

Estimation of the efficacy of mannheim peritonitis index in determining prognosis in perforation peritonitis

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Conflicts of Interest: Nil

Abstract

Background: Peritonitis due to hollow viscous perforation continues to be one of the most common surgical emergencies to be attended by a surgeon. It is a potentially life-threatening condition which carries 90% mortality if treatment is not provided. A fatal condition such as this most often requires an emergency surgical intervention, thereby emphasizing the need for scoring system that would be able to assess the need, type, and quality of the care required for a particular patient. The Mannheim’s peritonitis index is one of the simplest scoring systems in use that allows the surgeon to easily determine the outcome risk.

Objectives of The Study: This study is done to evaluate Mannheim’s peritonitis index score and its role in predicting mortality in patients of perforation peritonitis.

Methods: This study was carried out from January 2021 to July 2022. A total of 50 cases diagnosed with

perforation peritonitis and fulfilling the inclusion/exclusion criteria were included in the study. The MPI score was calculated for each patient. Presence of comorbidities was also included to study its effect on outcome. Mortality based on the descriptive statistics of MPI score was analysed.

Results: Of 50 patients studied, mortality rate among patients with MPI score > 29 was 85.7% and with MPI < 21 was 0, which was statistically significant. Duration of pain >24 h, organ failure on admission, and feculent exudate were found to be independently significant factors in predicting the mortality.

Conclusion: The Mannheim Peritonitis Index is disease specific, easy scoring system for predicting mortality in patients with secondary peritonitis. Increasing scores are associated with poorer prognosis, needs intensive management and hence it should be used routinely in clinical practice.

Keywords: Mannheim, Peritonitis, Hollow Viscus Perforation, Prognosis.

Introduction

Peritonitis can be defined as an inflammatory process of the peritoneum, which can be either localized or generalized.¹ Peritonitis due to hollow viscous perforation continues to be one of the most common surgical emergencies to be attended by a surgeon. This may be due to persistence of the various risk factors among the general population like Helicobacter pylori infection, NSAIDs, enteric fever and several others.² The etiology of perforation is very diverse those include gastric ulcer, duodenal ulcer, appendicitis, gastrointestinal malignancy, blunt trauma abdomen, typhoid fever. Perforation due to NSAID drug abuse, smoking, ingestion of corrosive substances can also be responsible.³ In spite of adequate surgical management, intensive care units with advanced technology, newly invented recent generation antibiotics and a good knowledge of the pathophysiology, the mortality rate of perforation peritonitis are is still high, ranging 13-43%.⁴ It is a potentially life-threatening condition which carries 90% mortality if treatment is not provided.⁵ A fatal condition such as this most often requires an emergency surgical intervention, thereby emphasizing the need for scoring system that would be able to assess the need, type, and quality of the care required for a particular patient. Many scoring systems have been designed and used successfully to grade the severity of acute peritonitis like, Acute physiology and chronic health evaluation (APACHE) II score, Simplified acute physiology score (SAPS), Sepsis severity score (SSS), Ranson score, Imrie score, Mannheim peritonitis index (MPI) ^{6,7}. Realizing the need for a simple accurate scoring system so as to

achieve better care, better decision making and decrease in duration of hospital stay and complications, the present study was undertaken to evaluate the performance of the Mannheim Peritonitis Index scoring system in predicting the risk of morbidity and mortality in patients with peritonitis due to hollow viscous perforation.

Aims And Objectives

To evaluate the effectiveness of the Mannheim's Peritonitis Index Score in predicting prognosis in patients with perforation peritonitis.

Materials And Methodology

Study Subjects: 50

Study Duration: March 2021 To August 2022

Study Place: ESIC And PGIMSR, Bangalore

Study Design: Prospective Study- Case Series

Sample Design: Purposive Sampling

After obtaining clearance and approval from the institutional ethical committee, 50 cases with peritonitis secondary to hollow viscus perforation and fulfilling the inclusion/ exclusion criteria were included in the study from January 2021 to August 2022 at ESICMC and PGIMSR, Rajajinagar, Bangalore.

Inclusion Criteria

- Patients willing to give informed written consent
- Patients with clinically proven features of perforation peritonitis
- Patients more than 18 years of age

Exclusion Criteria

- Patients less than 18 years
- Primary and tertiary peritonitis
- Traumatic perforation
- Perforation secondary to gastrointestinal malignancies.

Methodology

- Patients presenting with peritonitis secondary to hollow viscus perforation were included in the study.
- Initial preoperative work up and resuscitation with intravenous fluids, antibiotics, analgesics, nasogastric decompression was done in all the cases. Site of peritonitis secondary to hollow viscus perforation was diagnosed during surgery and was dealt with appropriate surgical procedure. Peritoneal lavage was given in all cases.
- The MPI was applied along with other clinical and biochemical parameters recorded in pre-structured proforma.
- Prediction was categorized into 3 groups:
i) score ≤ 20 ii) Score 21-28 iii) score ≥ 29 .
- Further resuscitation and ICU care was given as and when was necessary.
- Patients were followed up postoperatively till the outcome i.e. mortality, morbidity or discharge. Data obtained was analysed for predicting mortality and morbidity.

Statistical Analysis

The Patients were grouped into three categories based on disease severity: those with MPI less than 21, between 21 and 29, and greater than 29. Statistical Analysis: Data were entered in MS Excel and analysed in SPSS V22. Descriptive statistics for qualitative data was represented with percentages. Chi square test was applied to find the significance and $P < 0.05$ was considered as statistically significant.

Results

Age: A total 50 patients with hollow viscus perforation were studied at our institute. Out of which 15 people were above 50 years of age and 35 were below 50 years.

The mean age of the study group is 41 years (SD= 15.55)

| AGE | FREQUENCY | PERCENTAGE |
|-----------|-----------|------------|
| ≤ 30 | 15 | 30% |
| 31-45 | 16 | 32% |
| 46-60 | 12 | 24% |
| >60 | 7 | 14% |

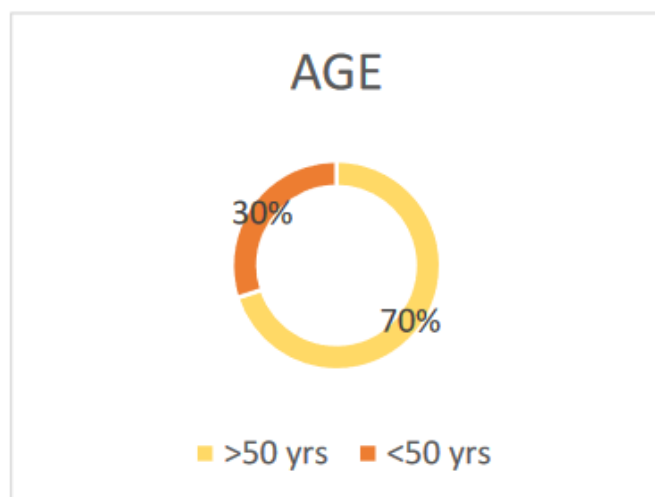
Table 1: Age distribution of the patients

The age group of 31- 45 contains maximum (32%) patients followed by 18-30 years. The oldest patient was 71 years of age and the youngest was of 18 years.

| AGE | NUMBER (%) |
|-----------|------------|
| >50 YRS | 15 (30%) |
| <50 YRS | 35 (70%) |

Table 2: Age distribution- >50 and <50 years of age as per MPI.

15 patients, i.e., 30% of the study group was above 50 years of age.



Graph 1: Distribution of patients based on age group

Sex Distribution

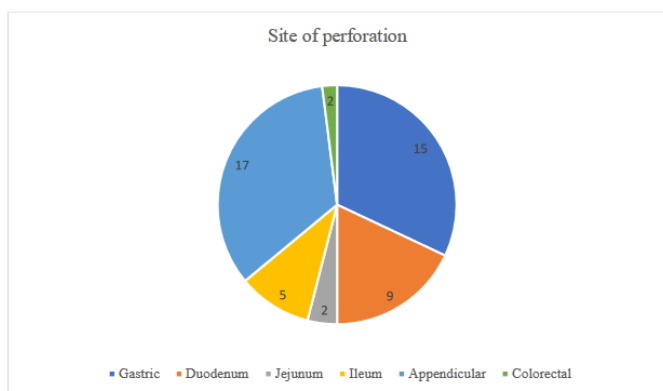
| SEX | FREQUENCY | PERCENTAGE |
|--------|-----------|------------|
| MALE | 38 | 76% |
| FEMALE | 12 | 24% |

Table 3: Gender-wise distribution of patients in the study group 76% of the patients were males and 24% were females.

Anatomical Site of Perforation

| Site | Total | Percentage |
|------------|-------|------------|
| Gastric | 15 | 30% |
| Duodenum | 9 | 18% |
| Jejunum | 2 | 4% |
| Ileum | 5 | 10% |
| Appendix | 17 | 34% |
| Colorectal | 2 | 4% |

Table 4: Distribution of anatomical site of perforation



Graph 2: Distribution of anatomical site of perforation

As shown above, the most common anatomical location for perforation of hollow viscus was appendicular (34%), closely followed by Gastric (30%), whereas

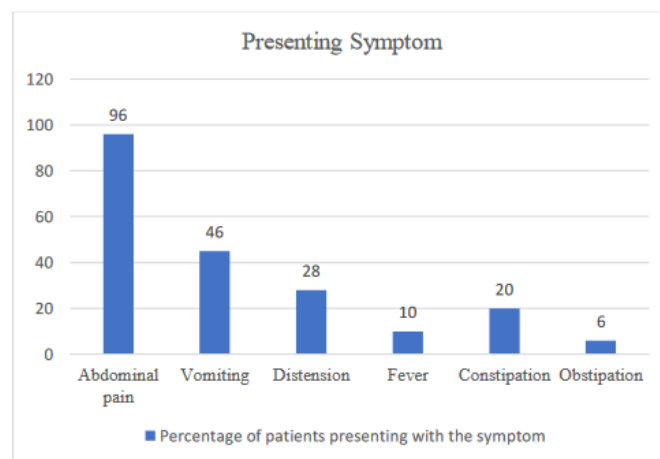
Colorectal and jejunal perforations only constituted 4% of the cases each.

Surgical Interventions Performed

| SURGERY DONE | FREQUENCY | PERCENTAGE |
|---|-----------|------------|
| Appendicectomy | 16 | 32% |
| EL With Ileostomy | 2 | 4% |
| EL With Omental Patch Repair | 25 | 50% |
| EL With Primary Closure of Ileal Perforation | 4 | 8% |
| EL With Primary Closure of Jejunal Perforation | 1 | 2% |
| EL Right Hemicolectomy with Ileo-Transverse anastomosis | 2 | 4% |

Table 5: Distribution of surgical interventions performed.

Symptoms At Time of Presentation



Graph 3: Distribution of presenting symptoms of the patients.

In our study, the commonest symptom was abdominal pain (96%), followed by vomiting seen in about 46% of the patients.

Organ Failure

| ORGAN FAILURE | FREQUENCY | PERCENTAGE |
|---------------|-----------|------------|
| PRESENT | 17 | 34% |
| ABSENT | 33 | 66% |

Table 6: Distribution of patients as per organ failure
17 patients, i.e, 34% of the patients had organ failure in the current study.

Pre-operative duration of peritonitis

| Pre-operative duration evolution time | Frequency | Percentage |
|---------------------------------------|-----------|------------|
| <24 hrs | 16 | 32% |
| >24hrs | 34 | 68% |

Table 7: Distribution of patients as per time of pre-operative duration since onset of symptoms.

32% of the patients presented to the hospital and underwent appropriate surgery before 24 hours of onset, whereas 68% of the people presented after 24 hours of onset of symptoms.

Malignancy with perforation

| MALIGNANCY | FREQUENCY | PERCENTAGE |
|------------|-----------|------------|
| PRESENT | 1 | 2% |
| ABSENT | 49 | 98% |

Table 8: Distribution of patients as per presence of malignancy.

Only 1 case of malignancy (Gastric Carcinoma) was present in our study.

Origin of sepsis- Colonic Vs Non Colonic

| ORIGIN OF SEPSIS | FREQUENCY | PERCENTAGE |
|------------------|-----------|------------|
| COLONIC | 2 | 4% |
| NON-COLONIC | 48 | 96% |

Table 9: Distribution of patients as per origin of sepsis-colonic vs non-colonic

2% of the cases of perforation were non-colonic in origin

Type of Peritonitis

| TYPE OF PERITONITIS | FREQUENCY | PERCENTAGE |
|---------------------|-----------|------------|
| GENERALIZED | 20 | 40% |
| LOCALIZED | 30 | 60% |

Table 10: Distribution of patients as per type of peritonitis

30% of patients had generalized peritonitis whereas 20% had features of localized peritonitis.

Type of Exudate

| TYPE OF EXUDATE | FREQUENCY | PERCENTAGE |
|-----------------|-----------|------------|
| Clear | 7 | 14% |
| Purulent | 35 | 70% |
| Fecal | 8 | 16% |

Table 11: Distribution of patients as per type of exudate
In the current study, 70% had purulent exudative discharge, whereas 14% had clear and 16% had fecal exudate.

Mannheim Peritonitis Index

| MPI | FREQUENCY | PERCENTAGE |
|-------|-----------|------------|
| <21 | 25 | 50% |
| 21-29 | 18 | 36% |
| >29 | 7 | 14% |

Table 12: Distribution of patients as per MPI Score
50% of the patients, i.e., 25 cases had an MPI score of less than 21. 36%, i.e., 18 cases were in the range of 21-29 and the rest, i.e., 14%, 7 patients, fell in the range above 29.

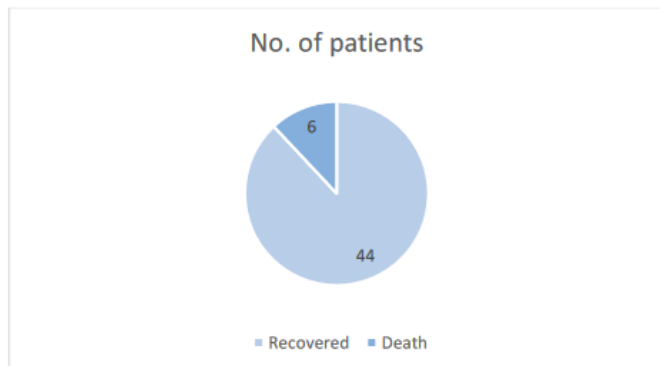
Post op Morbidity

| POST OP MORBIDITY | FREQUENCY | PERCENTAGE |
|-------------------|-----------|------------|
| PRESENT | 12 | 24% |
| ABSENT | 38 | 76% |

Table 13: Post op morbidity following surgery.

24% of the cases, comprising of 12 patients were found to have post op morbidity.

Outcome of Patients



Graph 4: Outcome of patients

| | | |
|-----------|----|-----|
| DEATH | 6 | 12% |
| RECOVERED | 44 | 88% |

Table 14: Outcome of cases

Mortality Incidence as Per Age

| AGE | DEATH | PERCENTAGE |
|-----------|-------|------------|
| <50 YEARS | 1 | 2% |
| >50 YEARS | 5 | 10% |

Table 15: Mortality incidence as per age 83.3% of the deaths were above the age of 50 years.

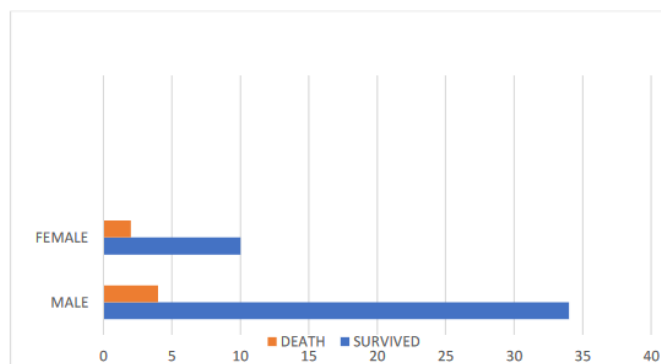
In correlation between Age > 50 years with incidence of mortality, our study showed statistically significant result with $p > 0.05$ i.e., 0.03

Mortality Incidence as Per Gender

| SEX | DEATH | PERCENTAGE |
|--------|-------|------------|
| FEMALE | 2 | 16.6% |
| MALE | 4 | 10.52% |

Table 16: Mortality incidence as per gender

33% of the deaths were female and 67% of the deaths were male in gender.



Graph 5: Bar graph presenting the survival and death rates according to gender.

In correlation of sex with incidence of mortality, p value in our study was 1.000 which is statistically not significant.

Mortality Incidence as Per Organ Failure

| | PRESENT | ABSENT |
|-----------|---------|--------|
| DEATH | 6 | 0 |
| RECOVERED | 9 | 33 |

Table 17: Mortality incidence as per organ failure

35% of patients who had organ failure succumbed to death, whereas 65% survived.

In correlation to organ failure with incidence of mortality, it showed statistically significant p value of 0.003.

Mortality Incidence In Correlation With Pre Operative Duration

| | <24 HOURS | >24 HOURS |
|-----------|-----------|-----------|
| DEATH | 0 | 6 |
| RECOVERED | 16 | 28 |

Table 18: Mortality incidence as per pre-operative duration.

17% of patients who presented post 24 hours of onset of symptoms succumbed, whereas 83% recovered.

In correlation of preoperative duration with incidence of mortality, our study showed statistically significant

result with $p < 0.010$ showing correlation between preoperative duration with incidence of mortality. Risk of mortality increased with increase in pre-operative duration.

Mortality Incidence with Malignancy

Only, one patient had malignancy (Gastric Carcinoma), who did not survive.

In correlation of malignancy with incidence of mortality, p value in our study was 0.249 which is statistically not significant and showed contrast results with MPI.

Mortality Incidence with Type of Peritonitis

| | GENERALIZED | LOCALIZED |
|-----------|-------------|-----------|
| DEATH | 6 | 0 |
| RECOVERED | 14 | 30 |

Table 19: Mortality incidence as per type of peritonitis

In correlation of type of peritonitis with incidence of mortality, p value in our study was 0.082 which is statistically not significant.

Mortality Incidence with Origin of Sepsis

| | COLONIC | NON-COLONIC |
|-----------|---------|-------------|
| DEATH | 2 | 4 |
| RECOVERED | 0 | 44 |

Table 20 : Mortality incidence as per origin of sepsis

In correlation of type of peritonitis with incidence of mortality, p value in our study was 0.146 which is statistically not significant.

Mortality Incidence With Type of Exudate

| | CLEAR | PURULENT | FECAL |
|-----------|-------|----------|-------|
| DEATH | 0 | 0 | 6 |
| RECOVERED | 7 | 35 | 2 |

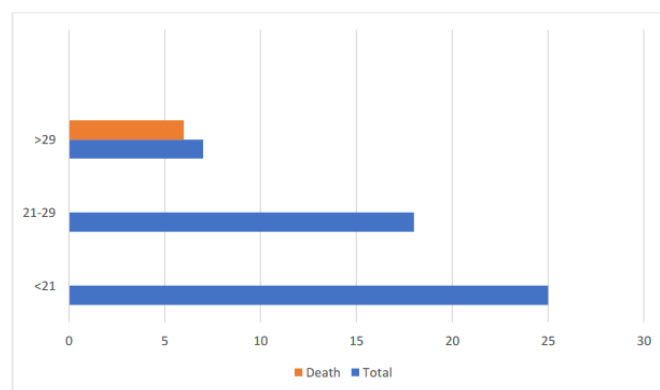
Table 21: Mortality incidence as per type of exudate

In correlation of type of peritonitis with incidence of mortality, p value in our study was 0.09 which is

statistically not significant but shows a positive correlation.

| MPI | FREQUENCY | DEATH | PERCENTAGE |
|-------|-----------|-------|------------|
| <21 | 25 | 0 | 0 |
| 21-29 | 18 | 0 | 0 |
| >29 | 7 | 6 | 85.7 |

Table 22: Mortality incidence as per Mannheim Peritonitis Index



Graph 6: Bar graph presenting the survival and death rates as per MP.

In our study mortality rate among patients with MPI score > 29 was 85.7% and with MPI < 21 was 0, which is statistically significant with $p < 0.0005$.

| VARIANT | TOTAL | RECOVERED | DEATH | P VALUE |
|-------------------------|-------|-----------|----------|---------|
| AGE >50 YEARS | 15 | 1 (67%) | 5 (33%) | 0.03 |
| FEMALE SEX | 12 | 10 (83%) | 2 (17%) | 1 |
| ORGAN FAILURE | 17 | 9 (53%) | 6 (47%) | 0.003 |
| MALIGNANCY | 1 | 0 | 1 (100%) | 0.249 |
| DURATION >24 HOURS | 34 | 28 (82%) | 6 (18%) | 0.01 |
| ORIGIN OF SEPSIS | 48 | 44 (91%) | 4 (9%) | 0.146 |
| GENERALIZED PERITONITIS | 20 | 14 (70%) | 6 (30%) | 0.082 |
| EXUDATE | | | | |
| CLEAR | 7 | 7 (100%) | 0 (0%) | 0.09 |
| PURULENT | 35 | 35 (100%) | 0 (0%) | |
| FECAL | 8 | 2 (25%) | 6 (75%) | |

Table 23: Summary of MPI Variables and their outcomes

Among the MPI variables of adverse outcome, Age > 50 years, Organ Failure and preoperative duration time >24 hrs showed statistical significance in predicting mortality. Generalized peritonitis and fecal exudate showed positive correlation with increased incidence of mortality but was found to be not statistically significant.

Discussion

Our study included a total of 50 patients and the outcomes with each Mannheim Peritonitis Index variable was found to be as stated below.

Age

Ages of the subjects ranged from 20 years to 84 years. The mean age of the study population was 41 years. The age group of 31- 45 contained maximum (32%) patients followed by 18-30years. In a study by Rajendra Singh Jhobta et al., 8 (2006) the mean age was 36.8 years, and the age range was 3 years to 90 years. In a study by Aijaz A Memon et al., 32 (2008) in which the spectrum of acute abdomen was studied the age range was from 13 years to 87 years.

| AUTHOR | YEAR | AGE |
|-------------------------------|------|-------|
| Ohmann C et al ⁹ | 1997 | 56 |
| Rodriguez et al ¹⁰ | 1999 | 39.8 |
| Corriea et al ¹¹ | 2001 | 58.9 |
| Rodolfo L et al ¹² | 2002 | 34.6 |
| Present study | 2022 | 47.57 |

The number of patients above the age of 50 years was 15, i.e., 30%.

The increased prevalence of the perforation in the age group of 31- 60 years in our study can be attributed to the fact that gastro duodenal perforations due to peptic ulcer disease is a major cause of perforation peritonitis in our study and the increased prevalence of the etiological risk factors such as

smoking, alcoholism and NSAID abuse in this age group.

Age And Mortality

In our study a total of 15 patients were less than 50 years of age, of which one patient died. 35 were of age >50 years, among whom, there were 5 deaths. In a study by Rodolfo L Braco et al.¹², the mean age of the survivors was 32.7 years (SD ±16.64), among non-survivors mean age was 63 years (SD ± 18.94). Kusumoto Yoshiko et al.¹³, 33 in their study of patients operated on for intraabdominal infection found that there was no mortality in less than 50 years age group, while mortality occurring only in patients older than 50 years.

Age And Mortality

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Death and other outcomes of acute surgical illness are uniformly worse in the elderly than in young patients and the adverse impact of age on outcome from abdominal sepsis in particular is well recognized. The higher death rate among the elderly undoubtedly reflects an increased prevalence of pre-existing cardiovascular and other diseases as well as a predictable decline in many physiological functions.

As patients get older coincident disease are more common. Even if there is no evidence of disease there may be a decrease in the physiological reserve such as

the decrease in the glomerular filtration rate despite a normal creatinine. The initial disease that requires surgery may be complicated by tissue hypo perfusion and acidosis from vomiting and loss of fluid into the gastrointestinal tract or bleeding in the elderly population.

Sex

In our study the incidence of male sex was 76%, while female sex was 24%. In a study by Rajender Singh Jhobta et al.,⁸ (2006) regarding the spectrum of perforation peritonitis in India, 84% patients were found to be male.

| AUTHOR | YEAR | MALE | FEMALE |
|-------------------------------|------|-------|--------|
| Tripathi et al ¹⁴ | 1993 | 45.5% | 54.5% |
| Yilmazlar et al ¹⁵ | 1999 | 37% | 63% |
| Corriea et al ¹¹ | 2001 | 26.7% | 73.3% |
| Rodolfo L et al ¹² | 2002 | 48% | 52% |
| Present study | 2022 | 76% | 24% |

In a study by Aijaz A Meman (2008) et al.,¹⁶ about the spectrum of disease in patients with acute abdomen, 70.30 % was males and 29.69% were females. In a study by Rodolfo L (2004) et al.,¹² 12 out of the 174 patients, 84 were females (48%) and 90 were males (52%). The increased prevalence of male sex in our study is mainly due to increased number of male patients in the group of duodenal perforation and the presence of risk factors such as smoking, alcoholism.

Sex And Mortality

In our study total of 38 patients were male, of which there were 4 deaths resulting in a mortality of 11.4%. Of the 12 female subjects, death occurred in 2 patients, i.e., 16.6%.

Yoshiko Kusumoto et al.¹³, found out in their study of 108 patients operated for intra- abdominal infections the mortality was 5.3% in men and 15.2% in women.

Site of Perforation

In our study, the most common anatomical location for perforation of hollow viscus was appendicular (34%), closely followed by Gastric (30%), duodenal (18%), ileal (10%), whereas Colorectal and jejunal perforations only constituted 4% of the cases each. In a study by Rajender Singh Jhobta et al.⁸, (2006) the different sites of perforations were: duodenum 57%, gastric 8%, jejunal 3%, ileal 15%, appendicular 12%, colonic 4% and esophageal 0.5 %.

| Site | Tripathi et al ¹⁴ (1993) | Desa L. A et al ¹⁷ (1983) | Kachroo et al ¹⁸ (1984) | Bohner et al ¹⁹ (1999) | Present Study |
|--------------|-------------------------------------|--------------------------------------|------------------------------------|-----------------------------------|---------------|
| Duodenal | 15% | 33% | 18.7% | 22.7% | 18% |
| Ileal | 24.5% | 27.3% | 15% | - | 10% |
| Appendicular | 10% | 18.1% | 41.1% | 15.9% | 34% |
| Others | 50.5% | 22.3% | 25.2% | 61.4% | 38% |

In a study by Rodolfo L et al.¹², majority were appendicular perforations constituting 48.28% while gastric and small bowel perforations constituted 2.87% each and colonic found to be 2.30%.

The perforations of the proximal gastrointestinal tract was higher compared to the perforations of the distal gastrointestinal tract as has been noted by earlier studies from India. This is in contrast to studies from the developed countries which reveal that distal gastrointestinal tract perforations are more common.

Organ Failure

In our study, 17 patients i.e., 34% of the study population showed evidence of organ failure.

The evidence-based distribution of organ failure in other studies are as follows-

48.5 % in MM Correia et al.11,

11.5 % in Rodolf L et al.12,

20 % in Murut Kologlu et al.20,

In peritonitis a systemic inflammatory response induced by the peritoneal infection may progress to septic shock and multi organ failure. The high rate of organ failure in our study is likely due to delay in presentation in most cases. This delay is may be due to poor referral services and negligence due to illiteracy and unawareness.

In our study, all 6 cases of death were also found to have organ failure, while 9 patients with organ failure recovered fully.

In the study by Rodolfo L et al.12, 11(6.32 %) patients died and all of them presented with the organ failure.

M Hynninen et al21., showed that the degree of organ dysfunction as measured by the SOFA (Sequential Organ Failure Assessment) score was the best predictor for hospital mortality in patients suffering from secondary peritonitis.

In our study, organ failure showed statistically significant results. Therefore, early identification and prompt resuscitation with aggressive treatment is recommended.

Preoperative Duration >24 Hours

In our study it was found that, 32% of the patients presented to the hospital and underwent appropriate surgery before 24 hours of onset, whereas 68% of the people presented after 24 hours of onset of symptoms.

In other studies, the distribution of preoperative duration is as below:

| AUTHOR | YEAR | <24 HOURS | >24 HOURS |
|------------------------------|------|-----------|-----------|
| Correia et al ¹¹ | 2001 | 54.48% | 45.12% |
| Rodolf L et al ¹² | 2002 | 34.5% | 65.5% |
| Present study | 2022 | 32% | 68% |

In our institute the cause of delayed presentation i.e., a preoperative duration of peritonitis more than 24 hours was mainly related to the illiteracy and lack of awareness among the study population. In some patients the delay was due to diagnostic dilemma which demands early use of more sophisticated investigations like CT scan, which is not available or not affordable at the peripheral hospitals. Scapellato S et al²² suggests that intervention time may be considered the main determinant of mortality in patients with peritonitis, since intervention time is a modifiable prognostic factor while many other factors are not.

Therefore, in cases of 82 perforation peritonitis after the initial resuscitation of the patient's immediate laparotomy should be done as a surgical emergency.

Presence of Malignancy

In our study 1 patient (2 %) had malignancy- carcinoma stomach with perforation. In a study by M.M. Correia¹¹ patients with cancer were studied. Among them 8 were preoperative and all other were postoperative. Among them 8 were preoperative and all other were postoperative. The cause of perforation in malignancy are mainly due to obstruction with perforation of bowel proximal to it. MM Correia et al., found that in presence of malignancy the mortality rate under the score of 21 was of 33.3% and for score equal to or greater than 21 the mortality rate was 70.6%. Chronic use of NSAIDs in patients of malignancies exposes them to an increased risk of perforation.

Origin Of Sepsis

In our study 2 patients i.e., 4% had colonic origin of sepsis while in the rest 48 patients the origin of sepsis was non colonic. In the study by Rudolf L et al, 64% of patients had colonic origin of sepsis. In the study by Rajendra Singh Jobhta,^{76%} of patients had colonic

origin of sepsis. Colonic perforation may present with faecal exudates and a severe form of peritonitis. John Bohnen et al¹⁹ in their study of 176 patients found mortality of 10% in appendicitis and duodenal perforation, 50% in peritonitis of intraperitoneal origin other than appendix and the duodenum and 60% in postoperative peritonitis. Thus, in this study the significance of the septic focus was high -lighted and it showed that colonic perforation is a higher risk while appendicular and duodenal perforations had a good recovery rate. Chao –Wen Hsu et al²³ in their study of 141 patients with colorectal perforations found a mortality of 36.9%.

Type of Peritonitis

In our study patients 20 i.e., 40% presented with a diffuse form of peritonitis while the remaining 30 i.e., 60% presented with localized peritonitis.

Data from other studies were as follows

| STUDY | DIFFUSE | LOCALIZED |
|-------------------------------------|---------|-----------|
| Rajender Jhobta et al. ⁸ | 83% | 17% |
| Rodolf L et al. ¹² | 34.5% | 65.5% |
| C Ohmann et al. ⁹ | 65.36% | 34.64% |
| Present Study | 40% | 60% |

Diffuse peritonitis is associated with a severe inflammatory reaction and development of sepsis and multi organ failure. Localization of peritonitis is body's defence mechanism and will lead to formation of abscess, usually seen in perforated appendicitis. In our study, all patients who died had generalized peritonitis, whereas 14 of the patients with diffuse peritonitis survived and recovered. In the study by Pacelli F et al²⁴., generalized peritonitis corresponded to 30.66% of the study group. In the study by Rodolfo L et al.¹², generalized peritonitis corresponded to 34%.

Nature of Exudates

In the current study, 70% had purulent exudative discharge, whereas 14% had clear and 16% had fecal exudate. In 1983 Killing back et al.²⁵, reported a mortality rate of over 70% in case of faecal peritonitis complicating diverticular disease. In a study by Rodolf L et al.¹², 69.5% had clear exudates and 21.8% had purulent exudates. In a study by Rajender Singh Jhobta et al.⁸, 15% had clear exudates, 71% had purulent and 13% had faecal exudates. Purulent and faecal exudates are associated with delayed presentation and presence of varying degree of septicaemia. In our study among 8 patients with fecal exudates 2 died. In the study of Rodolfo et al.³⁴ clear fluid had a mortality of 5.8% (7/121), purulent fluid had a mortality of 6.3% and faecal fluid had mortality of 25%. In a study by Chao-Wen-Hsu²³ in fecal peritonitis the mortality was 57.10% while in purulent peritonitis it was 30.25%. In a study by Christian Ohmann et al⁹ out of 166 patients with clear or purulent exudates 24 (14.45%) died while out of 188 patients with turbid or feculent exudates 35 (18.61%) died.

The nature of exudates and its mortality has got direct relationship with the amount of micro-organism that it contains. Clear exudates are generally sterile to start with, so evolution of sepsis is slow. Purulent exudates and fecal exudates had a significant number of microorganisms many of which are gram negative anaerobes, and they result in endotoxaemia and septic shock.

Mannheim Peritonitis Index as A Predictor Of Mortality

50% of the patients, i.e., 25 cases had an MPI score of less than 21. 36%, i.e., 18 cases were in the range of 21-

29 and the rest, i.e., 14%, 7 patients, fell in the range above 29.

In our study mortality rate among patients with MPI score > 29 was 100% and with MPI < 21 was 0, which is statistically significant with p <0.0005.

| MPI | Kusumoto Yoshiko et al ¹³ | Qureshi AM et al ²⁶ | Malik AA et al ²⁷ | Notash et al ⁵ | PRESENT STUDY |
|-------|--------------------------------------|--------------------------------|------------------------------|---------------------------|---------------|
| <21 | 3.8% | 1.9% | 0% | 0% | 0% |
| 21-29 | | 21.9% | 4% | 60% | 0% |
| >29 | 41% | 28.1% | 82.3% | 100% | 85.7% |

Rodolfo L et al¹² in their study found out that 26 MPI point was a useful reference. Patients with >26 points had mortality rate >40% whereas patients having a score < 21, in MPI score between 21 and 29 the mortality was 22.5% & it was 51.1% for MPI score greater than 29. Abrar Maqbool Qureshi et al in their study found out that for MPI score of less than 21 the mortality was 1.9%, for scores in between 21 - 29 it was 21.9% & for scores 30 or more it was 21.8%. When considering each risk factor constructing a contingency table in which presence and absence of adverse factor and result (death or survival) are considered the p value allow us to weigh in descending order of significance, each of risk factors as follows: a) Presence of organ failure b) Malignancy c) Age > 50 yrs d) Type of exudate e) Duration >24hrs; f) Diffuse / localised peritonitis Other studies like Pacelli et al²⁴ have shown that factors related to host overshadow type and source of infection in evaluation of patients with intra-abdominal infection. This is consistent with result of our study. This study proves that MPI scoring system is a simple and effective tool for assessing the morbidity and mortality in patients with peritonitis with statistically significant results. Age>50 years, duration of pain >24 h, organ failure on

admission, and were found to be independently significant factors in predicting the mortality. Feculent exudate also was found to show higher risk of mortality but not statistically significant.

malignancy, generalised peritonitis showed correlation with mortality, they failed to show statistical significance in our study. In our study we found that mortality can be further reduced by early arrival of the patients to hospital and early intervention. Reproducible scoring systems that allow a surgeon to determine the severity of the intra- abdominal infections are essential to: Mannheim Peritonitis index is a useful method to determine study group outcome in patients with peritonitis. Among the MPI variables of adverse outcome namely, presence of organ failure; time elapsed > 24hrs; presence of malignancy; age>50 years, generalized extension of peritonitis and type of exudate, organ failure and time of presentation >24 hrs showed statistical significance in predicting mortality. Even though other parameters such as:

- Ratify the effectiveness of different treatment regimen.
- Indicate individual risk to select patients who may require a more aggressive surgical approach.
- Inform patient relatives with greater objectivity.

In the past 30years, many prognostic scoring systems have been developed for critical patients. Presently one of the most accepted score is APACHE II score which integrates various physiological variables during the first 24 hours within the ICU. They are however both complex and time consuming. The MPI is one of the simplest scoring systems in use that allows the surgeon to easily determine the outcome risk during initial surgery. Early evaluation of severity of illness using MPI allows us to estimate the probability of patient's

survival. The simplicity of MPI makes ideal for hospitals with serious shortages of staff and resources. MPI is disease specific, easy scoring system for predicting the mortality in patients with secondary peritonitis. Increasing scores are associated with poorer prognosis, needs intensive management and hence it should be used routinely in clinical practice Based on our study results we conclude that: MPI is accurate to be used with patients with peritonitis and should be considered reliable and simple reference for estimating their risk of death.

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