Original Research Paper

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validation of Performance of Mannheim Peritonitis Index(MPI) Score in Patients of Secondary Peritonitis

Medical Science

KEYWORDS : Peritonitis, ROC curve, Mannheim Peritonitis Index,mortality

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ABSTRACT

Background:Early stratification of peritonitis by scoring system will allow in predicting the possible outcome and providing more critical care services to the serious patients. The objective of the study was to validate the performance of Mannheim Peritonitis Index (MPI) score in patients with secondary peritonitis.

Methods: This is a prospective study conducted on 105patients admitted and operated for peritonitis in the department of surgery. Clinical, laboratory, surgical finding, MPI scoring and outcome were recorded on pre-structured format. Collected data were analyzed. Pearson's chi square test was used as statistical test and considered as showing a significant difference if P was equal or less than< 0.05.

Result: The overall mortality and morbidity was 11.42% and 20.95% respectively. The mortality rate of 0%, 38% and 80% were at the MPI score of ≤20,21-29 and >29 respectively. There was strong association between increasing MPI score and mortality (p<0.001).MPI score also influences morbidity and hospital stay (P<0.05).The Receptor operating characteristic (ROC) curve prediction between non-survivors and survivors was an excellent with a sensitivity of 50% and a specificity of 98.5% at an MPI of 27 points.

Conclusion:The increasing MPI score is strongly associated with outcome of secondary bacterial peritonitis.

Introduction

Gastro-intestinal perforation and is one of the common surgical emergencies all over the World[1]. Most cases of peritonitis are consequence to the invasion of peritoneal cavity by bacteria from gut.[2] It is associated with high mortality and morbidity in-spite of advancement in surgical techniques, antimicrobial therapy and intensive care management.[3]Majority of the patients present late with septicemia.[4] therefore these patients pose difficult task to the surgeon and anesthesiologist for optimal perioperative care. Hence, early prognostic evaluation is desirable to select high-risk patients for more aggressive therapeutic measures, intensive care management .[4,5,6,7]

Categorizing patients into different risk groups helps to prognosticate the outcome, select patients for intensive care and determine operative risk .Thereby helping to choose the nature of operative procedures. For this purpose various scoring systems have been used to assess the prognosis and its outcome. Those commonly used are, Acute Physiology and Chronic Health Evaluation (APACHE II) score,the Peritonitis Index ofAltona (PIA), the Sepsis Score and the Physiological and Operative Severity Score for enumeration of Mortality and Morbidity (POSSUM),the Mannheim Peritonitis Index (MPI). Various authors concluded that MPI provides a more reliable means of risk evaluation.[2, 8]

MPI Scoring system includes 8 risk factors as shown in table 1[9]The aim of the present study was to evaluate the performance of MPI scoring system in patient with secondary bacterial peritonitis

Table 1: Mannheim peritonitis index[9]

Risk factor	Weightage(if any)points
Age >50years	**5**
Female gender	**5**
Organ failure*	**7**
Malignancy	**4**
Preoperative duration of peritonitis>24 hours	**4**
Origin of sepsis non colonic	**6**
Diffuse generalized peritonitis	**6**
Exudates	
Clear	**0**
Cloudy/purulent	**6**
Fecal	**12**

Definition of organ failure, Kidney: Creatinine>117µmol/L,Urea:>167µmol/L,Oliguria:<20mL/h, Lung:pO2<50mmHg,pCO2>50mmHg,Shock:hypodynamic or hyper dynamic Intestinal obstruction (only if profound),paralytic ileus >24 or complete mechanical ileus.

Material and Method

This is a prospective study conducted at UCMS and CIMSH Lucknow over a period of 2 years (June 2013-May 2015). Study included 105 consecutive patients with peritonitis who underwent surgical treatment. Patients enrolled for the study after signing informed consent except thosewho come under the exclusioncriteria until the sample size is reached.Exclusion criteria included patient with tuberculous,chemical, and primaryperitonitis,post-operative bile leak, laparotomy doneelsewhere forperitonitis or transferred out to continue treatment elsewhere. The sample size calculated using16% incidence from previous study using formula n = z2pq/d2 where n = required sample size, z = 1.96 at 94% confidence interval, p=estimated incidence from previous study, q=100-p, d = maximum tolerable error 7%.The sample size obtained was 104.210. Data were collected on a pre-structured format of all patients registered for study period. Clinical, laboratory, operative findings and outcome were recorded on pre-structured format andanalyzed. Morbidity was noted if any during the stay in the hospital and up to 30 days on follow up visit(Table 6).Pearson's chi square test was used as statistical test

and considered as showing a significant difference if P was equal or less than< 0.05.

Result

Out of the 105 patients included for study, 64 patients were male and 41patients were male.Of the cases studied 93 (59M, 34F) patients survived and 12 (5M,7F) patients died.This difference between male and female survivor and non-survivors was not statistically significant (>0.005)(Table 2). Their ages ranged from 7 - 66 years with an overall mean age was 27.28 ± 13.49 and a median of 20 years. Majority of them (30.74%) were aged between 10-19 years. The mean age between survivor and non-survivors were 27.92±18.17 and 46.5±16.66 years respectively. This difference of age between survivor and non-survivor was statistically significant (p=<0.001) (Table 2).

Table 2:Background information between survivor and Non-survivors

Characters	Survivor	Non-survivors	Total	P-value
Number (%)	93(88.57%)	12(11.43%)	105(100%)	
Gender				
Male (%)	59(92.1%)	5 (7.81%)	64(100%)	>0.05
Female (%)	34(82.9%)	7(12.19%)	41(100%)	
Age(mean ±SD)	27.28±13.49	27.92±18.17	46.5±16.66	<0.001
Preoperative duration (mean ±SD)	3.71±3.26	2.92±2.96	6.66±5.68	<0.05
Hospital stay (mean ±SD)[c]	7.85±1.59	6.9± 2.29	12.5±10.65	>0.05
MPI score	18.78±6.1	17.5±5.3	28.16±3.68	<0.001

The mean preoperative duration of symptoms was 3.71 days and ranged from 12 hours-15 days with median of 3 days.Vast majority of patients (73.30%) presented during the first week after the onset of the symptoms. The mean preoperative duration in survivors and non-survivors were 2.92±2.96 and 6.66±5.68 days respectively. This difference in preoperative duration of symptoms between survivors and non-survivors was statistically significant (p=<0.01) (Table 2)

Table 3: Organ of origin of peritonitis

Origin of peritonitis	Frequency (%)
Peptic ulcer perforation	14(13.32)
Small bowel perforation	15(14.28)
Acute appendicitis	56(53.31)
Appendicular perforation	16(15.23)
Others	04(03.80)

The origin of peritonitis was due to various causes. Acute appendicitis was the commonest cause of peritonitis (53.31%) followed by appendicular perforation (15.23%), Small bowel perforation (14.28%), peptic ulcer perforation (13.32%), and other very uncommon causes includes uterine perforation, caecal gangrene and perforation (Table 3).The difference in mortality due to peritonitis originating from colonic and non- colonic source was statistically significant (p<0.001) (Table 4)

Table 4: Risk factorsanalysis in MPI groups

MPI Risk factors	0-20		>20		P value	OR(RR)
	Survivor	Death	Survivor	Death		
Age <50 years	75	0	6	7	<0.01	Reference
Age > 50 years	04	0	8	5		4.7
Male	51	0	8	5	>0.005	Reference
Female	28	0	6	7		2.24
Organ failure()	79	0	7	4	<0.001	Reference
Organ failure(+)	0	0	7	8		24.78
Presence of malignancy	0	0	0	0	-------	
Absence of malignancy	79	0	14	12		
DOS[a]<24 hours	16	0	04	02	>0.005	Reference
DOS >24 hours	63	0	10	10		1.2
Localized peritonitis	57	0	01	02	<0.001	Reference
Generalized peritonitis	22	0	13	10		8.4
Colonic origin	69	0	03	02	<0.001	Reference
Non-colonic origin	10	0	11	10		6.29
Clear fluid	6	0	0	0	<0.01	--------
Purulent fluid	73	0	08	08		Reference
Fecal fluid	0	0	06	04		6.7

a= DOS =duration of symptom, OR =odd's ratio, RR=relative risk

Organ dysfunction and failure was observed in15 (14.28%) patients.Out of 105 cases studied there were 12 deaths. Of 12 deaths 8 deaths had multiple organ failure.The difference in the mortality between presence and absence of organ failure was statistically significant (p <0.001)(Table 4). The decreasing order of organ dysfunction /failure were, renal (15) cardiac (13), respiratory (12), liver dysfunction (9) hematological (7) cases.

Out of 105 cases of peritonitis 45cases had generalized peritonitis, 2 cases had half or 2/3rd peritonitis and, 58 had one –fourth peritonitis. Of 105 cases 12 died. Out of 12 deaths, 10 cases had generalized (full) peritonitis, 2 cases had 1/4th peritonitis (1 case had appendicular abscess spreading to parities of abdomen another cases had appendicular gangrene and peritonitis.Both cases had septicemia with hemodynamic imbalance (septic shock).The difference in mortality between generalized and localized peritonitis was statistically significant (p<0.001) (Table 4).

Table 5: Comparison of 3 MPI groups and out come

	MPI score				P-value
		<20	21-29	>29	
Mortality	Yes	0	8	4	<0.001
	No	79	13	1	
Complications	Yes	5	13	4	<0.001
	No	74	8	1	
Hospital stay	≤15 days	79	18	4	<0.001
	>15 days	0	3	1	
Reoperation	Nil	Nil	Nil	NIL	

The mean MPI score was 18.78± 6.17 points with 4 points as lowest and 33 points as highest score. Maximum (75%) patient had MPI score ≤ 20. MPI score influencing mortality rate mortality, morbidity and hospital stay. Mean MPI score between survivor and non-survivors were 17.5±5.3 and 28.16±3.68 points respectively. This difference in MPI score between survivor and non –survivor was statistically significant (p<0.001) (Table 2). Comparing 3MPI groups, mortality rates were 0%, 38% and 80% at the MPI score <20,21-29 and >29 respectively. Further comparing 2 MPI group of ≤20 and >20 score. Mortality rates were 0% and 38% respectively. Similarly, comparing another 2 MPI group of ≤ 27 and >27 score. Mortality rates were 6.1% and 85.7% respectively. The results of these conditions show

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an increasing trend of the mortality with increasing MPI score. It appears there is strong association between increasing MPI score and mortality. The difference in the mortality rates in above all three situations was statistically significant (p<0.001) (Table 5 Fig.1, 2, 3)

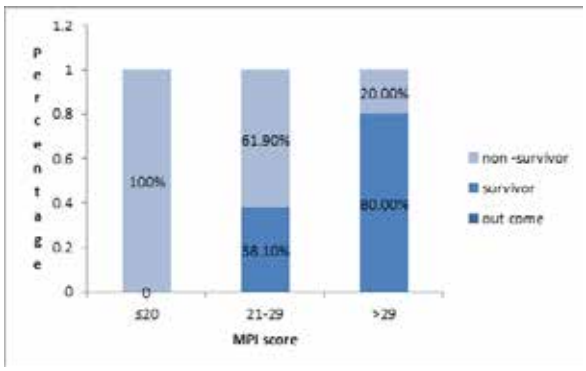

Fig.1: Comparison of 3MPI group and outcome

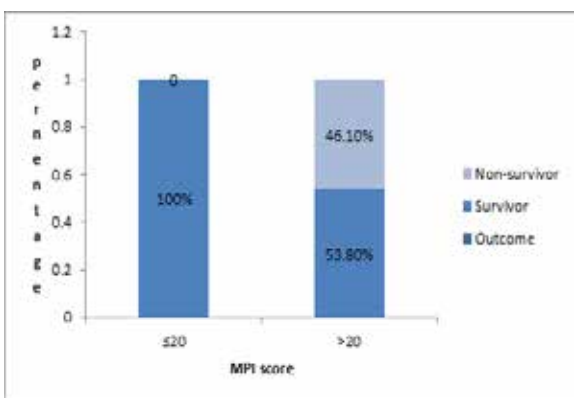

Fig.2.Comparison of 2 MPI scoreof outcome.

On analysis of MPI risk factor, age >50years, organ failure, origin of peritonitis, character of exudate, extent of peritonitis was statistically significant (P<0.05). Sex and duration of peritonitis were not statistically significant (P >0.05). However, duration of peritonitis between survivors and non-survivors was statistically significant (P <0.05).There was not a single case of malignancy in the present study. The relative risk (RR) of risk factors were in descending order; presence of organ failure (24.78), generalized peritonitis (8.4), fecal fluid (6.7), colonic origin (6.29) ,age >50 years (4.78), female gender (2.44) and duration of onset of symptoms of peritonitis before operation (1.2) (Table 4).

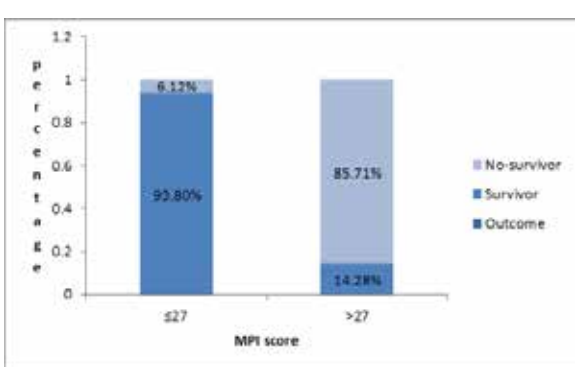

Fig.3.Comparison of 2MPI score of outcome

Table6: Distribution of complication (n=22)

Complication	Frequency (%)
Superficial surgical site infection (SSSI)	14 (41.1)
Septic shock	08 (23.5)
Intra-abdominal abscess	Nil
Re-perforation	Nil
Chest infection	04 (11.76)
Wound dehiscence	02 (5.88)
Anastomotic leak	01 (2.94)
DVT	Nil
Prolonged postoperative ileus(>5days)	05 (14,7)
Pulmonary embolism	Nil

Overall morbidity and mortality rate were 20.95% and 11.42% in the present study. Twenty two patients developed some complications during stay in the hospital. Among the cases who developed complications 14(41.1%) had SSSIs, 8(23.5%) had septic shock, 4(11.76%) had chest infection, 2(5.88%) had wound dehiscence,5(14.7%) had prolonged paralytic ileus and one case had anastomotic leak. There was no case of intra-abdominal abscess,re-perforation, DVT and pulmonary embolism.The commonest complication was SSSI (41.1%),followed by septic shock (23.5%), prolonged postoperative ileus (14.7%), chest infection (11.76%) and wound dehiscence (2.94%)(Table 6)

The ROC curve for mortality showed a predictive power of 0.922 with a sensitivity of 50%, 33% and specificity of 98.5% at both MPI of 27 and 29 points. (Fig.4,Table7) The predictive power of the MPI for morbidity was 0.795 with a sensitivity of 18% and specificity of 96.3% at MPI score of 27(Fig.5)

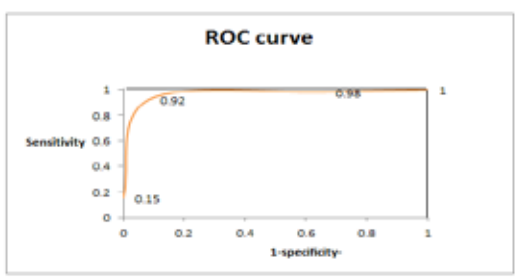

Fig.4. Mortality ROC curve for sensitivity and specificity. Area under the curve is 0.922

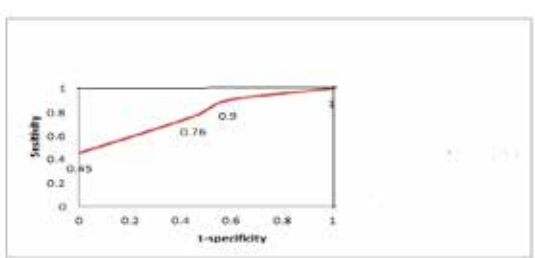

Fig . 5. Morbidity ROC curve for sensitivity and specificity. Area under the curve 0.795

Table 7.Sensitivity and specificity of mortality at different MPI score

MPI	Sensitivity	Specificity
27	50%	98.9%
29	33%	98.9%

Discussion

Until the end of late century, peritonitis was treated medically with a mortality of 90% [11].In 1926, Krishner showed that the mortality of peritonitis could be reduced by strict

implementation of surgical principles and the mortality rate dropped below 50%.Since then,despite of innumerable advances in surgical skills,antimicrobial agents and supportive care ,the mortality of peritonitis remains high and presently reported as between 13-43% .[12] Overall mortality rates in the present study was 11.4%.This lower mortality rate was because of cases included regardless of its etiology, extent and severity.

Categorizing patients into different risk group would help to select the patient for ICU and determine operative and postoperative risk of mortality and morbidity, thereby helping to choose nature of operative procedure [10].Some of the commonly used scoring systems are,MPI[13,14,17,18],APACHE-II,[14-16]SAPS [14], score. MPI score is specific, with good accuracy, allowing the prediction of individual prognosis of patient with peritonitis.

Various past studies have been undertaken to validate MPI scoring system including this study. When patients were divided into 3MPI groups of≤20,21-29 and >29. There was increasing trend of mortality rate of 0%, 61.5% and 80% respectively. Similarly, increasing trend of mortality rates of 0% , 46% and 6.1%,85.7% were also observed when the patients were divided into 2 MPI groups around threshold score of ≤20 , >20 and ≤27 , >27 MPI points respectively. This difference in mortality rates in different groups of MPIwere statistically significant (p=<0.001). There appears to be strong association between mortality and increasing MPI score. Similar observations of increasing trend of mortality with increasing MPI score was also made by previous workers [1,2,8,14]. .The maximum predictability of mortality rates were 80% and 85.7% at MPI score >29 and >27 respectively in this study. When cutoff MPI score of >29 or >27 were chosen for dividing serious and non-serious cases. Twenty and 14.3% cases were survivors which were included in serious cases. Therefore; it was very obvious that quality of prediction of mortality was the best at MPI score >27 Hence, MPI >27 can be selected as cutoff point for recommending aggressive treatment. There was no universal agreement of the cutoff point in past studies. It ranges from>25 to >30 MPI score. This variation is because of difference in the demographicsof the sample, origin of sepsis and extent of peritonitis[1,2,8,14]

On analysis of the predictive power of MPI risk factors , present study showed that among the risk factors, most statistically significant(p<0.05) predictive factors betweensurvival andmortality were the presence of organ failure, extent of peritonitis, age >50 years origin of sepsis, and the presence of fecal peritoneal fluid. However, gender and duration of onset were not significant (p >.0.05) predictors. There is no uniformity among MPI risk factor predictability in previous studies. Some authors have reported that age and gender both are not significant risk factors[13] whileMelero and associated[19] reported gender was significantwhile age was not a significant risk factor. In contrast to the finding of the present study some studies who recruited cases of generalized peritonitis only have shown that preoperative duration along with other risk factors were significant. [20] This difference in report could be because of patient demographics and sepsis source between the present and past studies.

In the present study the ROC curve for mortality had excellent predictive power of 0.922 with a sensitivity of 50%, 33% and specificity of 98.5% for both at an MPI of 27 and >29 points.Previous authors reported excellent [21]to low [22] predictive power of ROC curve. The ROC curve for morbidity had fair predictive power of 0.795 with a sensitivity of 18% and specificity of 96.3% at a score of 27 MPI points. This finding was not in agreement with previous studies which show poor predictive power of morbidity .[21]

Conclusion

In conclusion; MPI is easy, disease specific scoring system which allows categorization of patients into serious and non-serious groups. Increasing MPI score is strongly associated with poor prognosis. This may be helpful in taking management decision regarding ICU care, choice of surgical procedures alongwith predicting outcome. Therefore it can be used routinely to stratify the patient with peritonitis for proper care.

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Source of funding: self
Ethical clearance : taken from college ethical committee

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