ORIGINAL RESEARCH PAPER

General Surgery

# MANNHEIM PERITONITIS INDEX AS A PREDICTIVE TOOL IN PATIENT WITH PERFORATION PERITONITIS

KEY WORDS: .

**Dr. M.K. Maheshwari** Professor, Subharti Medical College, Meerut, India

**Dr. Loveneet Dogra** Resident, Subharti Medical College, Meerut, India

**Dr. Krishan murty** Asst. Professor, Subharti Medical College, Meerut, India

**Dr. Ritin Malik** Resident, Subharti Medical College, Meerut, India

**ABSTRACT**

**Objective:** To evaluate Mannheim Peritonitis Index (MPI) in predicting outcome in patients with secondary peritonitis and to assess each risk factor independently regarding its contribution towards final outcome.
**Design:** Prospective analytical study.
Place and Duration of Study: Surgery department of subharti medical college.
**Patients and Methods:** One hundred patients who presented to the department with secondary peritonitis were included in the study. MPI score was calculated for each patient on a pre-designed proforma and the patients were followed-up till death or discharged from the hospital. Death was the main outcome measure against which the MPI scores were analyzed for scores < 19, 19- 29, and ≥30. Data was analyzed on software SPSS (version 11.0). Chi- square test was used to assess any significant association between scores and outcome. Odds ratios were calculated for individual risk factors.
**Results:** Mortality rate for MPI scores <19 was 0% , for scores 19 - 29 it was 14.7% and for score ≥30 it was 80%. Chi-square showed significant association between mortality and increasing MPI score ($p < 0.01$). Odd ratios calculated were significant for age > 50 years, malignancy, organ failure, pre-operative duration of peritonitis > 24 hours and cloudy, purulent exudate.
**Conclusion:** Increasing MPI score is strongly associated with outcome in secondary peritonitis.

## INTRODUCTION

Peritonitis as a manifestation of intra-abdominal infections is one of the important infectious problems faced by a general surgeon. The severity of intra-abdominal infections varies greatly from a localized response to generalized peritonitis, which has an unacceptably high mortality associated with it, therefore, objective criteria are needed to timely grade the severity of infection and to predict prognosis. Several scoring systems including sepsis specific (e.g. sepsis severity score), physiological (e.g. APACHE II, simplified acute physiology score), and peritonitis specific scores for early outcome e.g. Mannheim peritonitis index (MPI). Mannheim peritonitis index of Altona have been designed to assess prognosis.[1] These scoring systems scientifically compare the effectiveness of different treatment regimens and health facilities and to inform patient's relatives with greater objectivity. They may also indicate individual patients who may require a more aggressive surgical approach.[1] The most popular scoring system at present is APACHE II. It integrates 12 physiological variables during the first 24 hours within the intensive care unit (ICU) with age and chronic health status of the patient.[2,3] So use of APACHE II score in under-staffed and under equipped circumstances is not practical.
Mannheim peritonitis index was described by Wacha et al. in 1986 where 8 factors were found to be truly relevant to the prognosis.[1,2] The score considers information obtained during history taking, clinical examination and first laparotomy of the patient to establish an initial classification (Table I).

| **Table I:** Mannheim peritonitis index. | |
|---|---|
| Risk factor present | Weightage, if |
| Age > 50 years | 5 |
| Female sex | 5 |
| Organ failure* | 7 |
| Malignancy | 4 |
| Pre-operative duration of peritonitis >24 hours | 4 |
| Origin of sepsis not colonic | 4 |
| Diffuse generalized peritonitis | 6 |
| Exudate | |
| Clear | 0 |
| Cloudy, purulent | 6 |
| Faecal | 12 |
| *Definitions of organ failure | |
| Kidney | Creatinine level >177mmol/l<br>Urea level >167mmol/l<br>Oligurea < 20ml/h |
| Lung | PO2< 50mmHg<br>PCO2> 50mmHg |
| Shock | (definition according to Shoemaker)<br>Hypodynamic or hyperdynamic |

Intestinal obstruction (only if profound) Paralysis > 24 hr. or complete Although MPI is not the sole disease specific scoring system, it definitely is the simplest.[4,5] Its effectiveness as a reliable predictor of the peritonitis outcome has also been confirmed in over 2000 patients from various European and Russian surgical centers.[1,4-13]

The aim of this study was to evaluate MPI in predicting outcome in patients with secondary peritonitis and to assess individual risk factors for their contribution towards mortality in our settings.

## PATIENTS AND METHODS

This prospective analytical study was conducted in surgery department of subharti medical college. One hundred patients who presented to the unit in emergency or outpatient department were included whose secondary peritonitis was confirmed during surgery regardless of etiology. The patients without surgical confirmation of secondary peritonitis and those shifted to other hospitals for various reasons were excluded from the study. Patients were followed-up till death or discharged from the surgical ward. Peritonitis related in hospital death was the main outcome measure.

Proforma were used to collect data regarding the patients' particulars, clinical presentation and important physical and laboratory findings at time of presentation along with important information gathered at surgery. Medical and/ or surgical treatment offered, any complications noted during the stay, days of postoperative stay and final outcome of the patients were also

recorded. Mannheim peritonitis index was then used to calculate a prognostic score for each patient according to the values given in Table I. The minimum possible score was zero and maximum was 47. The cut-off point taken was a score of 26, patients with higher values being classified as predicted non-survivors[1]. Patients were also divided into three categories of severity as described by Fugger et al. patients with MPI score 20 or less, between 21 and 29, and those with a score 30 or more[1].

Data was then entered into software SPSS (version 11.0) for statistical processing. Relationship between individual MPI score and mortality and significance of possible differences among three categories (<19 points, 19- 29 points, and □30 points) was calculated using Chi-square test. Odd ratios were calculated for each risk factor to determine its contribution towards mortality. In addition to above, following observations were also calculated: mean age of the sample, male to female ratio, mean postoperative stay of survivors and non-survivors, total mortality from peritonitis, mean MPI score of the sample and mean MPI scores of survivors and non-survivors, frequency of different etiologies of peritonitis and their rate of occurrence in non-survivors.

## RESULTS

Overall mortality rate was 15%. For patients with a score less than 19 the mortality rate was 0%, whereas for scores 19-29, and □30 it was 14.7% and 80% respectively ($p < 0.01$).

Odd ratios for organ failure (8.9), age > 50 years (8.8), malignancy (6.9), cloudy purulent exudate (3.3) and preoperative duration of peritonitis > 24 hours[2] had significant influence on outcome while the rest of the factors had insignificant odd ratios (female gender 18, generalized peritonitis 1, fecal exudate 0.4, non-colonic origin of sepsis 0.35 and no-exudate 0.31).

Mean MPI score of the sample was 21.18. The survivors had a mean score of 22.3 (range 4-38), while non-survivors had a mean score of 28.8 (range 14-36). Mean postoperative stay of the patients was 9.6 days. Relaparotomies were performed in 6.3 % of the cases. Small gut pathologies were the cause of peritonitis in the majority of patients(29.4%),followed by gastroduodenal pathologies (24.6%), appendix

(9.5%), sigmoid colon perforation (4.8%); acute pancreatitis, acute, inflammatory disease and ruptured liver abscess in 3.96%; and pyoperitoneum, gall bladder and tuberculous peritonitis in 2.4% each.

**Table II:** General characteristics of the sample.

| | Survivors | Non-survivors | Total |
|---|---|---|---|
| N | 85 | 15 | 100 |
| %age | 85% | 15% | 100 % |
| Gender | | | |
| Male (%) | 90.54 | 9.45 | 100 |
| Female (%) | 69.23 | 30.76 | 100 |
| Mean age | 32.7 ± 16.3 | 47.1 ± 25.05 | 34.9 ± 18.5 |
| Mean postoperative stay | 9.9 ± 6.96 | 7.8 ± 14.6 | 9.6 ± 8.5 |
| Rate of relaparotomy | 6.5% | 5.3% | 6.3 % |
| Mean MPI score | 22.3 ±7.5 | 28.8 ± 5.5 | 23.3 ± 7.6 |

Amongst non-survivors the sites of origin of infection were in the following order. Large gut pathologies were the commonest (21%) followed by small gut and gastroduodenal pathologies (18.8% each). Amongst causes for small gut perforations tuberculosis accounted for 1/ 3rd of the cases (10.3%) . Tuberculous peritonitis alone was the cause in 10.5% of cases as was acute pancreatitis. two percent cases amongst non-survivors had perforated appendix.

## DISCUSSION

Secondary bacterial peritonitis is one of the most common problems in general surgery practice.[14] When severe and generalized, it can lead to sepsis manifested by organ dysfunction and increased mortality. The mortality associated with peritonitis has been reported to be from 6% to 40% in several studies.[1,2,12,14-16].

Since its publication, all the studies undertaken to validate Mannheim peritonitis index including our study show a significant rise in mortality rate above the critical score of 26.[1,2,5-8,12,19] When classified in three groups, the lowest mortality was seen in <21 score and the highest with scores >29 ($p<0.01$).[1,2,8] Although increasing score predicts increasing mortality. This reflects that the quality of prediction is such that it cannot be applied to individual patients for taking decisions regarding more aggressive treatment or limitation of therapy. This has also been confirmed in the largest multicenter study to validate the use of MPI.[1] Contrary to this some studies have shown an almost 100% mortality above score [29,8,12,20] and have suggested that MPI can be used as a criteria for deciding the optimal treatment approach for peritonitis. Even laparoscopic sanitation of abdominal cavity has been recommended for patients having scores below. [29,8,21,22] Interestingly high MPI has also been shown to be associated with fungal infection in patients with perforated peptic ulcer and it has been recommended that a high MPI score in these patients should be used as an indication for prophylactic antifungal treatment.[23]

MPI has also been used in certain studies to stratify patients for comparison of different procedures[24-26] and has been shown to be accurately associated with morbidity and mortality.[23,27,28]

Considering each risk factor separately in our study only age>50 years, malignancy, organ failure, pre-operative duration of peritonitis > 24 hours and cloudy, purulent exudate behaved as expected. Rest of the factors had insignificant influence on mortality.

Age above 50 was associated with a high mortality (45.5%), a fact proven in all the studies carried out on peritonitis and mortality.[1,2,14,15,29] Mean age of the group as a whole (34.9 years) and that of survivors (32.7 years) was similar to what was seen in other studies.[2] But the mean age of non-survivors is considerably less than that shown in other studies (47.1 years compared to upto 66 years in other studies).[2,5]This may be due to a generally lower life expectancy in our population. Presence of organ failure at the time of first surgery was the most significant risk factor. It increased the chances of mortality by 8.9 times, however, it is important to note that of all the people who developed organ failure only 28.6% died while 71.4% still survived. Amongst non-survivors 84.2% had one or more organ failure at the time of first surgery. Other studies have shown organ failure to be present in 100% of expiries[2], but in those studies probably organ failure as cause of death has been confused with the presence of this factor at the time of first surgery.

Pre-operative duration of peritonitis > 24 hours was also significantly associated with early outcome, similar to other studies.[2,29] This indirectly also emphasizes the importance of early decision-making regarding surgery in these cases.

In this study, there was an obvious predominance of male patients (67%) unlike other studies where gender composition varies from 43 to 52% females and 48 to 57% males.[2,14] However, this did not influence mortality and the odds ratio calculated for female sex and mortality remained under.[2] This signifies that gender, as a risk factor for mortality in peritonitis is not independently associated with adverse outcome, a finding consistent with other reports.[2,14]

Furthermore, it was observed that although large gut pathologies constituted only 5.5% of the total, the mortality associated with them was the highest (21%). This has also been confirmed by other studies.[2,29] Noticeably abdominal kochs alone claimed 15.8% of deaths out of which 1/ 3rd were due to intestinal kochs and rest had tuberculous peritonitis. However, small number of patients of each etiology in this series did not allow conclusive results to be drawn from this study. Other studies have also shown that factors related to host and the difficulty or impossibility in eradicating the source of inflammation overshadowed type and

source of infection in evolution of patients with intra-abdominal infection.[2,15,16]

Amongst the present scoring systems, Mannheim peritonitis index is one of the easiest to apply. It has been compared with other well-known scoring systems like APACHE II, peritonitis index of altona and sepsis severity score in several studies[5,7,10,11,13,20] and has been termed equal to or superior to these in predicting prognosis.[10,11] A combination of MPI with other scoring systems has also been suggested as a better prognostic indicator.[13,20]

## CONCLUSION

The MPI is a well-validated peritonitis index. Its simplicity and accuracy makes it ideal for use in our setup. Further increase of its prognostic power is also desirable. In view of different performance of several risk factors in this study, larger studies are required to confirm their behavior in this population.

## REFERENCES


1. Billing A, Frohlich D, Schildberg FW. Prediction of outcome using the Mannheim peritonitis index in 2003 patients. Peritonitis Study Group. Br J Surg 1994; 81: 209-13.
2. Bracho-Riquelme R, Melero-Vela A, Torres-Ramirez A. Mannheim peritonitis index validation study at the Hospital General de Durango (Mexico). Cir Ciruj 2002; 70: 217-25.
3. Ohmann C, Wittmann DH, Wacha H. Prospective evaluation of prognostic scoring systems in peritonitis. Peritonitis Study Group. Eur J Surg 1993; 159: 267-74.
4. Ohmann C, Hau T. Prognostic indices in peritonitis. Hepatogastroenterology 1997; 44: 937-46.
5. Pacelli F, Doglietto GB, Alfieri S, Piccioni E, Sgadari A, Gui D, et al. Prognosis in intra-abdominal infections. Multivariate analysis on 604 patients. Arch Surg 1996; 131: 641-5.
6. Liverani A, Correnti SF, Paganelli MT, Antonini G, Mercati U. Mannheim index in prognosis and treatment of acute peritonitis. Minerva Chir 1998; 53: 385-9.
7. Grunau G, Heemken R, Hau T. Predictors of outcome in patients with postoperative intra-abdominal infection. Eur J Surg 1996; 162: 619- 25.
8. Ermolov AS, Bagdat'ev VE, Chudotvortseva EV, Rozhnov AV. Evaluation of the Mannheim peritonitis index. Vestn Khir Im I I Grek 1996; 155: 22- 3.
9. Demmel N, Maag K, Osterholzer G. The value of clinical parameters for determining the prognosis of peritonitis- validation of the Mannheim peritonitis index. Langenbecks Arch Chir 1994;379: 152- 8.
10. 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.
11. Rogy M, Fugger R, Schemper M, Koss G, Schulz F. The value of 2 distinct prognosis scores in patients with peritonitis. The Mannheim peritonitis index versus the APACHE II score. Chirurg 1990; 61: 297- 300.
12. Sokmen S, Coker A, Unek T, Tuncyurek P, Bora S. Effectiveness of the Mannheim peritonitis index in patients with peritonitis. Ulus Travma Derg 2001; 7: 100- 3.
13. Kologlu M, Elker D, Altun H, Sayek I. Validation of MPI and PIA II in two different groups of patients with secondary peritonitis. Hepatogastroenterology 2001; 48: 147- 51.
14. Anaya DA, Nathens AB. Risk factors for severe sepsis in secondary peritonitis. Surg Infect 2003; 4: 355-62.
15. Malangoni MA. Current concepts in peritonitis. Curr Gastroenterol Rep 2003; 5: 295- 301.
16. Yilmazlar T, Toker S, Zorluoglu A. Non-traumatic colorectal perforations. Int Surg 1999; 84: 155- 8.
17. Khan A. Typhoid enteric perforation: prognostic factors. An experience with 76 patients. J Ayub Med Coll (Abottabad) 2000; 12: 49- 52.
18. Mirza SM, Ali AA, Gondal KM, Asghar M, Hanif F, Ahmad M, et al. Typhoid perforation: an experience at Mayo Hospital, Lahore. Ann KE Med Coll 1999; 5: 34-7.
19. Gonzalez AJ. Prognosis of generalized peritonitis according to Mannheim index. Cir Ciruj 2002; 70: 179-82.
20. Bosscha K, Reijnders K, Hulstaert PF, Algra A, Van-der Werken C. Prognostic scoring systems to predict outcome in peritonitis and intra-abdominal sepsis. Br J Surg 1997; 84: 1532-4.
21. Hut'an M, Poticny V, Balaz P. Modern trends in the treatment of diffuse peritonitis. Rozhl Chir 2000; 79: 171- 4.
22. Malkov IS, Shaimardanov RSh, Zainutdinov AM, Birial'tsev VN, Lustina NI. Laparoscopic sanitation of the abdominal cavity in combined treatment of peritonitis. Khirurgiia (Mosk) 2002; 6: 30- 3.
23. Shan YS, Hsu HP, Hsieh YH, Sy ED, Lee JC, Lin PW. Significance of intraoperative peritoneal culture of fungus in perforated peptic ulcer. Br J Surg 2003; 90: 1215- 9.
24. Zeitoun G, Laurent A, Rouffet F, Hay J, Fingerhut A, Paquet J, et al. Multicentre, randomized clinical trial of primary versus secondary sigmoid resection in generalized peritonitis complicating sigmoid diverticulitis. Br J Surg 2000; 87: 1366-74.
25. Seiler CA, Brugger L, Maurer CA, Renzulli P, Buchler MW. Peritonitis in diverticulitis: the Bern concept. Zentralbl Chir 1998; 123: 1394-9.
26. Schilling MK, Maurer CA, Kollmar O, Buchler MW. Primary vs. secondary anastomosis after sigmoid colon resection for perforated diverticulitis (Hinchey stage III and IV): a prospective outcome and cost analysis. Dis Colon Rectum 2001; 44: 699-703.
27. Bielecki K, Kaminski P, Klukowski M. Large bowel perforation: morbidity and mortality. Tech Coloproctol 2002; 6: 177-82.
28. Makela J, Kiviniemi H, Laitinen S. Prevalence of perforated sigmoid diverticulitis is increasing. Dis Colon Rectum 2002; 45: 95561.
29. Correia MM, Thuler LCS, Velasco E, Vidal EM, Schanaider A. Prediction of death using the Mannheim peritonitis index in oncologic patients. Revista Brasileira de Cancerologia 2001; 47: 63-8.
30. Burger JA, Schoffel U, Sach M, Jacobs E, Kownatzki E, von Specht BU, et al. Effects of peritonitis exudates on chemotaxis and phagocytosis of human neutrophils. Eur J Surg 1995; 161: 647-53.
31. Schoeffel U, Jacobs E, Ruf G, Mierswa F, von Specht BU, Farthmann EH. Intraperitoneal micro-organisms and the severity of peritonitis. Eur J Surg 1995; 161: 501-8.
32. Sendt W, Amberg R, Hassan A, von Specht BU, Schoffel U.