

Mannheim Peritonitis Index in Predicting the Morbidity and Mortality in Patients with Peritonitis Due To Hollow Viscous Perforation

Sinha AvinashKumar¹, Mishra RK¹, Kumar Nilay¹, Kumar Abhinav¹
¹(General Surgery, Bokaro General Hospital, India)
Corresponding Author: Sinha Kumar Avinash

Abstract: Various methods and scoring systems are used to identify the risks and morbidity and mortality in patients with peritonitis due to hollow viscus perforation. Early assessment by scoring systems will influence the management and prognosis. Various factors like age, sex, duration, site of perforation, extent of peritonitis and delay in surgical intervention are associated with morbidity and mortality. Our study aims to predict the effectiveness of Mannheim Peritonitis Index scoring in predicting the morbidity and mortality due to hollow viscus perforation. This prospective observational study was conducted in patients presenting with peritonitis due to hollow viscus perforation to EMERGENCY OPD, at Bokaro General Hospital, Bokaro Steel City, India from both rural and urban area. A total of 73 patients were included in the study. Mortality Predicted by MPI Score and the mortality rate in each group is <21 - 0%; 21-29 - 11.8%; >29 - 50%. ROC analysis was done to identify the best cut off for MPI for mortality. The cut off came to be 23 for which the sensitivity and specificity was calculated to be 86 % and 89 % respectively. In the present study the numbers of complications due to perforation peritonitis were 22 and hence the morbidity rate was 30.1%. Morbidity Predicted by MPI Score and the morbidity rate in each group is <21 - 26%; 21-29 - 41.2%; >29 - 33.3%. ROC analysis was done to identify the best cut off for MPI. The cut off came to be 19 for which the sensitivity and specificity was calculated to be 79% and 57% respectively. Hence forth the above study showed that MPI is easy scoring system and a better option for predicting morbidity and mortality can be used as a guiding tool to decide on the management of the patient.

Keyword: Hollow viscus perforation, Peritonitis, Mannheim Peritonitis Index, Prognostic Outcome

Date of Submission: 30-06-2018

Date Of Acceptance: 13-07-2018

I. Introduction

Peritonitis is inflammation of the peritoneum and peritoneal cavity, usually caused by a localized or generalized infection.¹ Primary peritonitis results from bacterial (*Escherichia coli* and *Klebsiella pneumoniae* in adult & group A streptococcus, *Staphylococcus aureus*, and *Streptococcus pneumoniae* in children)¹, chlamydial, fungal, or mycobacterial infection in the absence of perforation of the GI tract. Secondary peritonitis occurs in the setting of GI perforation. Frequent causes of secondary bacterial peritonitis include peptic ulcer disease, acute appendicitis, colonic diverticulitis and pelvic inflammatory disease. Peritonitis due to hollow viscus perforation continues to be one of the most common surgical emergencies. Peritonitis due to hollow viscus perforation needs an emergency surgical intervention. A scoring system should be able to assess the need, type, and quality of the care required for a particular patient. Several scoring systems are in place to stratify the patients with peritonitis due to hollow viscus perforation like APS, SIS, APACHE, and BOEYS. APACHE-II is the most commonly used scoring system in a case of peritonitis due to hollow viscus perforation^{2,3}. But the large number of variables used in this scoring system makes it a tedious procedure. Realizing the need for a simple accurate scoring system in these conditions the present study was undertaken to evaluate the performance of MANNHEIM PERITONITIS INDEX scoring system in predicting the risk of morbidity and mortality in patients with peritonitis due to hollow viscus perforation.

MANNHEIM PERITONITIS INDEX^{4,5}

RISK FACTOR	WEIGHTING IF PRESENT
AGE > 50 years	5
Female sex	5
Organ failure	7
Malignancy	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Preoperative duration of peritonitis > 24h	4

Intra peritoneal Exudates	
Clear	0
Cloudy, purulent	6
Faecal	12

Definitions of organ failure: Kidney: creatinine >177 µmol/L, urea >167 µmol/L, oliguria <20 ml/h; Lung: pO2 <50 mm Hg, pCO2 >50 mm Hg; Shock: hypodynamic or hyperdynamic; Intestinal obstruction (only if profound): Paralysis >24 h or complete mechanical ileus

II. Material and Methods

A Prospective Observational study was conducted at the Bokaro General Hospital. A 910 bedded tertiary care hospital in Bokaro Steel City, Jharkhand, India under Bokaro Steel Plant, A Steel Authority of India Limited subsidy. The study is done in 73 patients presenting with peritonitis due to hollow viscus perforation to EMERGENCY OPD, at Bokaro General Hospital, Bokaro Steel City.

Study Design: Clinical, prospective, observational and open study.

Study Location: This was a tertiary care teaching hospital based study done in Department of General Surgery, at Bokaro General Hospital, Bokaro Steel City, Jharkhand, India.

Study Duration: August 2016 to December 2017.

Sample size: 73 patients.

Sample size calculation : Using Cochran formula⁶,

$$N = \frac{n_0}{1 + (n_0 - 1) / N}$$

$$\text{Where, } n_0 = z^2 pq / e^2$$

Here, z^2 = Abscissa of the normal distribution curve that cuts off an area at the tail which is 1.96 (This is a value which cuts the normal curve at 95% confidence interval 0.05 level of significance)

e = Desired level of precision (Generally it is 0.05)

p = the estimated proportion of an attribute that is present in the population.

(p = 2/10) q = 1-p

$$N_0 = (1.96)^2 * 2/10 * (1-2/10) / (0.05)^2 = 0.615 / 0.0025 = 245.9$$

Substitute this value of 245.9 in the above formula.

$$n = \frac{245.9}{1 + \frac{245.9 - 1}{100}}$$

(Total no of patient attending our hospital in a year with peritonitis due to hollow viscus perforation)

n = 71 or approximately

Subjects & selection method:

INCLUSION CRITERIA:

Patients with clinical suspicion and investigatory support for the diagnosis of peritonitis due to hollow viscus perforation who are later confirmed by intra op findings.

Various etiologies causing such features include:

Acid peptic disease,

Typhoid,

Tuberculosis,

Gangrenous cholecystitis,

Appendicitis,

Malignancy.

EXCLUSION CRITERIA

Patients with blunt injury abdomen who had other associated solid organ, vascular, neurological injury.

III. Methodology

The study is done after obtaining a detailed history, complete general physical examination and systemic examination. The patients are subjected to relevant investigations like x-ray erect abdomen, CXR, USG and routine investigations like Hb, TC, urea, creatinine, serum electrolytes. All investigations and surgical procedures were carried out with proper informed written consent as appropriately.

The data regarding patient particulars, diagnosis, investigations, and surgical procedures is collected in a specially designed case recording form and transferred to a master chart subjected to statistical methods like mean, standard deviation, proportion, percentage calculation and wherever necessary chi square test for proportion are used. MPI scoring system was done in all patients and patients were classified those with score less than 21, 21 to 29, and more than 29.

Preoperatively all patients received supportive treatment for correction of hypotension and electrolyte abnormalities.

During laparotomy, intra-abdominal examination of all organs was made in addition to specific pathology. Primary closure of hollow viscous perforation, bowel resection anastomosis, Diversion ostomies was done in cases as appropriate with thorough peritoneal lavage and abdominal drains were kept in all patients.

Post operative period was monitored , intake output charts and vital charts were maintained. Drains were removed after 48 hours if output is less than 25ml.

Sutures were removed on the 7th post operative day. Patients were asked to present themselves for follow up after a specific interval or at recurrence of symptoms.

Statistical analysis

Morbidity and Mortality based on the descriptive statistics of MPI score , Sensitivity and Specificity for prediction of morbidity and patient characteristics, clinical presentation, operative details, and surgical outcomes were analysed.

Data was entered in microsoft excel and analysis was done using SPSS version 20. Prospective statistical analysis was done. Chi-square test was performed to test for differences in proportions of categorical variables between two or more groups. The level $P < 0.001$ was considered as the cutoff value or significance and the chi square value as 25.56.

IV. Result

TABLE NO 1- SITE OF PERFORATION

S. NO.	Site of Perforation	Frequency	Percentage	Valid Percentage	Cumulative Percentage
1.	Duodenum	35	48	48	48
2.	Appendix	18	25	25	73
3.	Ileum	11	15	15	88
4.	Gastric	3	4	4	92
5.	Colon	3	4	4	96
6.	Jejunum	3	4	4	100
	Total	73	100	100	

In the study population of 73 subjects, duodenal perforation was seen in 48 % of patients, followed by appendicular (25%), ileum(15%) , gastric (4%), colon(4%) and jejunal(4%) perforation.

Chart no.1–SITE OF PERFORATION

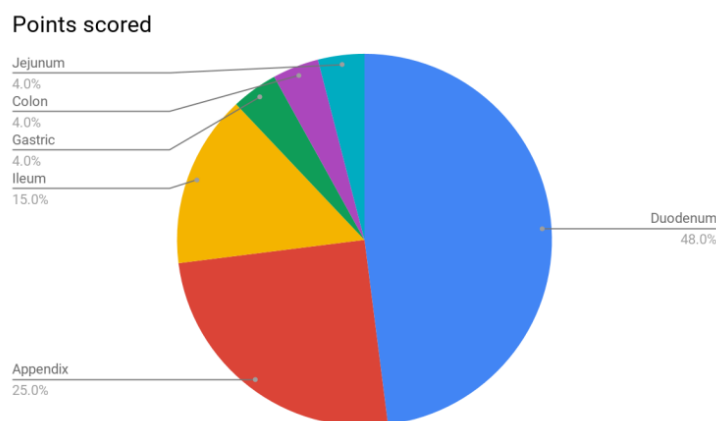


Table no.2- AGE(yrs) Statistics

N VALUE	73
Mean	31.3
Median	30
Range	65
Minimum	7
Maximum	72
Std Deviation	17.398

Table no.3- Summary of MPI in our study (73)

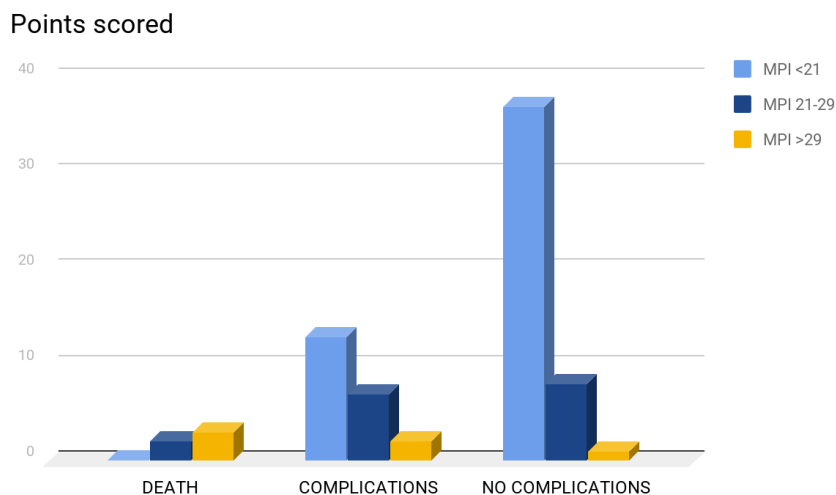
	SURVIVED	DEATH	TOTAL
AGE >50	14 (82.35%)	3 (17.65%)	17
FEMALE	10 (90.9%)	1 (9.1%)	11
ORGAN FAILURE	6 (60%)	4 (40%)	10
MALIGNANCY	1 (50%)	1 (50%)	2
ORIGIN OF SEPSIS NOT COLONIC	67 (95.7%)	3 (4.3%)	70
DIFFUSE GENERALISED PERITONITIS	53 (91.4%)	5 (8.6%)	58
PREOPERATIVE DURATION OF PERITONITIS >24H	37 (88.1%)	5 (11.9%)	42
INTRA PERITONEAL EXUDATES			
Cloudy, purulent	66 (95.7%)	3 (4.3%)	69
Faecal	2 (50%)	2 (50%)	4

Table no.4- FINAL OUTCOME and MPI Cross tabulation

		MPI				
			<21	21-29	>29	
FINAL OUTCOME	DEATH	Count	0	2	3	5
		% within FINAL OUTCOME	0%	40%	60%	100%
		% within MPI	0%	11.8%	50%	6.8%
		% of Total	0%	2.7%	4.1%	6.8%
	COMPLICATIONS	Count	13	7	2	22
		% within FINAL OUTCOME	59.1%	31.8%	9.1%	100%
		% within MPI	26%	41.2%	33.3%	30.1%
		% of Total	17.8%	9.6%	2.7%	30.1%
	NO COMPLICATIONS	Count	37	8	1	46
		% within FINALOUTCOME	80.4%	17.4%	2.2%	100%
		% within MPI	74%	47.1%	16.7%	63.1%
		% of Total	50.7%	11%	1.4%	63.1%
TOTAL		Count	50	17	6	73
		% within FINAL OUTCOME	68.5%	23.3%	8.2%	100%
		% within MPI	100%	100%	100%	100%
		% of Total	68.5%	23.3%	23.3%	

Among the total population, 30.1 % had complications, 63.1 % had no complications and 6.8 % had expired. Amongst those who expired there was no patient with MPI <21, 40 % had MPI 21-29 and 60% had MPI > 29. Amongst those who had complications 59.1 % had MPI <21, 31.8 % had MPI 21-29, 9.1 % had MPI >29. Amongst those without complications 80.4 % had MPI <21, 17.4 % had MPI 21-29, and 2.2% had MPI >29.

Chart No.2- FINAL OUTCOME and MPI Bar chart



FINAL OUTCOME

Observed Mortality Rate

In the present study the numbers of deaths due to perforation peritonitis were 5 and hence the mortality rate was 6.8%.

Mortality Predicted by MPI Score

MPI score was calculated for each patient of peritonitis as per the score sheet. The mortality rate in each group is

Score	No. Of Patient	Deat h	Mortality Rates
<21	50	0	0%
21-29	17	2	11.8%
>29	6	3	50%

Cut Off Point for MPI ⁷

ROC analysis was done to identify the best cut off for MPI. The cut off came to be 23 for which the sensitivity and specificity was calculated to be 86 % and 89 % respectively.

Analysis of MPI scoring system (Mortality)

Indices	MPI
Sensitivity	86%
Specificity	89 %
Positive Predictive Value	99%
Negative Predictive Value	31.1%

Observed Morbidity Rate

In the present study the numbers of complications due to perforation peritonitis were 22 and hence the morbidity rate was 30.1%.

Morbidity Predicted by MPI Score

MPI score was calculated for each patient of peritonitis as per the score sheet. The morbidity rate in each group is

Score	No. Of Patient	Complications	Morbidity Rates
<21	50	13	26%
21-29	17	7	41.2%
>29	6	2	33.3%

Cut Off Point for MPI ⁷

ROC analysis was done to identify the best cut off for MPI. The cut off came to be 19 for which the sensitivity and specificity was calculated to be 79% and 57% respectively.

Analysis of MPI scoring system (Morbidity)

Indices	MPI
Sensitivity	79%
Specificity	57%
Positive Predictive Value	79.2%
Negative Predictive Value	56.5%

This study evaluates the utility of MPI (Mannheim Peritonitis Index) as a tool to quantify the severity of peritonitis and predict the mortality and morbidity.

V. Discussion

In the present study, seventy three cases of were included with age ranging from 7 to 72 years. The mean age of the patients was 31.3 (SD 17.398) years. There was male preponderance (84.9%) in this study and the most common etiology of peritonitis was duodenal perforation seen in 48 % of patients, followed by appendicular perforation (25 %), ileal (15%), gastric (4%), colon (4%) and jejunum perforation (4%). 59.1% of patients with MPI score less than 21 developed complications. 31.8% of patients had complications with MPI score 21-27. Complications include Septic Shock, SIRS, MODS, Obstruction, Portal Pyemia and Paralytic ileus⁸. There was no mortality in patients with MPI less than 21, patients with MPI score 21- 29 had the mortality rate of 11.8% and patients with MPI >29 had the highest rate of mortality of 50%. The outcome of the study is statistically significant by chi-square test with p Value < 0.001. The numbers of deaths due to perforation peritonitis were 5 and hence the mortality rate was 6.8%. Mortality Predicted by MPI Score and the mortality rate in each group is <21 - 0%; 21-29 - 11.8%; >29 - 50%. ROC analysis was done to identify the best cut off for MPI for mortality. The cut off came to be 23 for which the sensitivity and specificity was calculated to be 86 % and 89 % respectively. The numbers of complications due to perforation peritonitis were 22 and hence the morbidity rate was 30.1%. Morbidity Predicted by MPI Score and the morbidity rate in each group is <21 - 26%; 21-29 - 41.2%; >29 - 33.3%. ROC analysis was done to identify the best cut off for MPI. The cut off came to be 19 for which the sensitivity and specificity was calculated to be 79% and 57% respectively.

According to the literature MPI is an independent, objective and effective scoring system in predicting mortality and has advantages over the other scoring systems^{9,10,11}.

Batra P., Gupta D., Batra R., Kothari R. & Deshmukh P.R. et al¹² of Department of Surgery, Mahatma Gandhi Institute of Medical Sciences, Sevagram, Wardha (Maharashtra), conducted a cross-sectional study of 160 patients of perforation peritonitis who were admitted in surgery department over a period of three years. The cut off from ROC curve came out to be 26. Sensitivity and specificity of MPI in predicting mortality was calculated to be 100% and 65.54 % respectively. The rate of mortality was 5.7%.

Sanjeev Sharma, Sumitroj Singh, Nikhil Makkar, Ashok Kumar, and Mandeep Singh Sandhu et al¹³ conducted a study in Government Medical College, Amritsar, in fifty cases with diagnosis of peritonitis. For patients with a score <21, the mortality rate was 0%; for score 21–27, it was 27.28%; and for score >27, it was 100% ($P < 0.001$). For patients with a score <21, the morbidity rate was 13.33%; for score 21-27, it was 65.71%; and for score >27, it was 100% ($P < 0.001$). For a score of 27, the sensitivity was 66.67%, specificity was 100%, and positive predictive value for mortality is 100% at an accuracy of 94%.

Pawanjeet Kumar, Kundan Singh, Amarnath Kumar et al¹⁴ conducted a comparative and prospective study in 50 patients of hollow viscous perforation admitted and operated in surgical emergency, Patna Medical College and Hospital. Mannheim peritonitis index and APACHE II score of each case was calculated and the prediction of outcome was compared with the final outcome. In this study with MPI score >25, 22.8% patients expired. MPI score between 25-15, 6.6% patients expired and with score ≤14 none of the patient expired. According to APACHE II system with APACHE II score less than 10, 8.6% patients expired. Between score 11 -20, 36% expired and With APACHE II score above 20, none of the patients survived I.e. 100% mortality.

S. K. Pattanaik, A. John, V. A. Kumar et al¹⁵ conducted a prospective observational study. Two thirds of 120 patients studied presented after 48 hours. MPI score of <14, 14-21, 21-29 and >29 had mortality of 0%, 2.2%, 27.2% and 50% respectively. ROC curve showed highest sensitivity and specificity of 79% and 70% respectively at MPI of 25. Significant value for mortality was obtained with MPI >25 ($p = 0.000012$) and with Revised MOFS >1 ($p < 0.001$); for morbidity with MPI >21 ($p = 0.010$) and with Revised MOFS >1 ($p < 0.001$). 20% patients with Revised MOFS zero were also morbid. MPI score >25 for mortality and >21 for morbidity are significant.

VI. Conclusion

MPI is an easy and effective scoring system with a better option for predicting morbidity and mortality and can be used as a guiding tool to decide on the possible outcome and the appropriate management .

References

- [1]. COURTNEY M. TOWNSEND, R. DANIEL BEAUCHAMP, B. MARK EVERS, KENNETH L. MATTOX , Sabiston 19th edition, chapter 45, page no 1100- 1101.
- [2]. Knaus WA, Zimmerman JE, Wagner DP, Draper EA, Lawrence DE. APACHE-acute physiology and chronic health evaluation: a physiologically based classification system. Critical Care Medicine. 1981;9.
- [3]. Moller MH, Adamsen S, Thomsen RW, Moller AM. Preoperative prognostic factors for mortality in peptic ulcer perforation – a systematic review. Scand J Gastroenterol. 2010;45:785–805.
- [4]. Demmel N, Muth G, Maag K, Osterholzer G. Prognostic scores in peritonitis: The Mannheim peritonitis index or APACHE II, Langenbecks Arch Chir 1994;379:347-52.
- [5]. Wacha H, Linder MM, Feldman U, Wesch G, Gundlach E, Steifensand RA. Mannheim peritonitis index – prediction of risk of death from peritonitis: construction of a statistical and validation of an empirically based index. Theoretical Surg. 1987;1:169–77.
- [6]. Cochran, W. G. (1977), Sampling Techniques, Third Edition, New York: John Wiley & Sons, Inc.: pg 75-76.
- [7]. Der Chirurg Zeitschrift fur alle Gebiete der operativen Medizin (1988) Volume:59, Issue:9, Pages: 598-601.
- [8]. Norman S. Williams, Christopher J.K. Bulstrode, & P. Ronan O'Connell , Bailey & Love's , 27th edition, chapter 61, page no 1052.
- [9]. Notash AY, Salimi J, Rahimian H, Fesharaki MH, Abbasi A. Evaluation of Mannheim peritonitis index and multiple organ failure score in patients with peritonitis. Indian Journal of Gastroenterology. 2005;24(5):197–200.
- [10]. Mulari K, Leppäniemi A. Severe secondary peritonitis following gastrointestinal tract perforation. Scand J Surg. 2004;93(3):204–8.
- [11]. Biondo S, Ramos E, Fracalvieri D, Kreisler E, Ragué J Martí, Jaurrieta E. Comparative study of left colonic peritonitis severity score and Mannheim peritonitis index. Br J Surg. 2006;93(5):616–22.
- [12]. Batra P, Gupta D, Batra R, Kothari R, Deshmukh PR. Mannheim peritonitis index as an evaluative tool in predicting mortality in patients of perforation peritonitis. CIBTech J Surg 2013;2:30-6.
- [13]. Sanjeev harma , Sumitaj Singh , Nikhil Makkar , Ashok Kumar , and Mandeep Singh Sandhu Assessment of Severity of Peritonitis Using Mannheim Peritonitis Index Niger J Surg . 2016 Jul-Dec; 22(2):118 -122.
- [14]. Pawanjeet Kumar, Kundan Singh, Amarnath Kumar A comparative study between Mannheim peritonitis index and APACHE II in predicting the outcome in patients of peritonitis due to hollow viscous perforation IJS, Home > Vol4,No2(2017) > Kumar ,ijsurgery.com/index.php/isj/article/view/982.
- [15]. S. K. Pattanaik, A. John, V. A. Kumar Comparison of mannheim peritonitis index and revised multiple organ failure score in predicting mortality and morbidity of patients with secondary peritonitis. International surgery journal Home >Vol 4, No 10 (2017) , <http://dx.doi.org/10.18203/2349-2902.isj20174524>.

Sinha Kumar Avinash "Mannheim Peritonitis Index in Predicting the Morbidity and Mortality in Patients with Peritonitis Due To Hollow Viscous Perforation."IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 7, 2018, pp 19-25