Original Research Article

A comparative analysis between Mannheim peritonitis score and acute physiological and chronic health evaluation II score in predicting prognosis of patients of perforation peritonitis

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ABSTRACT

Background: The early assessment and recognition of peritonitis patient is required in surgical emergency. Various scoring system have been designed successfully to assess the prognosis and outcome of peritonitis. The present study was carried out with an aim to evaluate the usefulness and severity of Mannheim peritonitis (MPI) score in comparison to acute physiological and chronic health evaluation II (APACHE II) scoring system for prediction of the outcome in patients with perforation peritonitis and thus decision making in perforation peritonitis.
Methods: A prospective observational study was carried out at Department of Surgery, King George's Medical University (KGMU), Lucknow for a period of one year from July 2018 to June 2019. A total of 100 patients were enrolled in the study.
Results: Majority of patients were males compared to females. Maximum number of patients (40%) was aged 51-60 years. Maximum number of patients (42%) had duodenal perforation. A significant association between higher MPI scores and mortality was seen (p<0.001). Statistically, the association between APACHE II scores and mortality was significant (p<0.001).
Conclusions: APACHE II had a slightly higher sensitivity as well as specificity as compared to MPI. MPI is easy to calculate but accuracy of APACHE II is more, compared to MPI.

Keywords: APACHE II score, MPI score, Perforation peritonitis

INTRODUCTION

Peritonitis is inflammation of the peritoneum, the lining of the inner wall of the abdomen and which covers the abdominal organs. Peritonitis due to hollow viscus perforation continues to be one of the surgical emergencies which is considered to be the life-threatening condition. Early evaluation by scoring system influences the management and prognosis.[1] Many scoring systems have been designed successfully to assess the prognosis and outcome of peritonitis. Those used were included as acute physiological and chronic health evaluation II (APACHE II) score, Mannheim peritonitis index (MPI) score, the peritonitis index Altona, the sepsis score, the Ranson score, Imrite score and the physiological and operative severity score for enumeration of morbidity and mortality.

MPI score was developed by Wacha et al.[2,3] It was based on the retrospective analysis of the data from patients with peritonitis. The MPI is a specific score which has a very good accuracy and serves as an easy way to assess clinical parameters which allows the determination of the individual prognosis of patients with peritonitis.[4]

APACHE II score was developed by Knaus et al.[5] It was devised to stratify prognosis in a group of ill patients and for the determination of success of treatment.

Objectives of the present study was carried out with an aim to evaluate the usefulness and severity of MPI score in comparison to APACHE II scoring system for prediction of outcome in patients with perforation peritonitis and thus decision making in perforation peritonitis.

METHODS

A prospective observational study was carried out at Department of Surgery, King George's Medical University (KGMU), Lucknow for a period of one year starting July 2018 to June 2019. Patients were presented in the outpatient department or emergency wards of Department of Surgery with clinical features of perforation peritonitis, after clinical and radiological evaluation. Perforation was diagnosed either by chest X-ray, X-ray abdomen (erect or lateral recumbant), ultrasonography of abdomen, computed tomography of abdomen or clinical evaluation.

The sampling frame of the study was bound by the following inclusion and exclusion criteria. Both sexes having 12-70 years of age group were admitted with diagnosis of perforation peritonitis with non-traumatic cause presenting within 72 hours of onset were included in the study. Patients aged less than 12 years and more than 70 years of age, having all traumatic cases and perforation more than 72 hours after onset; patients not undergoing surgery and colonic perforation cases were excluded from the study.

$$n=2(Z_\alpha+Z_\beta)^2 \times S(1-S)/(S1-S2)^2$$

where; $z_\alpha=1.96$; $z_\beta=0.84$; S=Pooled specificity=94.5%=0.945; S_1=89%=0.89; S_2=100%=1= 67.35273=68

Though the calculated sample size was 68, however, after adding for contingency and provision for loss to follow-up at 25%, author targeted a sample size of 85. Finally, 100 patients were enrolled in the study.

The MPI score was designed based on the retrospective analysis of data from patients with peritonitis, in which 20 possible and significant risk factors were considered. Among these 20 risk factors, only 8 approved to be of prognostic relevance which were entered into MPI and classified according to their predictive power (Table 1).

On the basis of clinical, laboratory or radiographic investigations, the APACHE II scores were calculated (Table 2).

Ethical clearance was obtained from the Institutional Ethical Committee vide letter no.622/Ethics/2019. An informed consent was obtained from all the patients. The statistical analysis was done using statistical package for social sciences (SPSS) version 21.0 statistical analysis software. The values were represented in number (%) and mean±SD.

Table 1: MPI score.[6]

Risk factor	Score
Age >50 years	5
Female gender	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis >24 hours	4
Origin of sepsis not colonic	4
Diffuse generalised peritonitis	6
Peritoneal fluid analysis	
Clear	0
Cloudy, purulent	6
Faecal	12

RESULTS

The present study was carried out to assess the usefulness of MPI and APACHE II scoring system in cases of perforation peritonitis. For this purpose, a total of 100 patients of perforation peritonitis were enrolled in the study. (Figure 1) presents the gender profile of patients. Male preponderance was seen in the study.
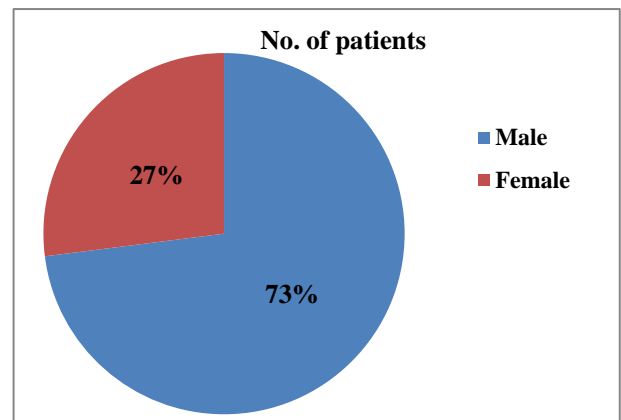
Figure 1: Gender profile of patients (n=100).

Table 3 presents the demographic characteristics of patients enrolled in the study. The age of patients ranged from 15 to 60 years of which maximum number of patients (40%) were aged 51-60 years followed by those aged 21-30 years (20%), 31-40 years (16%), <20 years (14%) and 41-50 years (10%) respectively. Mean age of patients was 41.68±15.61 years. Maximum number of patients (42%) had duodenal perforation followed by those having ileal perforation (38%), gastric perforation (11%) and jejuna perforation (6%) respectively. There were 2 cases having both jejuna and ileal perforation

while 1 case had both duodenal and jejuna perforations. MPI ranged from 10 to 30. Maximum number of cases (45%) had MPI >30 followed by those having MPI in 21-30 range (33%), 11-20 (15%) and only 7% had MPI in 0-10 range. Mean MPI of the patients was 26.45±8.03. APACHE II scores ranged from 9 to >19. Majority of patients (53%) had APACHE II scores >19. There were 2 (2%) cases with APACHE II scores in 0-9 range and 45% had APACHE II scores in 10-19 range. Mean APACHE II scores were 20.21±6.78. A total of 68 (68%) patients survived while 29 (29.0%) died during the hospital stay. A total of 3 (3%) patients were lost to follow-up.

Table 2: Physiological parameters of APACHE II.[7]

Physiologic variable	High abnormal range					Low abnormal range				Points
	+4	+3	+2	+1	0	+1	+2	+3	+4	
Temperature-rectal (ºC)	≥41º	39 to 40.9º		38.5 to 38.9º	36 to 38.4º	34 to 35.9º	32 to 33.9º	30 to 31.9º	≤29.9º	
Mean arterial pressure-mm Hg	≥160	130 to 159	110 to 129		70 to 109		50 to 69		≤49	
Heart rate (ventricular response)	≥180	140 to 179	110 to 139		70 to 109		55 to 69	40 to 54	≤39	
Respiratory rate (non-ventilated or ventilated)	≥50	35 to 49		25 to 34	12 to 24	10 to 11	6 to 9		≤5	
Oxygenation: A-aDO$_2$ or PaO$_2$ (mm Hg) a. FIO$_2$≥0.5 (record) A-aDO$_2$ b. FIO$_2$<0.5 record PaO$_2$	≥500	350 to 499	200 to 349		<200 PO$_2$>70	PO$_2$>61 to 70		PO$_2$>55 to 60	PO$_2$<55	
Arterial pressure (preferred)	≥7.7	7.6 to 7.69		7.5 to 7.59	7.33 to 7.49		7.25 to 7.32	7.15 to 7.24	<71.5	
Seum HCO$_3$ (venous mEq/l) (not preferred, but may use if no ABGs)	≥52	41 to 51.9		32 to 40.9	22 to 31.9		18 to 21.9	15 to 17.9	<15	
Serum sodium (mEq/l)	≥180	160 to 179	155 to 159	150 to 154	130 to 149		120 to 129	111 to 119	<110	
Serum creatinine (mg/dl) double point score for acute renal failure	≥3.5	2 to 3.4	1.5 to 1.9		0.6 to 1.4	<0.6				
Hematocrit (%)	≥60		50 to 59.9	46 to 49.9	30 to 45.9		20 to 29.9		<20	
White blood count (total/mm^3) (in 1000s)	≥40		20 to 39.9	15 to 19.9	3 to 14.9		1 to 2.9		<1	
Glasgow coma score (GCS)=15 minus actual GCS										
A. Total acute physiology score (sum of 12 above points)										
B. Age points (years)-<44 = 0, 45-54 = 2, 55-64 = 3, 65-74 = 5, >75 = 6										
C. Chronic health points										
Total APACHE II score (add together the points from A+B+C)										

Table 4 presents the association of the two scoring systems with outcome. There was no mortality in patients with MPI 0-10 and 11-20. Out of 31 patients with score 21-30, a total of 7 (22.5%) died. On the other hand among 44 patients with MPI >30, a total of 22 (50.0%) died. On evaluating the data statistically, a significant association between higher MPI scores and mortality was

seen (p<0.001). None of the patients with APACHE II score in 0-9 range died.

Table 3: Demographic characteristics of patients (n=100).

Parameters	N (%)
Age (in years)	
<20	14 (14)
21-30	20 (20)
31-40	16 (16)
41-50	10 (10)
51-60	40 (40)
Diagnosis	
Duodenal perforation	42 (42)
Ileal perforation	38 (38)
Gastric perforation	11 (11)
Jejunal perforation	6 (6)
Jejunal and ileal perforation	2 (2)
Duodenal and jejunal perforation	1 (1)
MPI score	
0-10	7 (7)
11-20	15 (15)
21-30	33 (33)
>30	45 (45)
APACHE II score	
0-9	2 (2)
10-19	45 (45)
>19	53 (53)
Outcome	
Non-survivors	29 (29)
Survivors	68 (68)
Loss to follow-up	3 (3)

Table 4: Association of the two scoring systems with outcome.

|	Total no. of cases	No. of deaths	% Mortality	Chi-square; p value; t value
MPI				
0-10	7	0	0	χ^2=18.658 (df=3); p<0.001; 't'=6.015
11-20	15	0	0	
21-30	31	7	22.5	
>30	44	22	50.0	
APACHE II				
0-9	2	0	0	χ^2=16.715 (df=2); p<0.001; 't'=6.363
10-19	42	4	9.5	
>19	53	25	47.16	

A total of 4 out of 42 patients with APACHE II score in 10-19 range died and 25 out of 53 patients with APACHE II score >19 died. Thus, mortality rate was 0%, 9.5% and 47.2% respectively among patients with APACHE II score 0-9, 10-19 and >19 respectively. Statistically, the

association between APACHE II scores and mortality was significant (p<0.001).

Table 5 shows that mean MPI score of non-survivors was 32.90±4.56 which was significantly higher as compared to that of survivors who had mean MPI score of 23.62±7.74 (p<0.001). Mean APACHE II score of non-survivors (26.03±5.09) was significantly higher as compared to that of survivors (17.94±5.99) (p<0.001).

Table 5: Comparison of mean±SD scoring system between survivors and non-survivors.

Outcome	No. of patients	Mean±SD
MPI score		
Non-survivor	29	32.90±4.56
Survivor	68	23.62±7.74
APACHE II score		
Non-survivor	29	26.03±5.09
Survivor	68	17.94±5.99
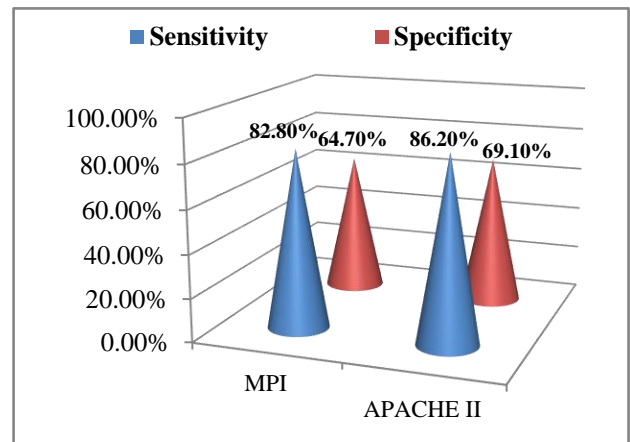
Figure 2: Receiver-operator characteristic curve analysis for derivation MPI and APACHE II for prediction of mortality in perforation peritonitis patients.

Figure 2 presents the receiver-operator characteristic curve analysis, the area under curve values of MPI and APACHE II were observed to be 0.849±0.039 and 0.863±0.041 respectively. For MPI, a cut-off value >27.50 was projected to be 82.8% sensitive and 64.7% specific in prediction of mortality whereas for APACHE II, a cut-off value >21.50 was projected to be 86.2% sensitive and 69.1% in prediction of mortality.

DISCUSSION

Peritonitis is inflammation of the peritoneum, secondary to hollow viscus perforation, is one of the commonest reasons for emergency surgery to be done immediately. The present study was carried out to evaluate the usefulness and severity of MPI score in comparison to APACHE II scoring system for prediction of outcome in patients with perforation peritonitis. The present study

indicated that majority of patients were males (73%) compared to females (27%). The present study was supported by Godara et al, which showed that majority of patients were from males.[8] The current study showed that majority of patients were of age group of 51-60 years which was similar to the study findings by Godara et al.[8] The origin of perforation peritonitis was from 6 different anatomical sites with most of the patients being observed under duodenal perforation and the study was supported by Godara et al, Arasu et al, and Malik et al.[8-10] The current study findings reported maximum number of patients, 45% had MPI >30 and 53% had APACHE II scores >19 which was supported by the study results of Kumar et al.[11]

The present study carried out shows majority of mortality rate of MPI score >30 and APACHE II score >19 which was similar to the study carried out by Malik et al.[10] The MPI and APACHE II score of non-survivor was less in comparison to survivors with majority being 68 which was in contrast to the study findings by Kumar et al.[11]

CONCLUSION

The present study evaluated and compared the prognostic efficacy of MPI and APACHE II scoring systems among patients of perforation peritonitis. The findings of the study showed that both MPI as well as APACHE II were good predictors of outcome among patients with perforation peritonitis, however, APACHE II had a slightly higher sensitivity as well as specificity as compared to MPI. MPI is easy to calculate but accuracy of APACHE II is more compared to MPI. In view of the dynamic changes in management strategies and emergence of newer techniques for management of perforation peritonitis patients, it is essential that continuous audit of the efficacy of existing and newer prognostic scoring systems should be carried out at regular intervals in order to update the management strategies in view of the changing mortality risk.

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