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Prognostic Predictive Value of Mannheim Peritonitis Index in Secondary Peritonitis: A Prospective Study

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ABSTRACT

Background: Secondary Peritonitis still remains a significant surgical presentation with high morbidity and mortality. Many scoring systems have been devised to assess prognosis in such patients including APACHE II, POSSUM and Mannheim Peritonitis Index (MPI). Among these scoring systems, MPI is relatively simple system utilized in European patients with good sensitivity and specificity.
Aim: To prospectively analyze the value of MPI in assessing prognosis in Pakistani patients.
Methods: In this prospective study 133 patients with at least 2-quadrant peritonitis were enrolled over a period of 6 years from 2003 to 2009 at a tertiary setting. MPI score were analyzed for each patient with death being the main outcome measure. The MPI scores were divided into three categories; scores <15 (category 1), 16-25 (category 2), and >25 (category 3). SPSS version 11 was used to calculate the various outcome measures and receiver operator curves (ROC).
Results: This prospective study consisted of 93 males and 40 females (M: F ratio 4.3:1), with the mean patients age of 42.96±12.1 years. These patients were categorized to MPI score categories 1(n=58), 2(n=42), and 3(n=34), respectively. The most common origin of sepsis was small gut perforation followed by appendicular and colorectal perforations. When the individual parameters of MPI score were assessed against the mortality; age >50 years (*P*=0.00001), organ failure (*P*=0.00001), colonic origin of sepsis (*P*= 0.008), and generalized peritonitis were significantly associated with mortality.
Conclusion: MPI is an effective tool for prediction of mortality in cases of perforation peritonitis, which may be helpful for the surgical team to take aggressive surgical decisions to improve patient outcome.
Keywords: Mannheim peritonitis index, perforative peritonitis, receiver operating characteristic curve

INTRODUCTION

Secondary peritonitis still remains one of the most frequent surgical emergencies with significant morbidity and mortality[1,2,3]. GI perforations lead to bulk of this morbidity and mortality and surgical decisions need to be tailored to the individual patients based on many surgical and non-surgical factors to eventually affect the patient outcome[1,2,3]. Any surgical clinician would believe that patient age, co-morbidities, origin of sepsis, level of generalization of peritonitis and multi-organ dysfunction play a dictatorial role in surgical decision making[3].

Many of these factors have been incorporated in a simple Mannheim Peritonitis Index (MPI), which can effectively predict the morbidity and mortality in surgical patients with secondary peritonitis[4,5]. Other scoring systems have also been used previously successfully in predicting the patient prognosis including APACHE II, POSSUM and APACHE III[4,5]. However these scoring systems are cumbersome to administer in critically ill patients and a relatively simpler scoring system like Mannheim peritonitis Index still remains valid and effective all over the world[4,5,6,7].

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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[4]. Moreover, performing a risk analysis for cases by detecting the prognostic factors that affect morbidity and mortality may help prognosis prediction. Along with the predictive factors affecting the morbidity and mortality of cases, scoring systems have also been developed with parameters including demographic and clinical features[4-7]. Here, we assessed the utility of one such scoring system that is, Mannheim peritonitis index (MPI) score system in predicting the outcome of patients with secondary peritonitis in our set of population.

PATIENTS AND METHODS

This study was approved by the institutional ethical committee prior to conduction. 133 patients were prospectively enrolled in this study with clinical diagnosis of secondary peritonitis. These 100 patients had confirmed diagnosis of perforation peritonitis from October 2002 to March 2009. All patients with age > 15 with provisional diagnosis of at least 2-quadrant secondary peritonitis were enrolled into the studies who were subjected to a midline exploratory laparotomy. Patients with primary

peritonitis or unfit for any surgical intervention were excluded from the study. Organ dysfunction was defined as per following parameters:
Renal Dysfucntion: Creatinine >177umol/L or Urea 166mmol/L or Oliguria <20mL/hr.
Pulmonary Insufficiency: PO2 <50mmHg or CO2>55mmHg
Intestinal Obstruction or Failure: Paralytic Ileus >24 hours or Complete Paralytic Ileus

Following evaluation using a predesigned proforma, MPI score was calculated for each patient and the patients were followed-up till death or discharge from the hospital (Table 1). Death was the main outcome measure against which the MPI scores were analyzed. The MPI scores were divided under three categories; scores <15 (category 1), 16-25 (category 2), and >25 (category 3).

Table 1: Mannheim Peritonitis Index (MPI)

Mannheim peritonitis index	
Organ Failure	7
Diffuse peritonitis	6
Age older than 50 years old	5
Female gender	5
Malignancy	4
Non-colonic Sepsis origin	4
Exudate	
Fecal	12
Cloudy or purulent	6
Clear	0

Statistical analysis: An analysis was performed using SPSS software for Windows (version 11.0, 2001, SPSS Inc., Chicago, IL, USA). The statistical analysis was done by Chi-square test for qualitative data, student's *t*-test for quantitative data. The receiver operating characteristic (ROC) curves were plotted with sensitivity against 1-specificity.

RESULTS

In this prospective study 133 patients with at least 2-quadrant peritonitis were enrolled over a period of 6 years from 2003 to 2009 at a tertiary setting. MPI score were analyzed for each patient with death being the main outcome measure. The MPI scores were divided into three categories; scores <15 (category 1), 16-25 (category 2), and >25 (category 3). There were 93 males and 40 females (M: F ratio 4.3:1), with the mean patients age of 42.96±12.1 years. These patients were categorized to MPI score categories 1(n=58), 2 (n=42), and 3(n=34), respectively. The mean age for the surviving and dying patients was similar (42.96±12.1 years) without any significant statistical difference (p=0.9). Category 3 MPI scores (n=34) had higher number of female patients (21 vs. 13; p<0.05). The most common origin of sepsis was from small gut perforation. The colorectal and appendicular perforations follow this trend (see the bar graph below). The reason for this higher trend of small gut perforations relates to the observed trends in underdeveloped countries where typhoid and tuberculous perforation is far more common than colonic perforations[18].

MPI scores were individually assessed for its correlation to mortality in our set of patients. Age >50 years (P = 0.00001), organ failure (P=0.00001), non-colonic origin of sepsis (P= 0.008), type of exudate (P=0.00001) and generalized peritonitis (P=0.0001) were significantly associated with mortality (Table 2).

Fig. 1: Distribution of the patients according to the site of perforation or injury

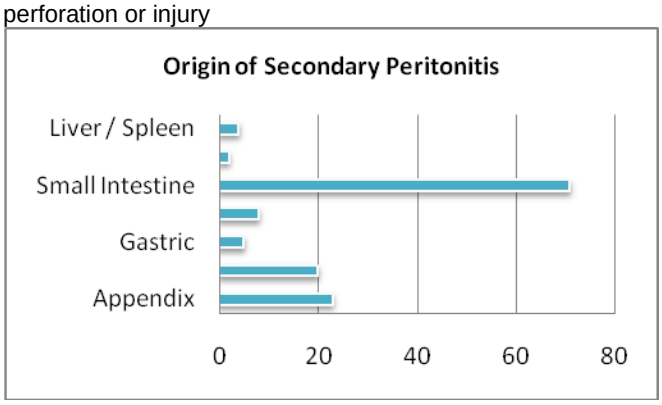
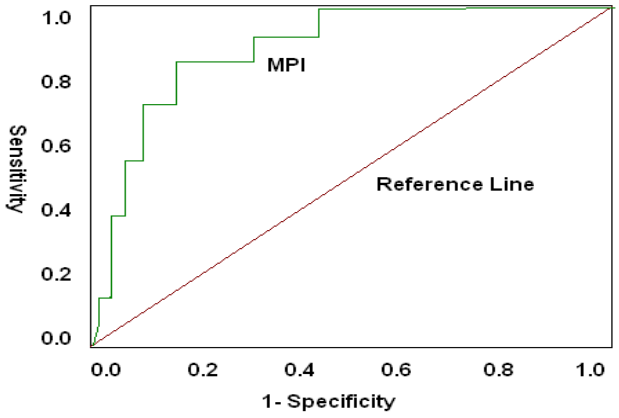


Fig.2: Receiver operating characteristic curve



The mortality rates observed were higher in category 3 of MPI. The difference in mortalities among MPI score categories was observed to be highly significant (P < 0.0001) (Table 3). On plotting the ROC curve, the sensitivity was 87%, and specificity was 81% with area under curve (AUC) being 0.92 at a cut-off of 23 MPI score (Fig. 2).

Table 2: Individual mortality risk of components of MPI

Parameter		Deceased	Survived	*P value*
Age	Age >50	29 (15.11) [12.78]	20 (33.89) [5.70]	0.00001
	Age <50	12 (25.89) [7.46]	72 (58.11) [3.32]	
Sex	Male	25 (28.67) [0.47]	68 (64.33) [0.21]	0.13
	Female	16 (12.33) [1.09]	24 (27.67) [0.49]	
Organ Failure	+	30 (8.54) [53.91]	11 (32.46) [14.19]	0.00001
	-	0 (21.46) [21.46]	103 (81.54) [5.65]	
Malignancy	+	8 (4.50) [2.73]	15 (18.50) [0.66]	0.042
	-	18 (21.50) [0.57]	92 (88.50) [0.14]	
Origin of Sepsis (Non-colonic)	+	12 (17.59) [1.78]	78 (72.41) [0.43]	0.008
	_	14 (8.41) [3.72]	29 (34.59) [0.90]	
Generalized Peritonitis	+	41 (38.53) [0.16]	84 (86.47) [0.07]	0.05
	_	0 (2.47) [2.47]	8 (5.53) [1.10]	
Preoperative Sepsis Duration	>24 hours	16 (11.29) [1.97]	63 (67.71) [0.33]	0.012
	<24 hours	3 (7.71) [2.88]	51 (46.29) [0.48]	
Exudate	Clear	0 (10.83) [10.83]	72 (61.17) [1.92]	0.00001
	Cloudy	8 (4.21) [3.41]	20 (23.79) [0.60]	
	Fecal	9 (1.96) [25.37]	4 (11.04) [4.49]	

Table 3: Survival within MPI score categories

MPI score categories	Outcome	
	Deceased	Survived
<15	0 (13.59) [13.59]	58 (44.41) [4.16]
16-25	15 (13.35) [0.20]	42 (43.65) [0.06]
>25	26 (14.06) [10.15]	34 (45.94) [3.10]

Table 4: Comparative validity assessment of MPI scores in predicting prognosis of peritonitis

Study	Sample size	Sensitivity%	Specificity%	AUC
Billing et al 1994[6]	2003	86	74	-
Demmel et al 1994[10]	108	93	76	-
Correia et al 2001[11]	89	87.3	41.2	0.69
Notash et al 2005[12]	80	86	74	0.972
Batra et al 2013[13]	160	100	65.54	0.89
Muralidhar et al 2014[14]	50	72.09	71.43	-
Sharma et al[18]	100	92	78	0.90
Present Study	133	87	81.3	0.86

DISCUSSION

Although new prognostic systems like APACHE II, III have gained popularity in assessing prognosis in critical surgical patients but it still remains difficult to administer them outside a clinical trial in the general surgical practice because they are too complex. Many researchers have found MPI scoring system to be quite useful in this regard with acceptable sensitivity and specificity and ease to administer[4-18].

In our study the sensitivity and specificity of MPI were 87% and 81%, respectively, at a cut-off of 23 MPI score. The area under ROC curve was 0.92. Our results correspond to previous reports[6-18]. Variation in sensitivity and specificity found here may be attributable to differences in set of patients, conditions, sample sizes and setting of cut-off values[7-10,15-17].

The most appropriate study favoring the MP scoring comes from Notash et al[12]. They did a prospective study on 80 consecutive cases of perforation peritonitis and compared MPI with the multiple organ failure score. The AUC of ROC for MPI was 0.972. MPI of 21 had a sensitivity of 100% and specificity of 79%. With MPI of 29 the sensitivity was 79%, and specificity was 96%. Similarly, Correia *et al* retrospectively analyzed data of 89 cases with secondary peritonitis and found the mean MPI score to be 26.6 with a sensitivity of 87.3%, and a specificity of 41.2%[11]. The best accuracy (69.7%) was calculated at a cut off score of 21. These results were comparable to the findings of our study. Batra et al calculated MPI score in a cross-sectional study of 160 patients of perforation peritonitis with cut off MPI of 26. Sensitivity and specificity of MPI in predicting mortality were calculated to be 100% and 65.54%,

respectively. The rate of mortality was 5.7%. In our study we found a cut off value of 23 to be appropriate with reasonable sensitivity and specificity.

APACHE II scoring system has been shown to have better sensitivities and specificities. Demmel *et al*[10] has compared MPI and Acute Physiology and Chronic Health Evaluation II (APACHE II) scores. Statistical validation showed a sensitivity of 93% and a specificity of 16% for MPI. The Ohmann Peritonitis study group[15] performed a multicentric study and compared APACHE II, MPI and peritonitis index altona scores in 271 cases of laparotomies for perforation peritonitis. The sensitivity and specificity of MPI were 60% and 80%, respectively. The AUC of ROC for a cut-off point of 26 was 0.79. These scoring systems were a bit inferior to APACHE II scoring but acceptable considering the broader application of this simple scoring system.

We conclude that MPI scoring is a simple and reliable predictor of death in secondary peritonitis and can be helpful in tailoring the surgical decisions according to the individual patient demands.

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