

## Original Research Article

# Mannheim's peritonitis index a more simpler prognostic index than APACHE II score

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### ABSTRACT

**Background:** The study was done with the aim to determine the clinical profile of patients with hollow viscus perforation and to compare MPI and APACHE II score

**Methods:** This study was a prospective and retrospective observational study conducted in the department of General Surgery, Gandhi Medical College and associated Hamidia Hospital from the June 2017 to August 2019. The possible score ranges from 0-47. All necessary preoperative data was recorded. Blood sample was taken and relevant blood investigations were done. Patients were resuscitated with iv fluids. Nasogastric tube and urinary catheter insertion were done. The parameters of modified APACHE II score and Mannheim's peritonitis index were recorded at the time of admission. Patients underwent emergency laprotomy and correction of pathology was done.

**Results:** Out of total 100 patients 79% were males, 21% were females, majority 45% belonged to the age group 26-35 years. To calculate the cut off point for mortality ROC curve was constructed. ROC curve analysis predicted that Mannheim's score of 22 or more would predict mortality. Out of total 16 deaths, 14 cases had Mannheim's score of 22 or more thus, giving the score a sensitivity of 87.5% and specificity of 77.38% and overall accuracy of 79% in our study. ROC also predicted that APACHE II score of 15 or more would predict mortality. Thus, giving APACHE II score a sensitivity of 93.75%, specificity of 100% and accuracy of 99%.

**Conclusions:** We consider MPI to be a more simpler prognostic indicator than APACHE II score.

**Keywords:** Mannheim's peritonitis index, Apache II score, Hollow viscus perforation, Peritonitis

### INTRODUCTION

The inflammation of both layers of peritoneum i.e. visceral and parietal peritoneum is called peritonitis.<sup>1</sup> Peritonitis is usually caused by bacterial infection, mostly secondary to perforation of intestine. Intestinal perforation can occur due to typhoid, tuberculosis, trauma, malignancy, ischemia, GB rupture, iatrogenic i.e. after an endoscopic procedure. Now a days, NSAIDS appear to be a common contributor. Perforation peritonitis is one of the most common surgical emergencies which need urgent surgical intervention, broad spectrum antibiotics and symptomatic treatment. It

is a life-threatening condition. Several scoring systems are available to stratify the patients with perforation peritonitis e.g. acute physiological and chronic health evaluation (APACHE II), Mannheim peritonitis index (MPI) i.e. simplified acute physiology score (SAPS), i.e. sepsis severity score (SSS), Ransom score and Imrite score.<sup>2,3</sup> APACHE II score is the most commonly used scoring system but due to the large number of parameters used, it becomes very complex. MPI is a simple scoring system in predicting the risk of mortality and morbidity in patients of perforation peritonitis. In our study, we have noted down the presenting signs and symptoms, the radiological and basic lab investigations

and various associated co-morbidities in patients with perforation peritonitis. Further we have compared a complex scoring system with a simple scoring system for easy prediction of patient's prognosis.

The study was done with the aim to determine the clinical profile of patients with hollow viscous perforation and to compare MPI and APACHE II score.

## METHODS

This study was a prospective and retrospective observational study conducted in the department of General Surgery, Gandhi Medical College and associated Hamidia Hospital from the June 2017 to August 2019. Patients with hollow viscus perforation were included in the study by the application of following criteria. Inclusion criteria for patients with peritonitis secondary to hollow viscus perforation were those who were above 15 years of age, who were able to give informed consent and who couldn't be managed conservatively. Patients below 15 years and those with traumatic perforation were excluded from the study. All the necessary preoperative data was recorded. Blood sample was taken and relevant basic investigations were carried out. The patients were resuscitated with intravenous fluids. Electrolytes were brought and maintained within normal range. Urethral catheter and nasogastric tubes were inserted. The parameters of modified APACHE II score and MPI were recorded at the time of admission. After adequate resuscitation and assessment, patients underwent exploratory laprotomy.

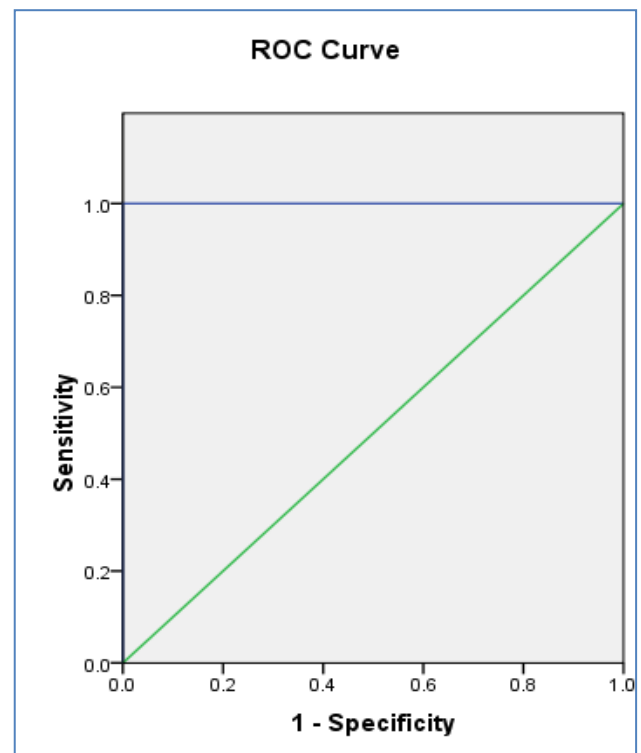
At surgery, the pathology was identified and treated accordingly. Thorough copious irrigation of the cavity was done and drain insertion was decided on case to case basis. Abdomen was closed with non-absorbable suture material in a continuous fashion. All patients received appropriate broad-spectrum antibiotics for a minimum period of 5 to 7 days. Approval from ethical committee of institute was sought. Informed consent was taken from all the patients after explaining the type of procedure they might need to undergo during laprotomy. To calculate the cut off point for each score ROC was constructed and area under the curve was also calculated.

## Ethical approval

Obtained from ethical committee of Gandhi Medical College, Bhopal prior to the commencement of the study.

## RESULTS

Out of 100 patients studied, 79% patients were males and 21% were females. 45% patients belonged to 26-35 years age group. Majority of patients were from rural background and belonged to low socio-economic status. Out of 16 patients who certified 14 had Manheim's score of 22 and above. Only 2 patients who died during the study had Manheim's score of less than 22. This gives the score a sensitivity of 87.5%, specificity of 77.38% and diagnostic accuracy of 79% in our study. ROC curve plotted for Manheim's score of 22 gave area under the curve to be 0.912.



**Figure 1: The ROC curve analysis predicted that APACHE II score of 15 or more will predict the mortality.**

Out of 16 deaths, 15 patients had APACHE II score of more than 15, only 1 patient had APACHE II score in the range of 6-15. Thus, giving the score a sensitivity of 93.75%, specificity of 100% and diagnostic accuracy of 99%. ROC curve plotted for APACHE II score of 15 gave the area under the curve to be 1.0.

**Table 1: The sensitivity, specificity, and positive predictive value and negative predictive value of Apache II score and MPI score**

Scoring	Sensitivity N (%)	Specificity N (%)	Positive predictive value N (%)	Negative predictive value N (%)	Accuracy rate N (%)
Apache II score	93.75	100	100	98.82	99
MPI score	87.5	77.38	42.42	97.01	79

## DISCUSSION

The present study compares Manheim's peritonitis index with APACHE II score. In our study, the commonest site involved in hollow viscous perforation was peptic perforation 51% followed by ileal perforation 23% and appendicular perforation 16%. Colonic perforation was least common 3%. In Jhobta study of 504 cases of perforation peritonitis duodenum was the commonest site of involvement, followed by appendicitis, gastrointestinal perforation due to blunt trauma abdomen, typhoid fever and tuberculosis.<sup>4</sup> Thirumalagiri et al study of 50 cases stated that the commonest site involved was duodenal ulcer perforation 52% followed by ileal perforation 26% and appendicular perforation 14%.<sup>5</sup> Velappan et al stated that most common site of perforation was duodenal ulcer perforation 52%, next was appendicular perforation 16% with gangrene of ileum 14%. Number of patients who had traumatic injury of abdomen was 4% among which 3 were ileal perforation and 1 was jejunal perforation.<sup>6</sup>

In our study, most of the patients with hollow viscous perforation were in the age group 26-35 years 45% followed by the age group of >55 years group 32%. The youngest patient in this study was 18 years who had appendicular perforation and the oldest patient are 76 years, with peptic perforation. In Velappan et al study of 100 cases the maximum number of patients 45 were in the age group of 20 to 40 years which is quite similar to our study.<sup>6</sup> Mewara et al study stated that the mean age of presentation was 40.29 years. The maximum number of patients of gastrointestinal perforation were in the age group of 31-40 years (23 patients, 23%) followed by in the age group of 21-30 years (20 patients, 20%).<sup>7</sup> In Amit K, study most patients belonged to the economically productive age-group of "21 to 50 years age" (≈57.8%).<sup>8</sup> Thirumalagiri et al study stated that the highest number of patients encountered was in the age group 50 years and above followed by the age group of 20-29 years.<sup>5</sup>

In our study, maximum number of patients were found to be males 79% and the females constituted about 21%. Most of the patients with peptic perforation were males. The male percentage within sex was 62.74% in peptic perforation. Females constituted a major group in appendicular perforation 56.25%. M: F ratio was found as 3.76:1. Thirumalagiri et al study, stated that the ratio of men to women with all types of perforation irrespective of site and pathological condition was 5.25:1.<sup>5</sup> Bharati et al study stated the sex ratio of 24:1 in their review of 50 cases.<sup>9</sup> In Velappan et al study there were 77 male patients 73% and 13 female patients 13%. Males were affected more than females.<sup>6</sup> In Mewara et al study also the males outnumbered females. There were 89 males 89% and as compared to 11 females 11% M: F ratio was 8.1:1.<sup>7</sup>

In Mewara et al study most of the patients belonged to the low socio-economic class 67% while its incidence in

the effluent class was very low 3%.<sup>7</sup> In sonawane et al study most of the patients belonged to lower socioeconomic status 65% and were residents of rural area 91%. Most of them were dependents 48% and were not employed.<sup>10</sup> Similar to other studies in our study also most of the patients belonged to lower socioeconomic status 62% and resided in rural area 86%. Most of them were laborer's 42% followed by dependents 36%.

In our study, all cases of perforation presented with symptoms of abdominal pain, distension and vomiting. Vomiting at the time of presentation was seen in 72 patients 72%. History of not passing flatus and motion was found in 95 patients 95%. Fever, altered sensorium and decreased urine output was found in 29, 27 and 29 patients respectively. Out of total 100 patients, all patients had abdominal tenderness, 96 patients had guarding, 91 patients had abdominal rigidity and 43 patients had hypotension. In 75 patient's bowel sounds were absent.

Tachypnoea, oliguria and shock was present in 30, 32 and 16 patients respectively. In Thirumalagiri et al study, pain in abdomen was present in all cases. Guarding and rigidity was present in 21 patients of duodenal ulcer, liver dullness was obliterated in 20 patients of duodenal ulcer perforation.<sup>5</sup> In Mewara et al study, pain was the most predominant feature. All the patients had pain abdomen 100%, followed by vomiting 74%, abdominal distention 64% and constipation 25% Panjwanial et al and Desa et al in their studies found the same results.<sup>7,11</sup> In Meena study, abdominal pain was observed in all the patients and distension and constipation in most of the patients. Tachycardia (pulse rate >100/minutes) was noted in 83.5% of patients, while about 30% of patients had low urine output.<sup>12</sup> In our study out of total 100 patients, 6 patients had history of diabetes mellitus, 12 patients had HTN/CAD, 19 patients had history of COPD/asthma/past history of tuberculosis and 2 patients had malignancy. 61 patients had no co-morbid conditions.

In our study out of total 100 patients, 52 patients had deranged TLC, 29 patients had low hemoglobin and 30 and 33 patients had raised urea, creatinine respectively. These were associated with poor outcome and high complications. Most of the patients had gas under diaphragm in plain radiograph of chest and abdomen erect view, 83 cases 83%. Meena et al study stated that chest X-ray or X-ray flat plate abdomen showed free gas under diaphragm in 86.2% patients, and the maximum proportion was found in acid peptic ulcer diseases 100%, followed by enteric 96.4% perforation, and the least was found in appendicular 28.6% type.<sup>12</sup>

Bansal et al study had an overall positivity rate of plain radiography in detecting pneumoperitoneum at 89.20%, which was highest for stomach and duodenal perforation 94.19% and the least for appendicular perforation 7.69% with highly significant difference ( $p < 0.001$ ).<sup>13</sup> According to Jhobta et al study pneumoperitoneum was seen in

67% patients, but none of the patients with appendicular perforation showed such finding.<sup>4</sup> Afridi et al study show that only 70% of patients had an evidence of pneumoperitoneum.<sup>14</sup> Thirumalagiri et al study stated that

gas under diaphragm was seen in 38 cases 76% irrespective of the site of perforation. Widal test was positive in 8 cases of ileal perforation.<sup>5</sup>

**Table 2: The sensitivity, specificity, and positive predictive value and negative predictive value of Apache II score comparison with other studies.**

Study	Sensitivity N (%)	Specificity N (%)	Positive predictive value N (%)	Negative predictive value N (%)	Accuracy rate N (%)
Dino et al	82.5	55.2	54.7	82.8	66
Headly et al	54	87	-	-	-
Kumar P	85	100	100	96	83.33
Our study	93.75	100	100	98.82	99

**Table 3: Sensitivity, specificity, positive predictive value and negative predictive value of MPI score comparison with other studies.**

Study	Sensitivity N (%)	Specificity N (%)	Positive predictive value N (%)	Negative predictive value N (%)	Accuracy rate N (%)
Watch et al	88	90	87	90	-
Dani et al	90.62	91.7	67.44	98.12	-
Biling et al	76	58	-	-	-
Lombordoand et al	87	88	93	94	-
Ojuka et al	84.2	90.7	75.9	94.2	-
Kumar et al	100	91	69	100	69
Our study	87.5	77.38	42.42	97.01	79

In our study, a variety of operative procedures were performed according to patient's general condition, peritoneal contamination, site of perforation, gut viability, and surgeon's decision.

In colorectal perforation, right/left hemicolectomy, simple closure with or without stoma, and Hartmann's procedure were done. Omental patch closure was the most commonly done procedure 51%. Appendectomy was done in 16% of cases and simple closure was done in 10% of cases. Resection and anastomosis were done in 5% of cases and loop ileostomy was done in 18% of cases. In small bowel perforation, simple closure, resection anastomosis with or without proximal diversion stoma, and loop ileostomy were done. In case of appendicular perforation, appendectomy and peritoneal lavage with drain placement was done. According to Meena et al the most commonly executed operative procedure was simple closure in 63.8% cases of the perforation, resection anastomosis in 7.2%, stoma in 17.4%, appendectomy in 7.9%, and definitive was done procedure in 3.6%.<sup>12</sup> In Thirumalagiri et al study, the most common procedure performed was omental patch closure 60%. Resection and anastomosis were performed in 6% of cases and loop ileostomy was done in 8% of cases. Appendectomy was done in 14% of cases and simple closure was done in 12% of cases.<sup>5</sup> Jhobta et al observed simple closure being the most commonly executed operative procedure in 60% patients.<sup>4</sup>

In our study, out of total 100 patients, 43 patients had complications. Most common i.e. 35% post-operative complication was related to lungs. The next most common complication observed was wound infection which was present in 22% of cases and mortality was 16%.

Patients having deranged in routine blood investigations hemoglobin level <9 gm%, deranged total leucocyte count, deranged renal function test and serum electrolytes were associated with higher rate of complications. More complications were observed in older patients, maximum in 60-80 years age group. In Thirumalagiri et al study, most common post-operative complication was lower respiratory tract infection (LRTI) and the LRTI patients presented with fever, cough with expectoration and the chest X-ray showing consolidation changes.<sup>5</sup> Afridi et al study found wound infection to be the most common complication in 42% patients.<sup>14</sup> Buddhraj et al study found that wound infection was commonest complication followed by fecal fistula.<sup>15</sup> In Mewara et al study, wound infection 11% was the second commonest complication after fever 14%.<sup>7</sup> Similar to our study, in Meena et al study, lung infection was most commonly observed postoperative complication followed by wound infection. Lung infection was significantly higher in proportion in malignant, tubercular, and peptic perforations.<sup>12</sup> Similar observations were obtained by Jhobta et al.<sup>4</sup>

In our study mortality rate was found to be 16%. Various other trials have estimated the mortality rate to be



between 10-60% and the average mortality is found to be 19.5% which is close to the value noted with our study. Carlos et al study found that overall mortality was 20% and mean hospital stay was 20 days.<sup>16</sup> In our study, an MPI score of 22 was found to predict mortality which was statistically significant. This is in accordance with previous studies where a score of 21 was found to predict mortality. In a study conducted by Billing et al, mortality rate was found to be 2.3% in patients with a score of less than 21 and above this score a mortality rate of 60-80% was observed.<sup>17</sup> Demmel et al study of 438 cases revealed MPI to have a sensitivity of 87% and a specificity of 77% for a score of 26. In our study, the cut off score of 22 had sensitivity of 87.5% and a specificity of 77.38%.<sup>18</sup> In our study APACHE II score of 15 and above was found to predict mortality with significant difference between the two groups. The mortality rate was 1.29% below the score of 15 and rises to 65.21% above the score of 15. This is comparable to Schein et al where the APACHE II score was found to predict mortality a score of 11-20.<sup>19</sup> According to Kulkarni et al APACHE II score between 11 and 20 was found to predict mortality with greater accuracy than a score of less than 10 or more than 20.<sup>20</sup> Our study is comparable; as the best cut off score was found to be 15. The overall diagnostic accuracy of mortality with this score is found to be 99% and positive predictive value is 100%.

The comparison between APACHE II score and MPI SCORE is varied among different studies. According to Bosscha et al multivariate analysis APACHE II and MPI to predict the outcome independently.<sup>21</sup> Malik et al achieved similar conclusions but favored APACHE II score as it better identified the physiological reserve of the patient under study whereas Ohmann et al found that the APACHE II score was better a predictor of mortality than MPI score.<sup>22,23</sup>

## CONCLUSION

In our study the data was collected prospectively on individual basis. The parameters of both, modified APACHE II score and Mannheim's peritonitis index were recorded. Demographic, clinical, preoperative and postoperative complications were noted in standard format. Each patient's postoperative outcome was correlated to Mannheim's score and APACHE II score. In our study both Mannheim's score and APACHE II score have been found to predict mortality beyond their respective cut off scores. APACHE II score is more physiological and is useful for risk stratification in acute settings. Mannheim's score also takes into account the intra-operative details. Hence, Mannheim's peritonitis index is more precise and relatively easy to apply.

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