



“ PATIENTS WITH PERFORATIVE PERITONITIS -A PROSPECTIVE STUDY COMPARING THE EFFECTIVENESS BETWEEN APACHE II AND MANNHEIM PERITONITIS IN PREDICTING THE OUTCOME “

General Surgery

Dr. M. Vanaja	Associate Professor, Department of General surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru-534005, West Godavari district, Andhra Pradesh, India.
Dr. Ghanta Taraka Raja Ram	Associate Professor, Department of General surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru-534005, West Godavari district, Andhra Pradesh, India.
Dr. Madala Samba Siva Rao*	Associate Professor, Department of General Surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru 534005, West Godavari district, Andhra Pradesh, India. *Corresponding Author
Dr. Vasishta Martha	Postgraduate, Department of General surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru-534005, West Godavari district, Andhra Pradesh, India.

ABSTRACT

Introduction: Acute generalized peritonitis from gastrointestinal hollow viscus perforation is a potentially life-threatening condition(1). Early identification of patients with severe peritonitis, exact recognition of the seriousness of the diseases, and an accurate assessment classification of the patient's risks may help in selecting patients for an aggressive surgical approach (2,3,4). The severity and prognosis of intra-abdominal infection are better assessed by the Mannheim peritonitis index with sensitivity and specificity comparable to the APACHE II score, which is the gold standard by Surgical Infection Society. This score is for peritonitis, and it combines preoperative and operative data and is easy to apply.

Materials And Methods: We conducted a prospective analytical study on 100 consecutive patients who presented to the surgical department of Alluri Sitarama Raju Academy of Medical Sciences, ELURU, with peritonitis secondary to hollow viscus perforation. Our study period was from May 2019 to January 2021.

Results: The area below the ROC curve was 0.988 for APACHE II and 0.946 for MPI, showing that APACHE II is significantly better than MPI ($p < 0.01$). 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.

Conclusion: As per our study APACHE II and MPI both had good sensitivity and specificity. Both scoring systems were accurate, reliable in predicting outcome. But in all these aspects APACHE II was found to be a tad better than MPI in prediction.

KEYWORDS

INTRODUCTION:

Acute generalized peritonitis from gastrointestinal hollow viscus perforation is a potentially life-threatening condition. Across the world, it is one of the most common surgical emergencies. Morbidity and mortality are significantly associated with it¹.

The prognosis remains weak, and mortality rates are high for perforation peritonitis despite the surgical treatment, sophisticated intensive care units, latest generation antibiotics, and a better understanding. Early identification of patients with severe peritonitis, exact recognition of the seriousness of the diseases, and an accurate assessment classification of the patient's risks may help in selecting patients for an aggressive surgical approach^{2,3,4}.

Early prognostic evaluation of peritonitis is desirable to select high-risk patients for more aggressive therapeutic procedures such as debridement, lavage system, open management and planned relaparotomy, nature of the operative procedure, eg. Damage control vs. definitive method⁵. For the assessment of the prognosis and outcome, many scoring systems were introduced, which include the Acute Physiological and Chronic Health Evaluation score, the Mannheim Peritonitis Index, the Peritonitis Index Altona, understanding of pathophysiology.

The mortality of intra-abdominal infection is related mainly to the severity of the patient's systemic response and his pre-morbid physiologic reserves, estimated best using the Acute Physiology and Chronic Health Evaluation II (APACHE-II) scoring system⁷. APACHE II is a better system for prognostication of patients with peritonitis, whereas MPI is more reliable for risk evaluation⁸.

AIMS AND OBJECTIVES:

1. To study the spectrum of perforation peritonitis.
2. To compare the efficacy of Modified APACHE II vs. MPI in predicting the mortality outcome of patients with peritonitis secondary to hollow viscus perforation.
3. To calculate the discriminatory power of each index by plotting Receiver Operator Characteristic curves (ROC).

Inclusion Criteria:

All patients diagnosed to have peritonitis secondary to hollow viscus perforation.

Exclusion Criteria:

1. Patients less than 12 years of age
2. Post-operative peritonitis.
3. Blunt and penetrating abdominal injuries.

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

- Symptoms, the onset of presenting illness, and the duration of illness noted.
- Patient details suggestive of chronic health disorders such as cardiac, respiratory, renal, liver failure, and immunodeficiency disorders noted.

Clinical examination:

- The presence of guarding, rigidity, tenderness on palpation, and obliteration of liver dullness of the abdomen were noted.
- Radiologically: air under the diaphragm in X-ray, usg abdomen, CT abdomen

At The Time Of Admission:

Vital parameters noted: Heart rate, Blood pressure, Mean arterial pressure, Respirator rate, Temperature

Investigations:

Hematocrit, Total WBC count, Tc, Dc, Blood - urea, Serum creatinine, Serum Na⁺, Serum K⁺, PaO₂, Arterial pH, Chest x-ray, Plain x-ray abdomen - erect., CT ABDOMEN, Usg abdomen.

Two systems, APACHE II and Mannheim Peritonitis Index (MPI) scoring systems were assigned to all the patients to calculate their risk of mortality and survival at the time of admission.

The case sheet and both the scoring system Proforma were filled.

- Intraoperative findings noted

Exploratory laparotomy was performed on all patients after stabilizing the patient. The surgical procedure performed depending upon the operative findings and the surgeon's choice and etiology.

Mannheim Peritonitis index (1983) 41'42.

The MPI analyzes 8 prognostically significant factors. Points were given to each element, as provided in table 9. Points were added for each factor present, and the MPI score was calculated by adding these points as given in table 3.

Table 3 Mannheim Peritonitis Index Scoring System.

Risk factor	Points
Age>50yrs	5
Female sex	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis>24h	4
Origin of sepsis not colonic	4
Diffuse, generalized peritonitis	6
Exudates	
Clear	0
Cloudy, purulent	6
Fecal	12
Definitions of organ failure	
Kidney	Creatinine level >177umol/L Urea>167mmol/L Oliguria<20ml/h
Lung	PO2<50mmHg PCO2>50mmg
Shock	Hypodynamic or hyperdynamic
Intestinal obstruction	Paralysis >24h or complete mechanical obstruction

APACHE II43

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.

Table 4 Calculation Of Acute Physiology And Chronic Health Evaluation II⁴³

Score	4	3	2	1	0	1	2	3	4
Rectal temperature, °C	>41	39.0-40.9		38.5-38.9	36.0-38.4	34.0-35.9	32.0-33.9	30.0-31.9	<29.9
Mean blood pressure, mmHg	>160	130-159	110-129		70-109		50-69		<49
Heart rate (ventricular response)	>180	140-179	110-139		70-109		55-69	40-54	<39
Respiratory rate (nonventilated or ventilated)	>50	35-49		25-34	12-24	10-11	6-9		<5
Arterial pH	>7.70	7.60-7.69		7.50-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15

If FIO2 > 0.5, use (A - a) DO2	>500	350-499	200 - 349		<200				
If Fo2 < 0.5, use PaO2					70	61-70		55-60	<55
Serum sodium, mMol/L	>180	160-179	155-159	150 - 154	130 - 149		120 - 129	111-119	<110
Serum potassium, mMol/L	>7.0	6.0-6.9		5.5 - 5.9	3.5 - 5.4	3.0 - 3.4	2.5 - 2.9		<2.5
Serum creatinine, mg/100ml	>3.5	2.0-3.4	1.5 - 1.9		0.6 - 1.4		<0.6		
Hematocrit (%)	>60		50-59.9	46-49.9	30-45.9		20-29.9		<20
WBC count, 10 ³ /mL	>40		20-39.9	15-19.9	3-14.9		1-2.9		<1

Glasgow Coma Score

Eye Opening	Verbal (Nonintubated)	Verbal (Intubated)	Motor Activity
4—Spontaneous	5—Oriented and talks	5— Seems able to talk	6—Verbal command
3—Verbal stimuli	4— Disoriented and talks	3— Questionable ability to talk	5—Localizes to pain
2—Painful stimuli	3— Inappropriate words	1 — Generally unresponsive	4—Withdraws to pain
1—No response	2— Incomprehensible sounds		3—Decorticate
	1—No response		2—Decerebrate
			1—No response

Points Assigned to Age and Chronic Disease as Part of the APACHE II Score

Age, Years	Score
<45	0
45-54	2
55-64	3
65-74	5
75	6

Chronic health points:

a) for non-operative or emergency postoperative patients – 5

b) for elective postoperative patients - 2

Score ranges in between 5 – 71

MATERIALS AND METHODS:

We conducted a prospective analytical study on 100 consecutive patients who presented to the surgical department of Alluri Sitarama Raju Academy of Medical Sciences, ELURU, with peritonitis secondary to hollow viscus perforation. Our study period was from May 2019 to January 2021.

RESULTS:

AGE DISTRIBUTION:

The age of the patients in our study ranged from 13-85 years. The mean age of the patients at admission was 44.78 years.

Outcomes By Age Groups:

The highest mortality is in the age group of 41-50 years of 41%, followed by 33% in 61-70 years. There were 3 patients in each age group. The next highest mortality, 16%, is seen in the age group of 51-60 years. 8% for above 70 years. Other age groups did not have any mortality. Thus in our study, mortality rate is more in the middle and older age group and with an increase in.

Status Of Mortality By Gender

Out of 88 patients who had survived, 75(85.2%) were males, and 13(14.8%) were females. Out of 12 patients who had expired, 8(66.7%) were males, and 4(33.3%) were females. Thus in our study, mortality was observed more in males.

Status Of Mortality Depending On Site Of Perforation

The mortality rate and rate of survival according to the site of perforation are depicted in the table. In the study group of 100 patients, the majority of the patients had duodenal perforation (44%). The highest survival rate was seen among duodenal perforation 43 of 44(100%), and the highest mortality was observed among patients with jejunal, colonic 1 out of 2(50%) each, and 4 out of 11 in gastric.

APACHE II score:

APACHE II score was assigned to all patients. Mean apache II scores in survivors were 7.5 ± 5.3 and in nonsurvivors 19.7 ± 4.7 . Of the 72 survivors, with a mean of 7.5, 8 patients who died had a mean 19.5, and again the difference between groups was significant ($p < 0.0001$).

Based on APACHE II scores patients were divided into 3 groups with scores of <10 , $11-20$ and >20 . The number of patients scoring less than 10 was 71(88.8%) of the study group. One patient with less than a score of 10 expired. 5 patients had scores in the range of $11-20$, 2 survived, and 3 expired. 4 patients had scored more than 20, and all 4 patients expired. These are shown in the table below.

MANNHEIM PERITONITIS INDEX (MPI):

Based on the MPI score, the patients were divided into three groups, MPI scores of less than 21, $21-29$, and more than 29. None of the 52 patients with score <21 had mortality. 22 patients scored in a range of $21-29$, with a mortality rate of 13.63%. 5 of 6 patients ($MR=83.72$) died who scored >29 , as shown in the table and graph below. The mean MPI score among survivors was 15.86 ± 6.57 , and in non-survivors was 32.13 ± 4.67 .

The Accuracy Or Discriminative Ability:

Receiver operative characteristic curve.

ROC curve was drawn by plotting sensitivity against specificity for different cut off points. The ROC curves that related sensitivity to specificity points were shown in graph below.

- Under the no n para metric assumption.
- Null hypothesis, true area = 0.5

The area below the curve was 0.988 for APACHE II and 0.946 for MPI, showing that APACHE II is significantly better than MPI ($p < 0.01$). 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.

DISCUSSION:

- The highest mortality in our study was in the age group of 41-50 years (41.7%). In our study, it was observed that the mortality rate increases with an increase in age.
- The current study showed the male preponderance in peritonitis with the ratio of male: female as 4.88:1.
- Gastroduodenal perforations were the most common site of etiology for perforation in the present study.
- Our analysis resulted in APACHE II being better accurate than MPI as with C Ohmann et al. and Samir Delibegovic et al. whereas MPI had better discriminative ability than APACHE II in Mishra et al. study.
- Distribution of APACHE II and MPI among survivors showed mean apache score of 4.92 ± 2.58 and mean MPI score of 16.19 ± 6.352 which was found statistically significant ($P < 0.0001$), and nonsurvivors had mean APACHE II score of 17.92 ± 5.125 and mean MPI score of 30 ± 5.510 and was statistically significant ($P < 0.0001$).
- Thus APACHE II scores were consistent with survivors having lower scores and non-survivors high scores. Similarly, MPI scores

were also consistent with low scores among survivors and higher scores among nonsurvivors.

CONCLUSION:

APACHE-II is a highly accurate score with good reliability at higher scores and moderate sharpness.

To conclude we can say that while these scores do provide a method of estimating mortality, they are no substitute to clinical management. APACHE-II seems to be the ideal score; still using more than one score may improve the reliability of prediction.

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