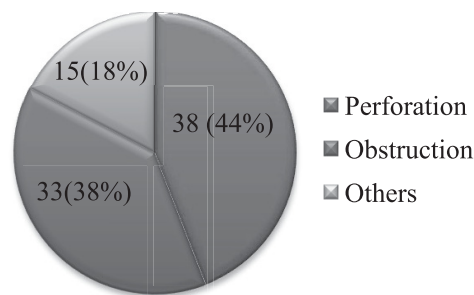


Figure 1. Surgical pathologies causing peritonitis

Primary perforation repair was done in 25(29.1%) , resection- anastomosis was required in 19(22.1%) patients, 8(9.3%) needed stoma, and various other procedure were done in 34(39.5%) (Figure 2) .

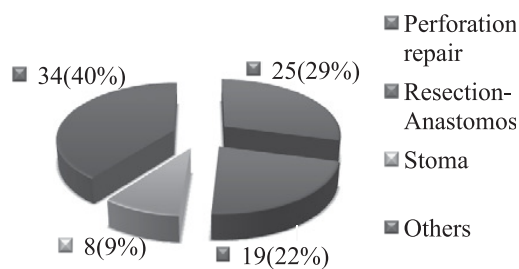


Figure 2. Surgical Procedures

There were total 29 complications, including 10 mortalities which were mostly due to sepsis, ARDS and multiorgan dysfunction. Among the 19 patients who improved, 9 had complications related to the procedure like surgical site infection, abscess, wound dehiscence and 10 patients had complications which wasn't related to procedure itself like pneumonia, ARDS, sepsis, septic shock, hypoalbuminemia and multi organ failure.

There was no significant difference in the mean MPI Score of the patient who had complications (23.4 ± 7.9) and those who did not have complications (20.9 ± 6.4) p value=0.12 (Table 2).

Table 2. Correlation of Mean MPI value with outcome

Outcome parameters		Mean MPI	P value
Complications	Yes	23.4 ± 7.9	0.12
	NO	20.9 ± 6.4	
Mortality	Yes	28.5 ± 9.5	0.001
	NO	20.8 ± 6.1	

There was no significant difference in the rate of complications with the cut of MPI score of 21 (p value=0.22 and cut off value of 26 (p value=0.09) (Table 3).

Table 3. Correlation of cut off MPI value with complications

Cut off MPI value	Complications		P value
	(Number of patients)		
	Yes	No	
MPI < 21	16	39	0.226
MPI $\geq$ 21	13	18	
MPI < 26	22	51	0.096
MPI $\geq$ 26	7	6	

However, the mean MPI Score of the patients who had mortality (28.5 ± 9.5) was significantly higher than who survived (20.8 ± 6.1) (p value =0.001). (Table 2) The mortality was higher with cut off MPI score of >21 ($p=0.017$) and even more significantly higher with cut off value of >26 (p value = 0.001) (Table 4).

Table 4. Correlation of cut off MPI value with mortality

Cut off MPI value	Mortalities		P value
	(Number of patients)		
	Yes	No	
MPI < 21	3	52	0.017
MPI $\geq$ 21	7	24	
MPI < 26	5	68	0.001
MPI $\geq$ 26	5	8	

Predictive accuracy of MPI score for mortality was 75.1%. The sensitivity and specificity of MPI score was 65% and 71.5 % with cut off value >21 and 50 % and 84.7% with cut off value of >26 (Figure 3).

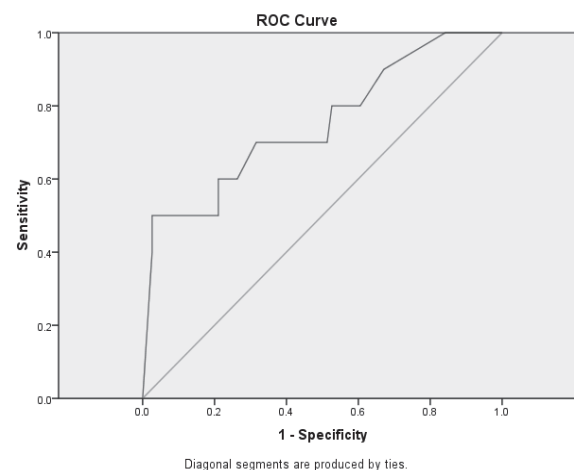


Figure 3. ROC curve of MPI cut off value of 26 for prediction of mortality

Discussion

Acute Peritonitis is still one of most important emergency problem that a surgeon has to face on daily practice. The outcome of surgery for acute peritonitis depends on various factors like patient's general condition, durations of illness, the underlying pathology and the multitude of interventions. The outcome in most of these patients is therefore difficult to predict. Despite of the progress in antimicrobial agents and intensive care treatment, multicenter studies have shown that in-hospital mortality of peritonitis continues to be high (10 – 20 %), although in some studies it reaches 60%.^{3, 12, 13} In our series, 11.6% of the patients who underwent exploratory laparotomy for acute peritonitis had mortality.

Early diagnosis and treatment leads to improved results in terms of mortality. Majority of patients in our series presented late with the time interval between the onset of symptoms and admission varying from 12 hours to up to 15 days with an average of 3.5 days. Kaur N et al., in their study, attribute delay seeking surgical treatment as an important cause for high morbidity.¹⁴ The vast majority of patients presented during the first week of symptoms. This late presentation of patients can be explained by local health system organization and referral system making patients to pass through district hospitals which have generally no surgical facilities before being sent to one of the main referral hospitals of the country.

Early grading of the severity of peritonitis may help in deciding surgical and medical management. The MPI and APACHE II systems have been shown to contribute independently to the prediction of outcome.⁵ MPI score being a peritonitis specific scoring system, has accuracy superior to other scoring systems.^{6, 15} The effectiveness of the MPI as a reliable predictor of the peritonitis outcome was also confirmed after investigation exceeding two thousand patients from several European surgical units.¹²

The MPI is based upon data from 1253 patients with peritonitis treated between 1963 and 1979 and was developed by analysis of 17 possible factors.^{4, 16} In previous studies, patients with scores of less than 21 had a mortality rate ranging from 0-2.3% and those with MPI between 21 and 29 had a mortality rate of approximately 65%.^{12, 17} MPI score of more than 29 had the highest mortality, up to more than 80% in some studies.¹⁸ MPI score of 26 is an useful reference, as reported in other series. Rodolfo L et al. reported mortality rate of 40% with MPI > 26 and mortality rate of 3% with score < 26.⁷ Our study showed mortality rate of 26% with MPI score of > 26 and 6.3 % with score < 26.

The most significant predictive factors for morbidity/mortality in this study were the presence of organ failure, the presence of malignancy, duration of symptoms more than 24h, the origin of sepsis, the extent of peritonitis, and the presence of fecal peritoneal fluid. However, gender and age were not significant predictors. Wabwire et al found as predictive factors the female gender, age above 50 years, presence and number of organ dysfunction, character of exudate extent.¹⁹ Melero reported a similar pattern but noted that gender was not a significant factor.²⁰ Sailer et al whose studies focused on generalized peritonitis reported similar findings only that he found preoperative duration to significantly influence eventual mean MPI from 23.2 to 29 points.³

Ntirenganya F. et al reported in their study that the predictive power of the MPI for morbidity was 0.896 with a sensitivity of 66.7% and specificity of 99.04% at a score of 29 points.²¹ Wabwire et al, in Kenya reported a morbidity predictive power of 0.663 by ROC curve analysis.¹⁹ In analysis of ROC curve for mortality, Biondo et al reported a predictive power of 0.725 at an MPI score of 26 points, while Billing et al in a meta analysis of 2003 patients reported a mean sensitivity of 86% (54%-98%) and specificity of 74% (58%-97%) at a score of 26 points.^{12, 22} In his study, Wabwire attained a mortality predictive power of 0.916 with a sensitivity of 88.9% and specificity of 85.2% at an MPI of 29 points.¹⁹ This result compares favourably with ours and what has already been reported in literature. Our study revealed, MPI score with cut off value 26 had sensitivity 50%, specificity 84.7% and predictive accuracy 75.1% for prediction of mortality.

Conclusion

Prognosis of peritonitis and intra-abdominal sepsis particularly when multiorgan dysfunction develops, remains poor despite improvements in surgical and critical care management. Early and objective classification of severity of peritonitis can help in selecting patients for more aggressive surgical approach. Mannheim peritonitis index is a good predictor of mortality in patients undergoing exploratory laparotomy for acute peritonitis.

Conflict of interest: The authors declare that they have no conflict of Interest.

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