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Comparison of Apache-II vs Mannheims Scoring System in Prediction of the outcome in the Patient with Peritonitis

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Abstract

Methodology: A prospective survey of patients with acute generalized peritonitis due to hollow viscus perforation was carried out in general surgical wards of our institute during the period starting from September 2014 to September 2015. Study population consisted of 75 consecutive patients with perforativeperitonitis, which confirmed on emergency laparotomy. *Statistical analysis:* APACHE II and MPI scores were tested by quantitative methods based on statistical criteria. *Results:* The area under the curve was 0.938 for APACHE II and 0.914 for MPI as shown in.The APACHE II curve showed that it discriminated better than the MPI. The sensitivity of APACHE II was superior to MPI at any given point of specificity. This difference was maintained across the entire range of values. The area below the curve was 0.938 for APACHE II and 0.914 for MPI showing that APACHE II is better than MPI ($p < 0.01$). *Conclusion:* As per our analyses APACHE II and MPI both had good sensitivity and specificity. Both the scoring systems were accurate, sharp and reliable in predicting outcome. In all these aspects, APACHE II found to be better than MPI in prediction

Keywords: Apache Ii; Mpi Score; Peritonitis.

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Introduction

Peritoneum inflammation, called peritonitis, presents most commonly due to localized or generalized infection caused from various probable factors. Secondary peritonitis is the most common & follows an intraperitoneal source usually from perforation of hollow viscera. Acute generalized peritonitis coming forth due to underlying hollow viscus perforation is a critical & life-threatening medical condition. It is a common surgical emergency in most of the general surgical units, across the world. It is often associated with significant morbidity and mortality [1].

The prognosis and outcome of peritonitis depend upon the interaction of many factors, including patient-related factors, disease-specific factors, and diagnostic and therapeutic interventions. Categorizing patients into different risk groups would help prognosticate the outcome, select patients for intensive care and determine operative risk, thereby helping to choose the nature of the operative procedure, e.g. damage control vs. definitive procedure [2]. Various scoring systems have been used to assess the prognosis and outcome of peritonitis. Those used include the Acute Physiological and Chronic Health Evaluation score (APACHE II)(1985), the Mannheim Peritonitis Index (MPI)(1983), the Peritonitis Index Altona (PIA), The Sepsis Severity Score(1983), and the Physiological and Operative Severity Score for Enumeration of Mortality and Morbidity (POSSUM) [3].

The mortality of intra-abdominal infection is related mainly to the severity of the patient's systemic response and his premorbid physiologic reserves, estimated best

using the Acute Physiology and Chronic Health Evaluation II (APACHE-II) scoring system [4].

The Mannheim peritonitis index emerged as a reliable marker for assessing the severity and prognosis of intra-abdominal infection with sensitivity and specificity comparable to APACHE II score which has been adopted as the gold standard by Surgical Infection Society. The score designed specifically for peritonitis, combines preoperative and operative data and is easy to apply [3-4]. Various authors have reported APACHE to be a better system for prognostication of the outcome of patients with peritonitis, while others concluded that MPI provides a more reliable means of risk evaluation [5].

Materials and Methodology

A prospective survey of patients with acute generalized peritonitis due to hollow viscus perforation was carried out in general surgical wards of our institute during the period starting from September 2014 to September 2015. Study population consisted of 75 consecutive patients with perforative peritonitis which were confirmed on emergency laparotomy.

Inclusion Criteria

1. Peritonitis secondary to hollow viscus perforation.
2. Age group more than 15yrs.
3. Non traumatic perforative peritonitis.

Exclusion Criteria

1. Perforation secondary to abdominal trauma.
2. Primary peritonitis.
3. Post op peritonitis due to anastomotic leak, etc.
4. Perforative peritonitis patients managed conservatively.

Diagnosis of peritonitis due to hollow viscus perforation was made by:

- History: Symptoms, onset of presenting illness and duration of illness noted.
- Patient details suggestive of chronic health disorders such as cardiac, respiratory, renal, liver failure and immunodeficiency disorders noted.
- Clinical examination Presence of guarding, rigidity, tenderness on palpation and obliteration of liver dullness of the abdomen were noted.
- Radiologically: gas under diaphragm.
- At the time of admission:

Mannheim Peritonitis Index (1983) [6]

- The MPI analyzes 8 prognostically significant factors. Points were given to each factor . Points were added for each factor present and the MPI score was calculated by adding these points.

APACHE II [6]

- APACHE II scores were calculated as per the method of Knaus. Acute physiological and chronic health evaluation includes The Acute Physiological Score (APS), age points and chronic health score. APS is based upon 12 physiological variables.

Statistical analysis

APACHE II and MPI scores were tested by quantitative methods based on statistical criteria.

The following statistical tests were done to know the ability to predict outcome.

1. Accuracy or Discriminative Ability

The accuracy of the test depends on how well the test separates the group being survivors and non survivors. Accuracy is measured by the area under the ROC curve. The area measures discrimination, that is, the ability of the test to correctly classify those who survived or not.

Accuracy explains What is the percentage of correct predictions in the group of survivors (specificity), what is the percentage of correct predictions in the group of non-survivors (sensitivity), what are the differences between these as measured by the area under the receiver-operator characteristic (ROC) curve. A rough guide for classifying the accuracy of a diagnostic test is the traditional academic point system:

- 0.9-1.0 = excellent
- 0.8-0.9 = good
- 0.7-0.8 = fair
- 0.6-0.7 = poor
- 0.5-0.6 = fail

Decision matrices were formed that compared predicted events with events that occurred. Subsequently, sensitivity was plotted against specificity for different cut-off points, which gave ROC curves. The difference between areas under two ROC curves was calculated using the trapezoidal rule, a conservative estimate for the standard deviations, and Kendall's **r** to measure the correlation between the areas.

2. Sharpness

What is the degree of confidence associated with the predictions for example, do most of the predictions for survival or death exceed a certain value (> 0.9)?

The distribution of scoring systems, is a measure for sharpness. Sharpness was estimated measuring the proportion of high probabilities for one of the outcome categories (death or survival). Predicted probabilities of death in between (> 0.9 and <0.1) designated as "not sharp".

3. Distribution of scores

4. Reliability

How good is the agreement between predicted and observed mortality? To test reliability (calibration), 10 equidistant intervals were drawn on a probability scale of 0 to 1. The predicted death rate (sum of the individual probabilities for each interval) was compared with the observed mortality (number of actual deaths for each equidistant interval), and the agreement between observed and predicted events was compared.

Results

Our study is conducted in the Department of General Surgery BLDE. The study period is from September 2014 to September 2015. A total of 75 cases of perforative peritonitis confirmed on emergency laparotomy were included. 56 males and 19 females were included in the study group

Age of the patients in the study ranged from 16years to 75years. Maximum number of patients 25 (33.33%) were in the age group of 11-30years, followed by 26.7% (n= 20) in age group of 31-50years, 30.7% (n=23) in 51-70yrs, 9.3% (n=7) in >70years.

Highest mortality is in the age group of > 51-70 (34.8%). There were 23 patients in this age group out of which 8 patients died. Lowest mortality (0) is seen in age group of 11-30years. 2 of 20 patients (MR=10%) died in age group of 31-50years. Mortality rate of 14.3% (1 of 7 patients) seen in age group of >70. Thus in our study mortality rate increases with increase in age.

Out of 56 males 48 (85.7%) patients survived and 8 (14.3%) died. 19 females were included in the study. Among them 16 (84.2%) survived and 13(15.8%) died Thus in our study mortality is observed more in females.

Based on APACHE II scores patients were divided into 3 groups with scores of <5, 6-15 and >15. Numbers of patients scoring less than 5 were 27 of 75 (36%) study group. All patients with less than 10 score survived and were discharged. 38 patients scored in range of 6-15, 34 survived with mortality in case of 4 patients (10.5%).there were 10 who had score of more >15 with 7 mortality with rate of 70% and survivors were 30%.

Based upon their MPI score, the patients were divided into three groups, MPI scores of less than 15, 16-25 and more than 25. None of the patients (n=25) with score <15 had mortality. 35 patients scored in range of 16-25 with mortality rate of 5.7%. 9 of 16 patients (MR=56.2%) died who scored >25.

Accuracy or Discriminative Ability

Receiver operative characteristic curve

ROC curve was drawn by plotting sensitivity against specificity for different cut off points.

Table 1: Age wise distribution of subjects

Age	N	Percent
16-30	25	33.3
31-50	20	26.7
51-70	23	30.7
>70	7	9.3
Total	75	100

Table 2: Distribution of status of mortality according to age groups

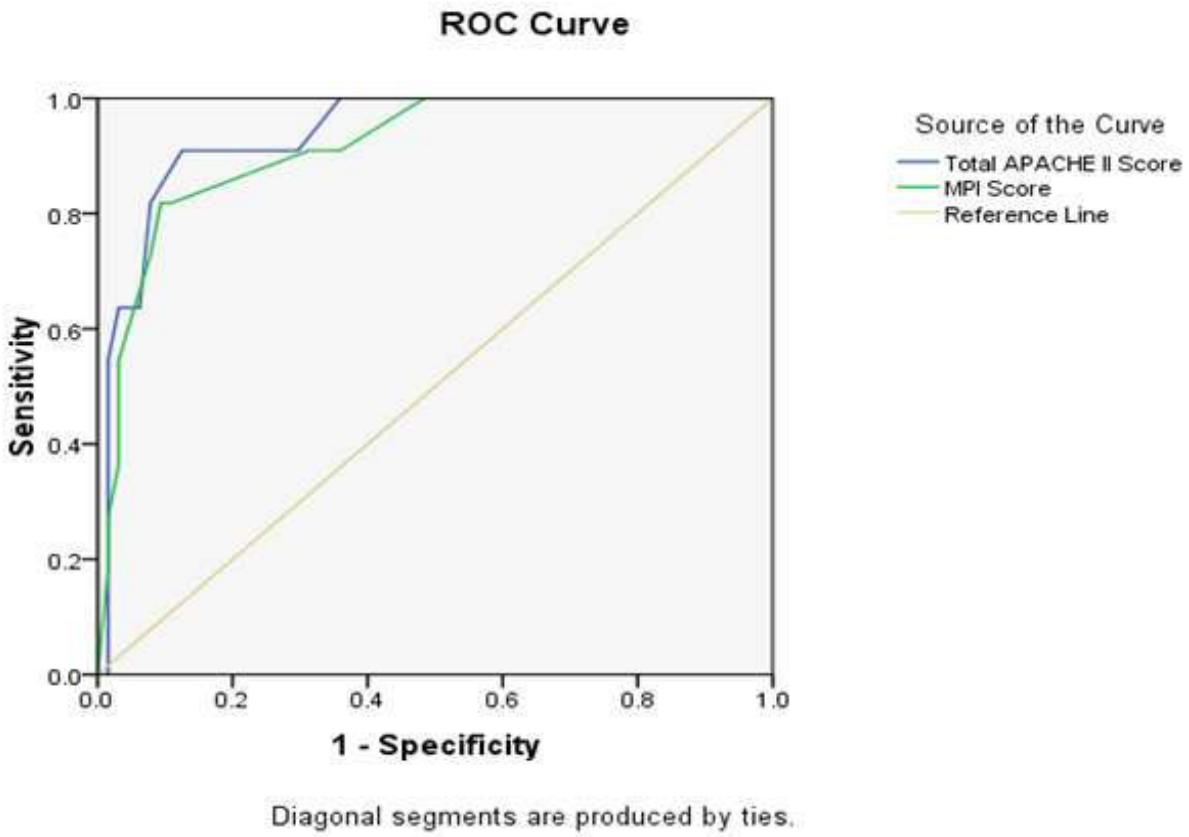
Age	Non survivors		Survivors		Total	p value
	N	Percent	N	Percent		
16-30	0	0.0	25	100.0	25	0.007*
31-50	2	10.0	18	90.0	20	
51-70	8	34.8	15	65.2	23	
>70	1	14.3	6	85.7	7	

Table 3: Distribution of subjects according to APACHE II score and status mortality

APACHE II	Non survivors		Survivors		Total
	N	percent	N	percent	
<5	0	0.0	27	100.0	27
6-15	4	10.5	34	89.5	38
>15	7	70.0	3	30.0	10

Table 4: Distribution of subjects according to MPI score and status mortality

MPI	Non survivors		Survivors		Total
	N	percent	N	percent	
<15	0	0.0	24	100.0	24
16-25	2	5.7	33	94.3	35
>25	9	56.2	7	43.8	16



The ROC curves that related sensitivity to specificity for different cut-off points are shown.

Variables	Area
APACHE II Score	0.938
MPI Score	0.914
Average area	0.926

The area under the curve was 0.938 for APACHE II and 0.914 for MPI as shown in.The APACHE II curve showed that it discriminated better than the MPI. The sensitivity of APACHE II was superior to MPI at any given point of specificity. This difference was maintained across the entire range of values. The area below the curve was 0.938 for APACHE II and 0.914 for MPI showing that APACHE II is better than MPI ($p < 0.01$).

Discussion

Prediction of outcome in patients with peritonitis is unpredictable due to certain unforeseen complications that occur during the course of the disease. In this respect we must find out whether for these reasons prediction is simply not possible in most patients or whether the prediction instruments are faulty or inadequate data are used.

Peritonitis and Mortality

In hospital mortality rate due to peritonitis remains high. In the current study, the in hospital mortality rate was 14.66% most of them were due to septicemia.

The hospital mortality rate according to other studies ranged from 16% in Ajaz et al. [2] and reaching up to 21% per cent in case of C Ohmann et al. [1].

APACHE II Score

All the patients were assigned APACHE II score. APACHE II score in our study was from 0 to 30. patients (n-10)with scores >15 had mortality rate of 70%. All the patients with score <10 survived. There was 100% mortality in patients whose score was >20 in Ajaz et al. [2], andAshish Ahuja studies [1].

MPI score

Our study had MPI score ranging from 10 to 38, the overall mean score among non survivors is 31.7. in the study done by Ajaz et al. [2] it was > 29 with 100 % martalirty.

Accuracy or discriminative ability

The area under ROC curve measures discrimination, that is, the ability of the scoring system to correctly classify survivors and non survivors. The area below the curve was 0.938 for APACHE II in our study and

was consistant with Samir Delibegovic et al study [8] (0.96) implying that it has an excellent discriminative ability where asMishra et al. [9] (0.82) and C Ohmann et al. (0.87) [7] showed good accuracy. AUC for MPI in our analysis was 0.914 which was consistant with Notash et al. (0.97) [10] and Samir Delibegovic et al. [11] (0.90) implying excellent discriminative ability but Mishra et al with AUC of 0.85 showed good accuracy where as COhmann et al. [7] (AUC-0.79) had fair accuracy. our analysis resulted in APACHE II being more accurate than MPI.

Conclusion

Perforative peritonitis is most common in elderly males. In hospital mortality rate for perforative peritonitis remains high in spite of advances in investigation, improved treatment modality, better inpatient care and advanced hospital resources.

MPI score has the advantage of being easier to calculate with very minimum basic investigations and was specifically designed as scoring system for peritoitis. Draw back with MPI is, it needs operative findings to complete the scoring. WhereasModified APACHE II Score considers physiological adversities of the disease which can be used easily and effectively to identify high risk patients for intensive therapy.

As per our analyses APACHE II and MPI both had good sensitivity and specificity. Both the scoring systems were accurate, sharp and reliable in predicting outcome. In all these aspects APACHE II found to be better than MPI in prediction

A scoring system is efficient if it is accurate and sharp in predicting prognosis and also reliable and which can be reproduced if needed to stratify the patients to risk category. This will help us to divert the resources of hospital to appropriate patient help in decisions like transfer of patients to intensive care unit, the choice of more effective but expensive antibiotics and treatment modality. By comparing expected against observed outcome the score can be used to monitor quality of patient care.

These scoring systems are most effective in predicting out come in perforative peritonitis and will be valuable in tertiary care centre where there is availability of all diagnostic tools and also resources for effective management in terms of ICU care and surgical management of perforative peritonitis.

Reference

1. Ashish Ahuja, RavinderPal. Prognostic Scoring Indicator in Evaluation of Clinical Outcome in Intestinal Perforations. Journal of Clinical and Diagnostic Research. 2013 Sept;7(9):1953-55.
2. Ajaz Ahmad Malik, KhurshidAlamWani, Latif Ahmad Dar, Mehmood Ahmed Wani, Rauf Ahmad Wani, FazlQadirParray. Mannheim Peritonitis Index and APACHE II - Prediction of outcome in patients with peritonitis. Turkish Journal of Trauma and emergency Surgery. 2010;16(1):27-32.
3. Dr. Tushar Dani, Prof. L. Ramachandra, Dr. Rajesh Nair, Dr. Digvijoy Sharma. Evaluation of prognosis in patients with perforative peritonitis using mannheims peritonitis index. International Journal of Scientific and Research Publications, 2015 May;5(5):1-5.
4. A.Y. Ukwenya, Ilyasu Muhammad and P.T. Nmadu. Assessing the severity of intraabdominal Infections; the value of APACHE II Scoring System. Nigerian jounal of surgical Research. 2006;8:24-29.
5. Dietmar H. Wittmann, Moshe Schein, Robert E. Condon. Management of Secondary Peritonitis. Annals of Surgery. 1995;224(1):10-18.
6. Ali Tavakaaolizadeh. Small intestine In: F Charles Brunicardi. Schwartz's principles of surgery. 9thed USA Mc GrawHill .2010 .
7. Ohmann C, Wittmann DH, Wacha H. Prospective evaluation of prognostic scoring systems in peritonitis. Peritonitis Study Group. Eur J Surg 1993 May;159(5): 267-74.
8. Delibegovic S, Markovic D, Hodzic S, Nuhanovic A. Evaluation of Prognostic Scoring Systems in the Prediction of the Outcome in Critically Ill Patients with Perforative Peritonitis. Acta Inform Med. 2010 [cited January 10, 2014];18(4):191-195.
9. Arpan Mishra, Dhananjaya Sharma, VK Raina. A simplified prognostic scoring system for peptic ulcer perforation in developing countries. Indian J Gastroenterol. 2003;22:49-53.
10. Ali Yaghoobi Notash, Javad Salimi, Hosein Rahimian, Mojagan Sadat HahemiFesharaki, Ali Abbasi. Evaluation of Mannheim peritonitis index and multiple organ failure score in patients with peritonitis. Indian J Gastroenterol 2005;24:197-200.
11. Delibegovic S, Markovic D, Hodzic S, Nuhanovic A. Evaluation of Prognostic Scoring Systems in the Prediction of the Outcome in Critically Ill Patients with Perforative Peritonitis. Acta Inform Med. 2010 [cited January 10, 2014];18(4):191-95.