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"A Comparative Study between Apache-Ii Scoring and Mannheim Peritonitis Index to Assess Prognosis In Perforation Peritonitis"

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ABSTRACT
Background & Introduction- Peritonitis is inflammation of the peritoneum, the lining of the inner wall of the abdomen and which covers the abdominal organs. Early objective and reliable classification of severity of peritonitis and intra-abdominal sepsis is to predict prognosis, and APACHE-II & MPI are two such scoring systems. APACHE II is a disease independent scoring system used most commonly in ICU settings. MPI on the other hand is disease specific scoring system. APACHE II has a greater number of variables than MPI which makes it more time consuming and cumbersome calculation when compared to MPI which is relatively simple to calculate and less time consuming. This study was done to find out efficacy of MPI in comparison to APACHE II to prognosticate perforation peritonitis.
Material and methods- It was a cross-sectional observational study conducted in 100 admitted patients of perforation peritonitis, who were taken up for emergent surgery. MPI and APACHE-II scores were calculated for each patient, and then compared and correlated to the post-operative outcomes and mortality.
Observation and Results- Out of 100 patients operated, 24 didn't survive. Both MPI and APACHE-II scores calculated were found to be statistically highly significant. (p value< 0.001), where higher scores were associated with higher mortality. APACHE-II was found to be slightly more sensitive than MPI. Diagnostic accuracy of MPI was found to be 70% and that of APACHE-II to be 84.50%.
Discussion and conclusion- Both MPI as well as APACHE II are good predictors of outcome among patients with perforation peritonitis. MPI is a simpler tool, easy to calculate, considers the etiology of peritonitis and the nature of peritoneal contamination, which are lacking with APACHE II score. Furthermore, the APACHE II score is more extensive and requires elaborate laboratory support. But, MPI needs the operative findings to complete the score, so in a true sense cannot be used as a preoperative scoring system. It is worthwhile to use combination of both scores for a superior prediction of mortality in patients of perforation peritonitis.
Keywords: Peritonitis, APACHE, Mannheim peritonitis index, MPI, Perforation

I. INTRODUCTION

Peritonitis is inflammation of the peritoneum, the lining of the inner wall of the abdomen and which covers the abdominal organs[1]. It may be localized or generalized, and may result from infectious (often due to rupture of a hollow abdominal organ) or from a non-infectious process[2]. Peritonitis due to hollow viscous perforation continues to be one of the commonest surgical emergencies. It is a life threatening condition[3]. Until the end of the last century, peritonitis was treated medically with a mortality of 90%[4]. In 1926, Krishner showed that the mortality of peritonitis could be reduced by strict implementation of surgical principles, and the mortality rate dropped to below 50%. Since then, despite innumerable advances in surgical skills, antimicrobial agents and supportive care, the mortality of peritonitis remains high and is presently reported as between 13 and 43%[5,6].

The respected aphorism that states that the diagnosis of peritonitis is made by clinical evaluation remains true today. Constant abdominal pain is almost universally the predominant symptom, aggravated by movement in fully

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established peritonitis. Others are anorexia, nausea, vomiting, thirst and oliguria. Systemic signs included fever, diaphoresis, tachycardia etc., while focal sings are tenderness, rebound tenderness, guarding and rigidity. Bowel sounds are usually markedly diminished or absent and abdominal distension is often present.

Despite aggressive supportive management and surgical techniques such as radical debridement, lavage systems, open management and planned re-operation, the prognosis of peritonitis and intra-abdominal sepsis is still poor, especially when multiple organ failure develops (Bosscha et al, 1997)[7,8]. Therefore, early objective and reliable classification of severity of peritonitis and intra-abdominal sepsis is needed not only to predict prognosis and to select patients for these aggressive surgical techniques but also to evaluate and compare the results of different treatment regimens. Various scoring systems have been used to indicate prognosis of patients with peritonitis:[9,10]

1. Disease independent e.g., Acute Physiological and Chronic Health Evaluation (APACHE)-II, Simplified Acute Physiology Score II, Multiple Organ Dysfunction Score.
2. Disease dependent e.g., MPI, Peritonitis Index of Altona-II score.

APACHE II score was developed by Knaus et al[11]. It was devised to stratify prognosis in group of critically ill patients, and to determine the success of treatment. The Surgical Infection Society (SIS) adopted APACHE II score, consisting of 12 acute physiological variables, age point and chronic health point.

Mannheim peritonitis index (MPI) was developed by Wacha and Linder in 1983[12,13]. It was designed based on the retrospective analysis of the data from patients with peritonitis, in which 20 possible and significant risk factors were considered. Among these 20 risk factors, only 8 proved to be of prognostic relevance and they were entered into the Mannheim Peritonitis Index and they were classified according to their predictive power. It is a specific score, which has a very good accuracy and serves as an easy way to assess clinical parameters, allowing the determination of the individual prognosis of patients with peritonitis.

APACHE II is a disease independent scoring system used most commonly in ICU settings. MPI on the other hand is disease specific scoring system. APACHE II has a greater number of variables than MPI which makes it more time consuming and cumbersome calculation when compared to MPI which is relatively simple to calculate and less time consuming. In emergency settings, time is an important factor. So, we need a scoring system which is easy, less time consuming and also precise in assessing prognosis of the disease. Few studies in the past conducted by Kumar P et al[3], Fugger R et al[14], have indicated that MPI may be comparable or even better than APACHE II in emergency settings. This study was done to find out efficacy of MPI in comparison to APACHE II to prognosticate perforation peritonitis.

II. MATERIAL AND METHODS

It was a cross-sectional observational study, conducted amongst 100 consenting patients of peritonitis following hollow viscus perforation admitted in Chhatrapati Shivaji Subharti Hospital, Meerut from October, 2019 to September, 2021. Patients of primary peritonitis and that following abdominal trauma or post-operative anastomosis leak, were not included in the study. APACHE II and MPI scoring systems were calculated in all the patients in order to assess their individual risk of morbidity and mortality, and were correlated with post-operative outcome variables (wound infection, wound dehiscence, anastomotic leak, respiratory complications, duration of hospital stay, need of ventilator support, and mortality). Data was computed and analysed using SPPS v.22, and t—test and chi-square test was applied to determine the significance of correlation.

- **APACHE II –** a score from 0 to 71 consisting of weights for age at admission (0 to 6 points) and severe conditions in the past medical history (0 to 5 points) plus an Acute Physiology Score (0 to 60 points) based on weightings for deviations from normal in the twelve physiological parameters during the first 24 hours (Temperature, mean arterial pressure, heart rate, respiratory rate, pH, PaO2, sodium, potassium, creatinine, hematocrit, total leucocyte count, and Glassgow Coma Scale score).

Patients were divided into three categories according to the score: 0-10- Low risk, 11-20- Moderate risk, >20- High risk.[23]

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- MANNHEIM PERITONITIS INDEX- (Table 1)

Table 1- Mannheim Peritonitis Index[24]

RISK FACTOR		**SCORE**
Age >50years		5
Gender- Female		5
Organ Failure (Kidney Failure/ Pulmonary Insufficiency/ Intestinal Obstruction/ Shock)		7
Malignancy		4
Preoperative peritonitis >24 hours		4
Sepsis Origin- Not Colonic		4
Diffuse generalized peritonitis		6
Exudate	- Clear	0
	- Purulent	6
	- Fecal	12

Patients were divided into three categories according to the score: <21- Low risk, 21- 29- Moderate risk, >29- High Risk.

III. OBSERVATION AND RESULTS

The study was conducted in 100 patients of peritonitis following some or the other hollow viscus perforation. APACHE-II and MPI were calculated for all the patients. Out of 100 patients, 24 didn't survive. Table 2 shows the correlation of the two scoring systems and the associated mortality in the subjects graded as per the scores.

Table 2- Association of the two scoring systems with outcome

MPI Score	**N N= 100**	**Mortality**		**Chi Square**	**p value**
		M=24	**%**		
0-10	9	0	0	23.56	<0.01*
11-20	12	0	0		
21-30	36	5	13.89		
>30	43	19	44.19		
APACHE II Score					
0-9	3	0	0	16.81	<0.01*
10-19	48	7	14.58		
>19	49	17	34.69		

*: statistically significant

There was no mortality in patients with MPI 0-10 and 11-20. Out of 36 patients with score 21-30, a total of 5 (13.89%) died. On the other hand among 43 patients with MPI >30, a total of 19 (44.19%) died. On evaluating the data statistically, a highly 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. A total of 7 out of 48 patients with APACHE II score in 10-19 range died and 17 out of 49 patients with APACHE II score >19 died. Thus, mortality rate was 0%, 14.58% and 34.69% 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 ($p<0.001$).

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Table 3: Comparison of mean MPI and APACHE II scoring system betweensurvivors and non-survivors

Scoring System	Survivors		Non-survivors		t test	p value
	Mean	SD	Mean	SD		
MPI Score	22.98	5.91	33.05	4.87	17.69	<0.01*
APACHE II Score	17.09	5.14	25.84	4.83	12.78	<0.01*

*: statistically significant

Table 3 shows that mean MPI score of non-survivors was 33.05±4.87 which was significantly higher as compared to that of survivors who had mean MPI score of 22.98±5.91 (p<0.001). Mean APACHE II score of non-survivors (25.84±4.83) was significantly higher as compared to that of survivors (17.09±5.14) (p<0.001).

Table 4: Diagnostic efficacy of MPI and APACHE II Score

Parameters	MPI Score	APACHE II Score
Sensitivity	100%	87%
Specificity	89%	100%
Positive Predictive Value	72%	100%
Negative Predictive Value	100%	94%
Accuracy Rate	70%	84.50%

The sensitivity, specificity, positive predictive value and negative predictive value of MPI in the present study is 100% , 89% , 72%, 100% respectively. The accuracy rate of MPI is 70%. The sensitivity, specificity, positive predictive value and negative predictive value of APACHE II in the present study is 87%, 100% ,100%, 94% respectively. The accuracy rate of APACHE II is 84.50% (table 4).

IV. DISCUSSION

Peritonitis is one of the commonest reasons for emergency surgery to be done immediately, with more frequency in tropical countries like India. Outcome of such patients depends upon several factors- age, sex, co-morbidities, time of presentation, therapeutic intervention undertaken and the post-operative complications. Pre-operative assessment by various scoring systems provide the approximate estimates of mortality risk. Apart from risk categorization, they also help in evaluation of new diagnostic modalities & therapeutic advances and in the comparison of treatment results from different settings.

MPI Score and APACHE II Score

Maximum number of cases (43%) had MPI >30 followed by those having MPI in 21- 30 range (36%). Majority of patients (49%) had APACHE II scores >19. There were 3 (3%) cases with APACHE II scores in 0-9 range and 48% had APACHE II scores in 10-19 range. Mishra A et al[1] too in their study revealed that maximum number of patients, 45% had MPI >30 and 53% had APACHE II scores >19. Kumar et al in their study reported similar findings too[3].

Outcome- A total of 76 (76%) patients survived while 24 (24%) died during the hospital stay. Kumar P et al[3] in their study revealed mortality rate of 18%. Mishra A et al[1] in their study showed that 29.0% of the patients died during the hospital stay.

Association of the two scoring systems with Outcome

There was no mortality in patients with MPI 0-10 and 11-20. Out of 36 patients, with MPI score 21-30, a total of 5 (13.89%) died. On the other hand among 43 patients with MPI >30, a total of 19 (44.19%) 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. A total of 7 out of 48 patients with APACHE II score in 10-19 range died and 17 out of 49 patients with APACHE II score >19 died. Thus, mortality rate was 0%, 14.58% and 34.69% 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).

Similar findings were revealed by Mishra A et al[1]. Malik et al in their study found that majority of mortality rate was associated with MPI score >30 and APACHE II score >19[6]. Kumar P et al[3] in their study reported that MPI score >25, 22.86% patients expired. MPI score between 25-15, 6.7% patients expired and with score ≤14 none of the patient expired. With APACHE II score above 20, none of the patients were survived. In a study by Ahmed A et al, there was no mortality in MPI score group less than 15, while 28% mortality in group with the score more than 25[15].

Ntirenganya et al[16] in their study reported 15% mortality in score group more than MPI score 29. 65% of the patients who survived in their study had a MPI score less than 29. MPI score of more than 29 had the highest mortality, up to more than 80% in some studies. In a meta-analysis of results from 7 centers involving 2003 patients. In the study done by Ajaz Ahmed et al[15] there was 91.7% mortality in the APACHE IIscore group of more than 20, 35.3% in the score group of 11-20 and 0% below score 10.
Comparatively, in study conducted by Agarwal S et al[8,] Bohnen et al[17], Adesunkanmi et al[18], the mean APACHE II score among survivors was 8 (low risk group) and among non-survivors was 22.4 (high risk group). Thus, conclusive of the fact, that mortality is directly related with higher scores.

Diagnostic Efficacy of Two Scoring Systems

The sensitivity, specificity, positive predictive value and negative predictive value of MPI in the present study is 100% , 89% , 72%, 100% respectively. The accuracy rate of MPI is 70%. The sensitivity, specificity, positive predictive value and negative predictive value of APACHE II in the present study is 87%, 100% ,100%, 94% respectively. The accuracy rate of APACHE II is 84.50%. According to Kumar P et al[3], the accuracy rate of APACHE II (83.3%) is higher than the MPI (69%) in predicting the mortality. The sensitivity, specificity, positive predictive value and negative predictive value of MPI in the present study is 100%, 91%, 69%, 100% respectively. The sensitivity , specificity, positive predictive value and negative predictive value of APACHE II in the present study is 85%, 100%, 100%, 96% respectively. These findings were similar to our study.

In a study by Mishra A et al[1], MPI had 82.8% sensitivity and 64.7% specificity in prediction of mortality whereas for APACHE II, sensitivity was 86.2% and specificity was 69.1% in prediction of mortality[1]. These findings are approximately similar to our study.

V. CONCLUSION

The present study concluded that both MPI as well as APACHE II are 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.

Mannheim peritonitis index is a simpler tool, easy to calculate, considers the etiology of peritonitis and the nature of peritoneal contamination, which are lacking with APACHE II score. Furthermore, the APACHE II score is more extensive and requires elaborate laboratory support so cannot be done in remote areas where elaborate laboratory setup is not present. MPI does not consider the underlying physiological derangement of the patients, which is important in the categorization of the patients who need intensive supportive care. Furthermore, MPI needs the operative findings to complete the score, so in a true sense cannot be used as a preoperative scoring system. This hampers its use to stratify patients into groups to decide whether definitive surgery or damage control surgery can be carried out safely. On the other hand, APACHE II can be calculated preoperatively to categorise patients but it does not take into account peritoneal contamination which has a huge bearing on the final outcome. It is worthwhile to use combination of both scores for a superior prediction of mortality in patients of perforation peritonitis.

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.

REFERENCES

[1]. Mishra A, Singh KK, Jain V. A comparative analysis between Mannheim peritonitis score and acute physiological and chronic health evaluation II score in predicting prognosis of patients of perforation peritonitis. Int J Res Med Sci 2020;8:10-4
[2]. Arasu VT, Lakshmipathy N. A prospective study of evaluation of Mannheim peritonitis

index to predict outcome of patients with peritonitis. Int J Contem Med Res. 2015;3.
[3]. Kumar P, Singh K, Kumar A. A comparative study between Mannheim peritonitis index and APACHE II in predicting the outcome in patients of peritonitis due to hollow viscous perforation. Int Surg J 2017;4:690-6.
[4]. Hiyama DT, Bennion RS. Peritonitis and intraperitoneal abcess. In: Zinner MJ, Schwartz SI, Ellis H, editors. Maingots Abdominal Operations. Vol 1. 10th ed. McGraw Hill: 2001. p. 633-53.
[5]. Wittman DH. Intraabdominal infections, pathophysiology and treatment intra abdominal infection. In: Wittman DH, editor. Marcel Decker Inc: 1991. p. 6- 11.
[6]. Malik AA, Wani KA, Dar LA, Wani MA, Wani RA, Parray FQ. Mannheim Peritonitis Index and APACHE II-prediction of outcome in patients with peritonitis. Turkish journal of trauma and emergency surgery. 2010 Jan 1;16(1):27-32.
[7]. Bosscha K, Reijnders K et al. Prognostic scoring systems to predict outcome in peritonitis and intra-abdominal sepsis. Br J Surg 1997; 84: 1532-34.
[8]. Sanjeev Agarwal, Lalit Shrimali, Ritu Mehta, C. P. Joshi. ―Prediction of Outcome Using the Mannheim Peritonitis Index in Cases of Peritonitis‖. J Evid Based Med Healthcare. 2015 ;2(35) :5387-5397.
[9]. Jaimes F, Farbiarz J, Alvarez D, Martinez C. Comparison between logistic regression and neural networks to predict death in patients with suspected sepsis in the emergency room. Critical Care. 2005;9(2):R150.
[10]. Clermont G. Artificial neural networks as prediction tools in the critically ill. Critical Care. 2005;9(2):153-54.
[11]. Knaus WA, Zimmerman JE , Wagner DP, Draper EA , Lawrence DE. APACHE- acute physiology and chronic health evaluation: a physiological based classification system. Crit Care Med. 1981; 9:591-7.
[12]. S Biondo, E Ramos, D Fraccalvieri, E Kreisler, J Martí Ragué, E Jaurrieta. Comparative study of left colonic peritonitis severity score and Mannheim peritonitis index. Br J Surg. 2006;93:616–22.
[13]. Kusumoto Yoshiko, Neyagawa Masayuki, et al. Study of Mannheim Peritonitis Index to Predict Outcome of Patients with Peritonitis. Japanese Journal of Gastroenterological Surgery. 2004;37:7-13.
[14]. Függer R, Rogy M, Herbst F, Schemper M, Schulz F. Validation study of the Mannheim peritonitis index. Der Chirurg; Zeitschrift fur alleGebiete der operative Medizen. 1988;59(9):598-601
[15]. Ahmed M, RT D. Case-based review: bile peritonitis after T-tube removal. The Annals of The Royal College of Surgeons of England. 2013 Sep;95(6):383-5.
[16]. Ntirenganya F, Ntakiyiruta G, Kakande I. Prediction of outcome using the Mannheim peritonitis index in patients with peritonitis at Kigali University Teaching Hospital. East and Central African Journal of Surgery. 2012;17(2):52-64.
[17]. Bohnen J, Boulanger M, Meakins JL, Mclean APH. Prognosis in generalized peritonitis: relation to cause and risk factors. Arch Surg. 1983;118:285-90.
[18]. Adesunkanmi ARK, Ajao OG. The prognostic factors in Typhoid ileal perforation. A prospective study of 50 patients. IO J Roy Coll Surg Edinb. 1997;42:395-9