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Mannheim Peritonitis Index in Predicting the Morbidity and Mortality in Patients with Peritonitis due to Hollow Viscus Perforation - A Prospective Study

Kannan G[1], Niruban Chakaravarthi G[2]

Abstract: ***Introduction: Peritonitis due to hollow viscus perforation is one of the common causes for emergency admission. Scoring systems that provide objective descriptions of the patient's conditions at specific points in the disease process aid our understanding of these problems. Hence this study was undertaken to study the effectiveness of Mannheim peritonitis index (MPI) in predicting the outcome in peritonitis patients. Methods: This study was a prospective observational study conducted at Government Tiruvannamalai Medical College and Hospital, during the period January 2021 to July 2022. The data regarding patient particulars, diagnosis, investigations, and surgical procedures were 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 chi square test for proportion was used. Results: In this study of 100 cases of secondary and tertiary peritonitis. The mean age of patients was 44.89 (SD 16.2) years ranging from 16 to 79 yrs. Majority (50%) of patients had MPI less than 21.52.5% of patients with MPI score less than 21 developed complications.45% of patients had complications with MPI score 21 to 27. There was no mortality in patients with MPI less than 21, whereas those patients with MPI score more than 29 had the highest mortality rate of 76.9%. Patient with MPI score from 21 to 29 had mortality rate of 23.1%. The outcome of the study is statistically significant by chi - square test with p Value <0.0001. Conclusion: MPI scoring system is simple score to apply to determine the risk during surgery and the surgeon can know about the possible outcome. MPI is a useful and simple index which can be effectively used in prediction of outcome of patients presenting with peritonitis due to hollow viscus perforation.***

Keywords: Peritonitis, Mannheim's Peritonitis Index, Hollow Viscus Perforation, Emergency, Outcome

1. Introduction

With the advances that are being made in many areas of medicine, the surgeon must be familiar with infectious diseases of the peritoneal cavity which has increased in severity and complexity. In addition to the surgical management of secondary peritonitis from gastro intestinal perforation, the practicing surgeon may be called in to manage patient with cirrhosis with infected ascitic fluid as well as patient undergoing peritoneal dialysis with infected dialysis fluid. In addition, there is increasing recognition of a group of patients with persistent intra - abdominal sepsis or tertiary peritonitis in whom infection is associated with multi system organ failure and general depression of immune system. Peritonitis continues to be one of the major infectious problems confronting the surgeons. Despite the many advances in anti - microbial agents and supportive care, the mortality rate of diffuse supportive peritonitis remains unacceptably high. Its causes vary from the one requiring immediate surgical intervention to that requiring conservative management. Its accurate diagnosis and management is a challenge to every surgeon. The complex nature of infections in surgical patients, the multifaceted aspects of treatment, and the increasing complexity of ICU support make evaluation of new diagnostic and therapeutic advances in this field very difficult. Scoring systems those provide objective details of the patient's conditions at specific stages in the disease process aid in understanding these problems. This is important in determining the course, the disease is taking in a particular patient and whether the line of management taken is appropriate or need to be changed. The management of peritonitis patients has taken a new turn with the understanding of patho - physiological basis of the disease, the concept of sepsis syndrome and multi - organ failure. The current trend is to recognize these at the earliest and institute aggressive therapy. When the patient has already gone into multi - organ failure, the outlook appears dismal even with intensive critical care. It is here that conservative line of management, as well as newer modalities of treatment such as programmed re - laparotomy and immunomodulation is being tried. Although these newer modalities may be useful, they are expensive. Hence, proper clinical monitoring with optimum number of investigations remain the corner stone of emergency surgery and also for the better use of above methods.

2. Materials and Methods

The study was done in 100 patients presenting with peritonitis due to hollow viscus perforation to the Government Tiruvannamalai Medical College and Hospital, during the period January 2021 to July 2022. This was a prospective observational study. A detailed history, complete general physical examination and systemic examination were done. The patients were subjected to investigations including X - ray erect abdomen, chest X - ray, ultrasound and routine investigations including Hb, TC, urea, creatinine, serum electrolytes were. 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 were 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. Inclusion

Criteria: Patients with clinical suspicion and investigatory support for the diagnosis of peritonitis due to hollow viscus perforation who were later confirmed by intra op findings. Various etiologies causing such features included acid peptic disease, tuberculosis, typhoid, appendicitis, gangrenous cholecystitis, and malignancy. Exclusion Criteria: Patients with hollow viscus perforation due to trauma, associated injuries to other organs, associated vascular, neurogenic injuries, and any other significant illness which was likely to affect the outcome more than the disease in study. Mannheim Peritonitis Index (MPI) system was done in all patients and 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 with output less than 30ml. Sutures were removed on the 7th post - operative day. The Patients were followed up after a specific interval or at recurrence of symptoms.

3. Observation and Results

In the study population of 100 subjects, duodenal perforation was seen in 63% of patients, followed by appendicular (22%), gastric (7%), ileal (4%), colon (3%) and jejunal (1%) perforation.

Table 1: Site of perforation

S. No	Site of Perforation	Frequency	Percent	Valid Percent	Cumulative Percent
1.	Duodenum	63	63.0	63.0	63.0
2.	Appendix	22	22.0	22.0	85.0
3.	Gastric	7	7.0	7.0	92.0
4.	ileum	4	4.0	4.0	96.0
5.	Colon	3	3.0	3.0	99.0
6.	jejunum	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

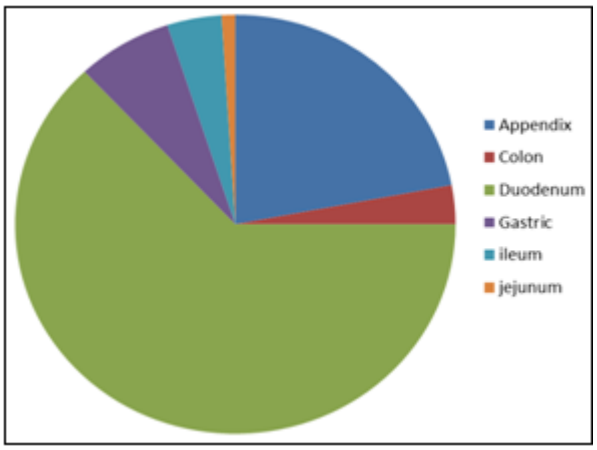

Chart 1: Site of perforation

Table 2: Age and MPI cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Age	Not more than 50	Count	49	8	2	59
		% within AGE	83.1%	13.6%	3.4%	100.0%
		% within MPI	98.0%	21.1%	16.7%	59.0%
		% of Total	49.0%	8.0%	2.0%	59.0%
	More than 50	Count	1	30	10	41
		% within AGE	2.4%	73.2%	24.4%	100.0%
		% within MPI	2.0%	78.9%	83.3%	41.0%
		% of Total	1.0%	30.0%	10.0%	41.0%
Total		Count	50	38	12	100
		% within AGE	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

In the total study population, among patients younger than 50 years of age 83% had MPI < 21 13.6% had MPI 21 - 29 and 3.4% had MPI >29 and among patients older than 50 years of age 2.4% had MPI <21 73.2% had MPI 21 - 29 and 24.4% had MPI >29.

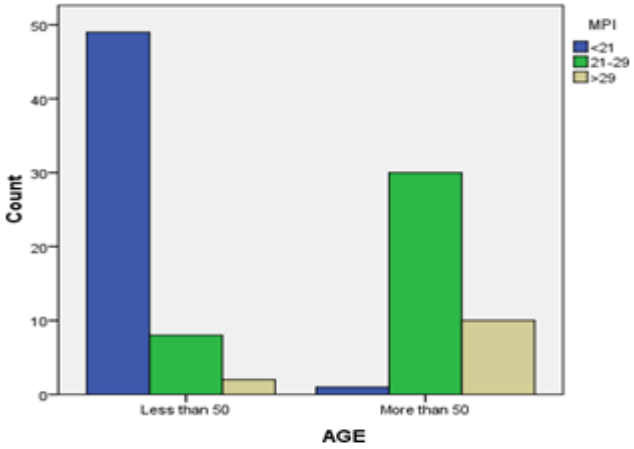

Chart 2: Age and MPI Bar chart

Table 3: Age (yrs) Statistics

N value	100
Mean	44.89
Median	43.50
Range	63
Minimum	16
Maximum	79
Std. Deviation	16.201

Table 4: Sex and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Sex	Male	Count	50	37	11	98
		% within SEX	51.0%	37.8%	11.2%	100.0%
		% within MPI	100.0%	97.4%	91.7%	98.0%
		% of Total	50.0%	37.0%	11.0%	98.0%
	Female	Count	0	1	1	2
		% within SEX	.0%	50.0%	50.0%	100.0%
		% within MPI	.0%	2.6%	8.3%	2.0%
		% of Total	.0%	1.0%	1.0%	2.0%
Total		Count	50	38	12	100
		% within SEX	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among the males in the study population, 51% had MPI<21, 37.8% MPI 21 - 29 and 11.2% >29% and among the females 50% had MPI 21 - 29 and 50% had MPI >29.

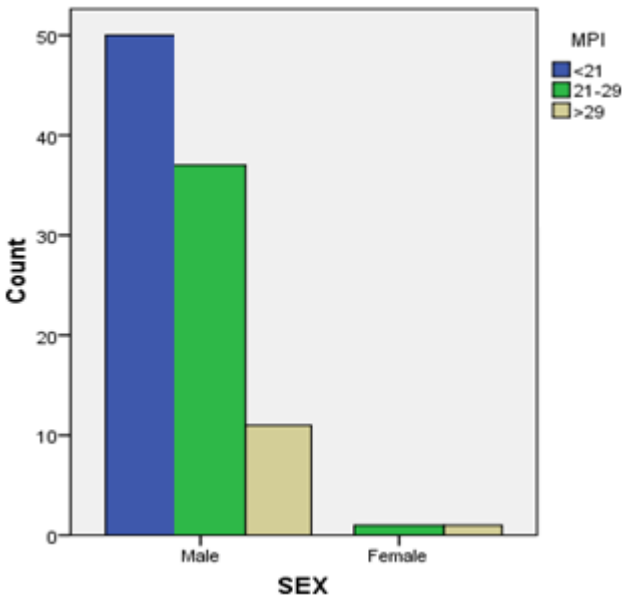

Chart 3: Sex and MPI Bar Chart

Table 5: Organ Failure and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Organ Failure	No	Count	50	33	0	83
		% within organ failure	60.2%	39.8%	.0%	100.0%
		% within MPI	100.0%	86.8%	.0%	83.0%
		% of Total	50.0%	33.0%	.0%	83.0%
	Yes	Count	0	5	12	17
		% within organ failure	.0%	29.4%	70.6%	100.0%
		% within MPI	.0%	13.2%	100.0%	17.0%
		% of Total	.0%	5.0%	12.0%	17.0%
Total		Count	50	38	12	100
		% within organ failure	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those without organ failure, 60.2% had MPI <21, 39.8% had MPI 21 - 29, none had MPI >29 and those with organ failure, none had MPI <21, 29.4% had MPI 21 - 29, and 70.6% had MPI >29.

Table 6: Duration of Peritonitis and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Duration of Peritonitis	Not more than 24 hrs	Count	4	4	0	8
		% within Duration of Peritonitis	50.0%	50.0%	.0%	100.0%
		% within MPI	8.0%	10.5%	.0%	8.0%
		% of Total	4.0%	4.0%	.0%	8.0%
	More than 24hrs	Count	46	34	12	92
		% within Duration of Peritonitis	50.0%	37.0%	13.0%	100.0%
		% within MPI	92.0%	89.5%	100.0%	92.0%
		% of Total	46.0%	34.0%	12.0%	92.0%
Total		Count	50	38	12	100
		% within Duration of Peritonitis	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those with peritonitis duration < 24 hours, 50% had MPI <20 and 50% had MPI 21 - 29 and those with duration >24 hours, 50% had MPI <20, 37% had MPI 21 - 29 and 13% had MPI>29.

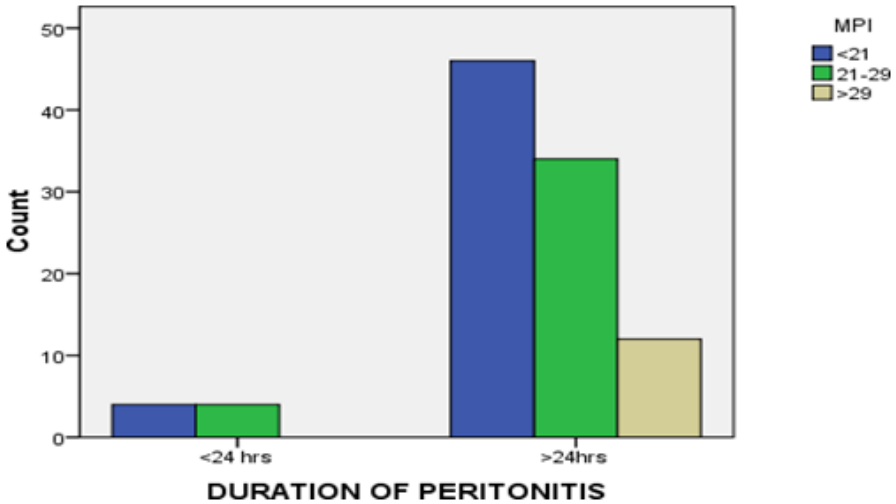

Chart 5: Duration of Peritonitis and MPI Bar Chart

Table 7: Site of pathology and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Site of Pathology	Colonic	Count	0	1	2	3
		% within Site of Pathology	.0%	33.3%	66.7%	100.0%
		% within MPI	.0%	2.6%	16.7%	3.0%
		% of Total	.0%	1.0%	2.0%	3.0%
	Non - Colonic	Count	50	37	10	97
		% within Site of Pathology	51.5%	38.1%	10.3%	100.0%
		% within MPI	100.0%	97.4%	83.3%	97.0%
		% of Total	50.0%	37.0%	10.0%	97.0%
Total		Count	50	38	12	100
		% within Site of Pathology	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those with colonic pathology none had MPI <20 and 33.3% had MPI 21 - 29 and 66.7% had MPI >29 and non - colonic pathology 51.5% had MPI <20 and 38.1% had MPI 21 - 29 and 10.3% had MPI >29.

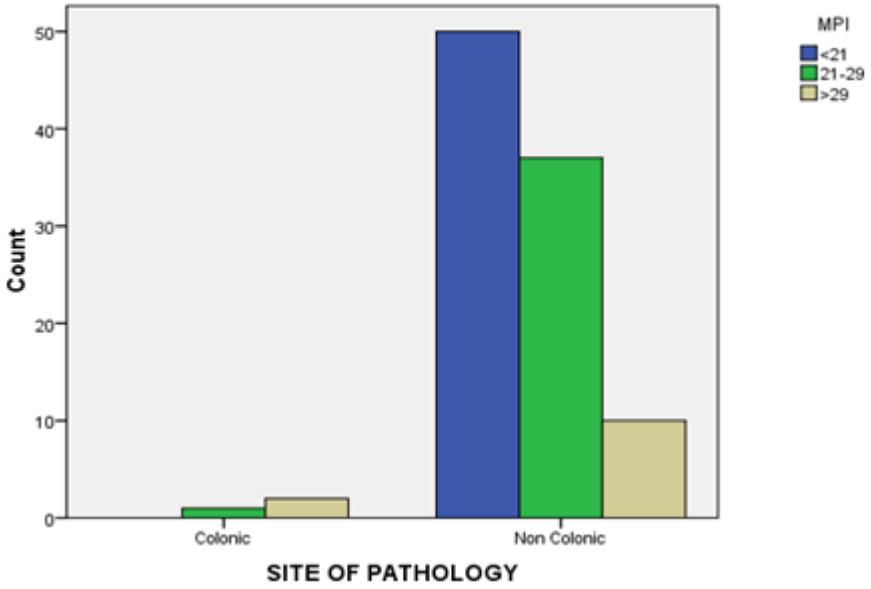

Chart 6: Site of pathology and MPI Bar Chart

Table 8: Nature of pathology and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Nature of Pathology	Benign	Count	50	36	11	97
		% within Nature of Pathology	51.5%	37.1%	11.3%	100.0%
		% within MPI	100.0%	94.7%	91.7%	97.0%
		% of Total	50.0%	36.0%	11.0%	97.0%
	Malignant	Count	0	2	1	3
		% within Nature of Pathology	.0%	66.7%	33.3%	100.0%
		% within MPI	.0%	5.3%	8.3%	3.0%
		% of Total	.0%	2.0%	1.0%	3.0%
Total		Count	50	38	12	100
		% within Nature of Pathology	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those with benign pathology 51.5% had MPI <21 and 37.1% had MPI 21 - 29 and 11.3% had MPI >29 and malignant pathology none had MPI <21 and 66.7% had MPI 21 - 29 and 33.3% had MPI >29.

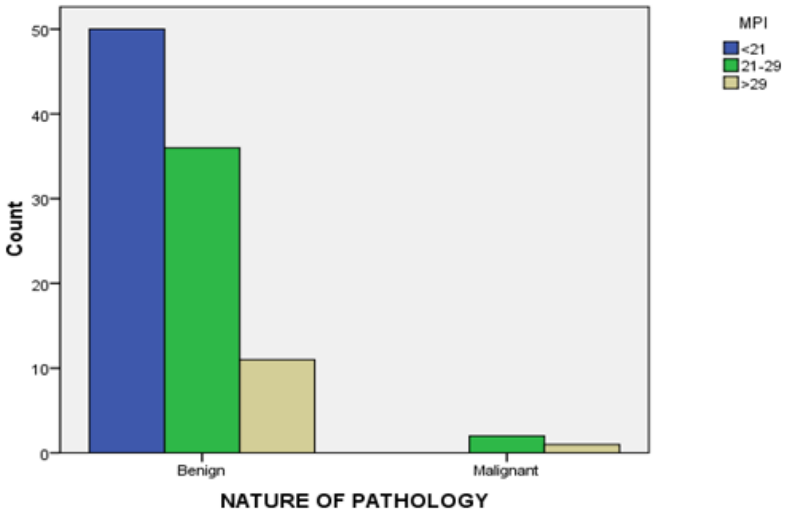

Chart 7: Nature of pathology and MPI Bar Chart

Table 9: Peritonitis and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
PERITONITIS	Localised	Count	6	0	0	6
		% within PERITONITIS	100.0%	.0%	.0%	100.0%
		% within MPI	12.0%	.0%	.0%	6.0%
		% of Total	6.0%	.0%	.0%	6.0%
	Generalised	Count	44	38	12	94
		% within PERITONITIS	46.8%	40.4%	12.8%	100.0%
		% within MPI	88.0%	100.0%	100.0%	94.0%
		% of Total	44.0%	38.0%	12.0%	94.0%
Total		Count	50	38	12	100
		% within PERITONITIS	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those with localized peritonitis, 100% had MPI <21 and those with generalised peritonitis 46.8% had MPI <21 40.4% had MPI 21 - 29 and 12.8% had MPI >29.

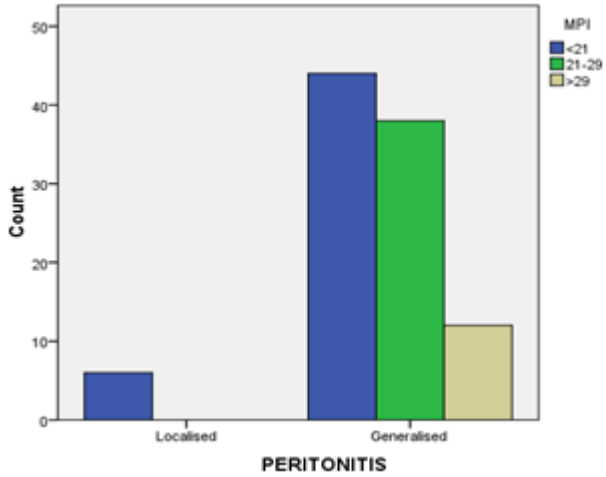

Chart 8: Peritonitis and MPI Bar Chart

Table 10: Nature of exudate and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Nature of exudate	Cloudy, Purulent	Count	50	37	9	96
		% within Nature of Exudate	52.1%	38.5%	9.4%	100.0%
		% within MPI	100.0%	97.4%	75.0%	96.0%
		% of Total	50.0%	37.0%	9.0%	96.0%

	Faeculent	Count	0	1	3	4
		% within Nature of Exudate	.0%	25.0%	75.0%	100.0%
		% within MPI	.0%	2.6%	25.0%	4.0%
		% of Total	.0%	1.0%	3.0%	4.0%
Total		Count	50	38	12	100
		% within Nature of Exudate	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Among those with cloudy, purulent exudates 52.1% had MPI <21, 38.5% had MPI 21 - 29 and 9.4% had MPI >29 and those with faeculent exudates none had MPI <21, 25% had MPI 21 - 29 and 75% had MPI >29.

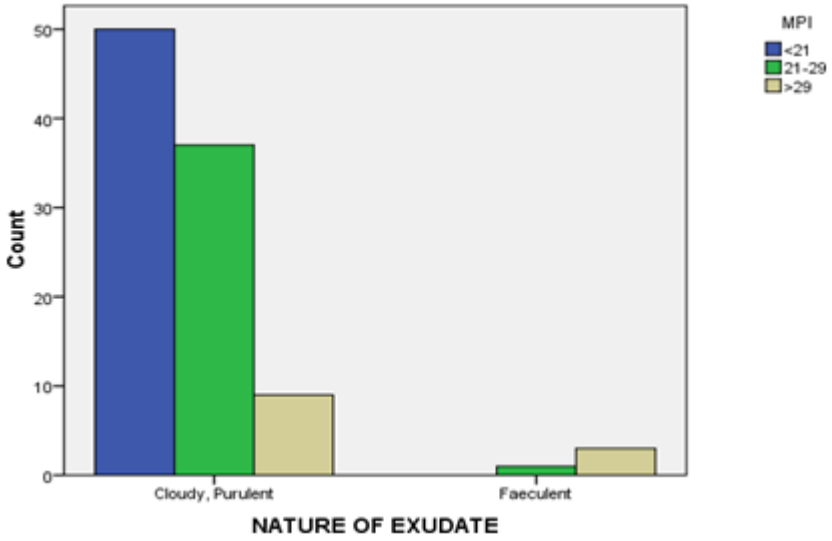

Chart 9: Nature of exudate and MPI Bar chart

Table 11: Final Outcome and MPI Cross tabulation

			MPI			Total
			<21	21 - 29	>29	
Final Outcome	Death	Count	0	3	10	13
		% within Final Outcome	.0%	23.1%	76.9%	100.0%
		% within MPI	.0%	7.9%	83.3%	13.0%
		% of Total	.0%	3.0%	10.0%	13.0%
	Complication	Count	21	18	1	40
		% within Final Outcome	52.5%	45.0%	2.5%	100.0%
		% within MPI	42.0%	47.4%	8.3%	40.0%
		% of Total	21.0%	18.0%	1.0%	40.0%
	No Complication	Count	29	17	1	47
		% within Final Outcome	61.7%	36.2%	2.1%	100.0%
		% within MPI	58.0%	44.7%	8.3%	47.0%
		% of Total	29.0%	17.0%	1.0%	47.0%
Total		Count	50	38	12	100
		% within Final Outcome	50.0%	38.0%	12.0%	100.0%
		% within MPI	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	38.0%	12.0%	100.0%

Pearson Chi - Square value - 61.64. p value - 0.0001

Among the total population, 40% had complications, 47% had no complications and 13% had expired. Amongst those who expired there was no patient with MPI <21 23.1% had MPI 21 - 29 and 76.9% had MPI > 29. Amongst those who had complications 52.5 % had MPI <21, 45% had MPI 21 - 29, 2.5% had MPI >29. Amongst those without complications 61.7% had MPI <21, 36.2% had MPI 21 - 29, and 2.1% had MPI >29.

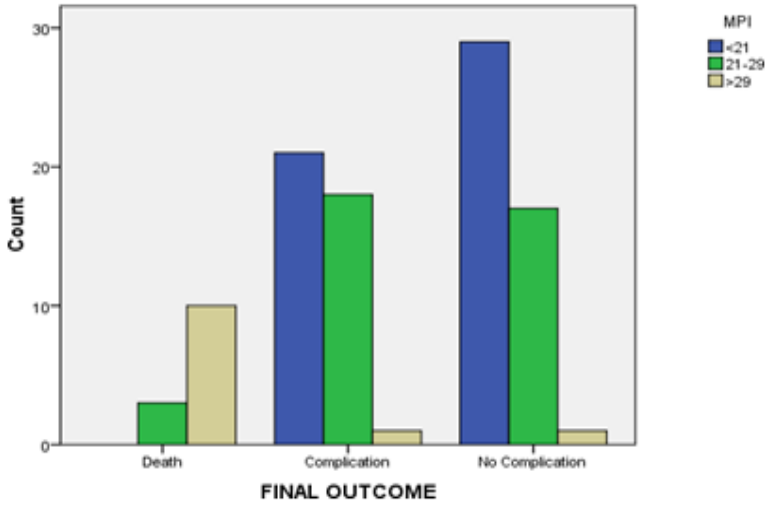

Chart 10: Final Outcome and MPI Bar chart

Figures

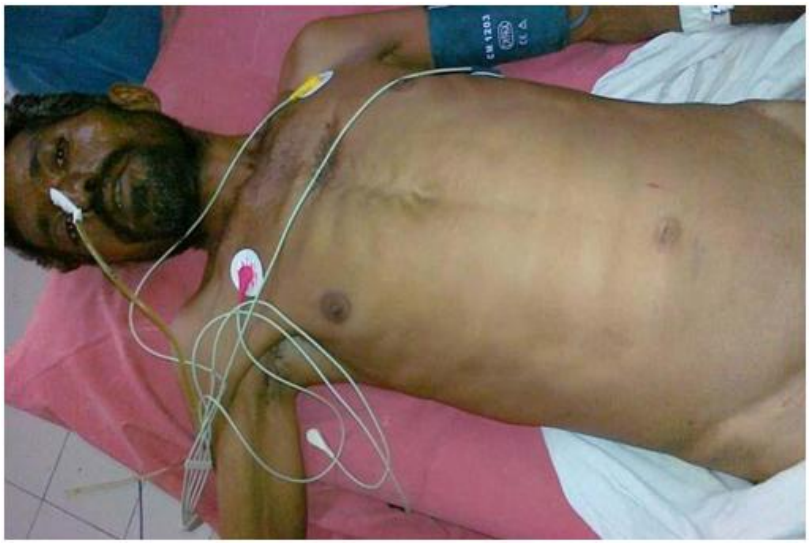

Figure 1: Pre - operative photograph of a peritonitis patient

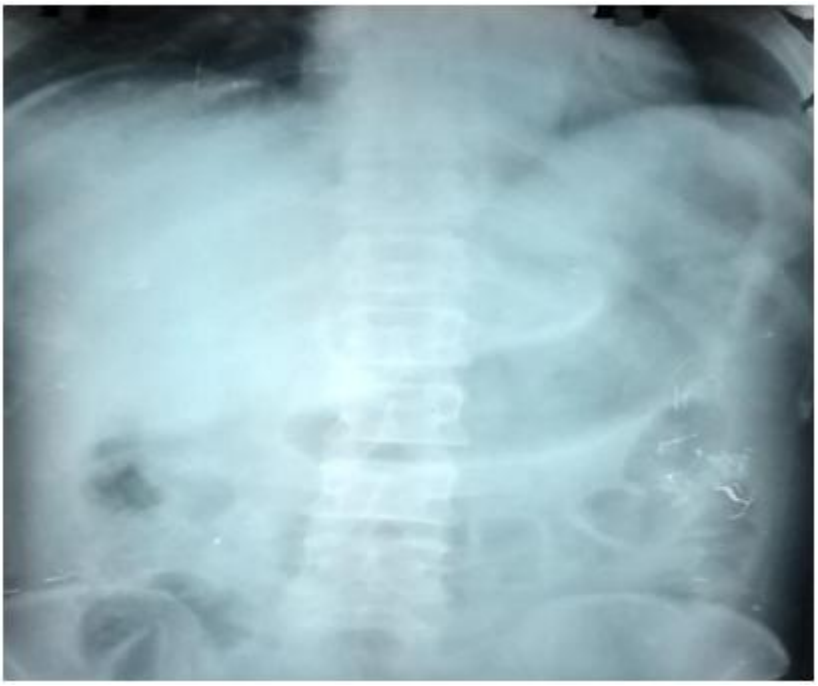

Figure 2: Plain radiograph photo of peritonitis patient

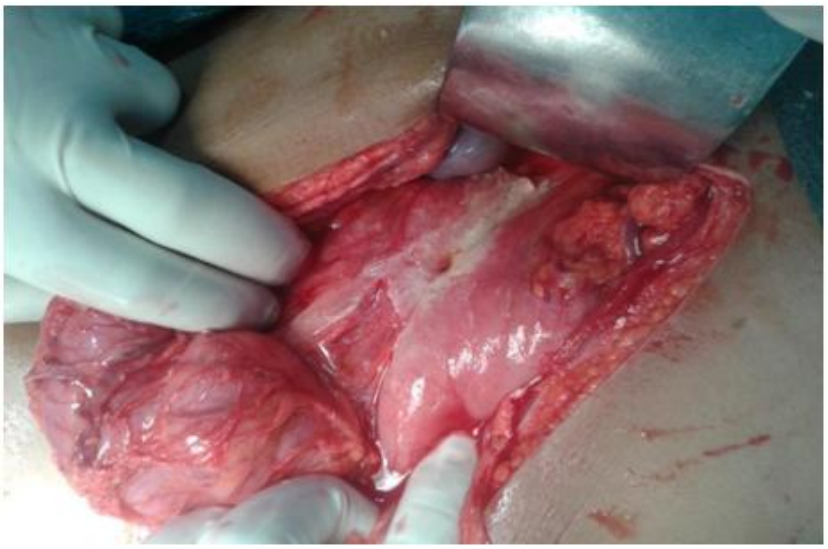

Figure 3: Intra - op photo of duodenal perforation

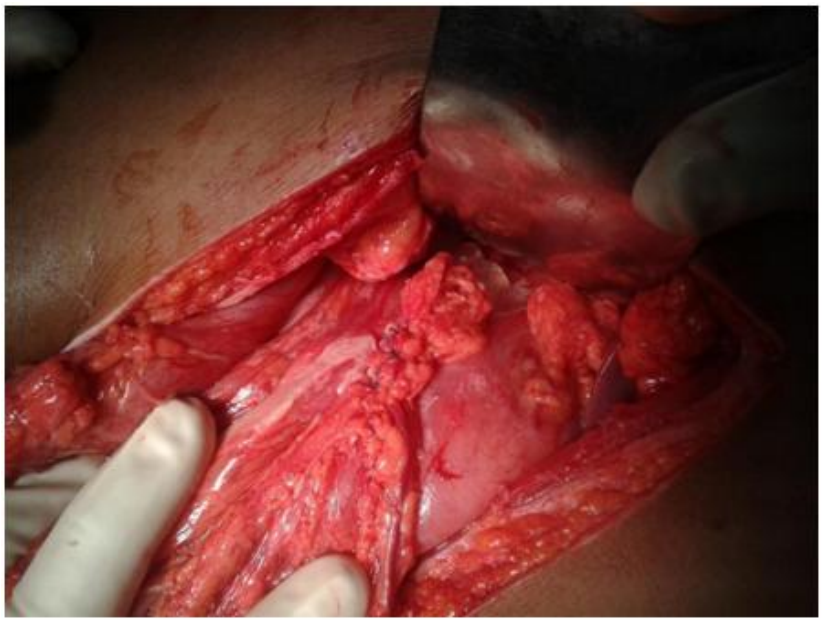

Figure 4: Intra - op photo of closure of duodenal perforation

Figure 5: Post - op photo of wound infection

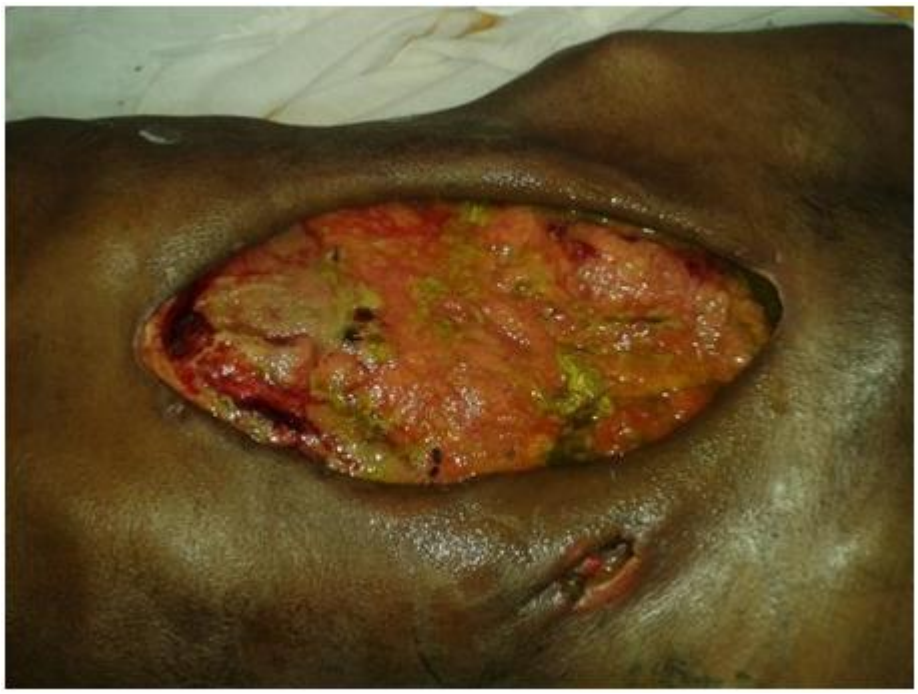

Figure 6: Post - op photo of enterocutaneous fistula

4. Discussion

Peritonitis remains a hot spot for the surgeons despite advancements in surgical technique and intensive care treatment. Various factors like age, sex, duration, site of perforation, extent of peritonitis and delay in surgical intervention are associated with morbidity and mortality. A successful outcome depends upon early surgical intervention, source control and exclusive intraoperative peritoneal lavage. Also, various methods and scoring systems are used to identify the risks and morbidity and mortality in those patients.

In the present study, hundred cases of peritonitis those attended the Government Tiruvannamalai Medical College and Hospital, during the period January 2021 to July 2022 were included with age ranging from 16 to 79 years. The mean age of the patients was 44.89 (SD 16.2) years. There was male preponderance (98%) in this study and the most common etiology of peritonitis was duodenal perforation seen in 63% of patients, followed by appendicular perforation (22%), gastric (7%), ileal (4%), Colon (3%) and jejunal perforation (1%). Most patients presented with history of abdominal pain, abdominal distension and fever with varying duration, most (92%) presenting after 24 hours of onset of symptoms.

MPI scoring system done in all patients depending on preoperative and intra - operative finding and patients were categorized into three categories those <21, 21 to 29, >29. Majority (50%) of patients had MPI less than 21.52.5% of patients with MPI score less than 21 developed complications.45% of patients had complications with MPI score 21 - 27. Complications include minor (wound infection) and major (Respiratory, Renal, Circulatory, Post - operative leak) categories. There was no mortality in patients with MPI less than 21, whereas those patients with MPI score more than 29 had the highest mortality rate of 76.9%. Patient with MPI score with from 21 to 29 had mortality rate of 23.1%. The outcome of the study is statistically significant by chi - square test with p Value <0.0001. This study is compared to available literature and other studies.

R Függer, M Rogy, F Herbst, M Schemper, F Schulz.113 patients suffering from purulent peritonitis entered this retrospective study for evaluation of the prognostic value of the Mannheim Peritonitis - Index. There was no lethality below an index x = 21, between x = 21 and x = 29, it was 29% and lethality increased to 100% in patients with an index x greater than or equal to 30. Statistical validation showed that prognosis was correct in 93% for the index x = 27, with a sensitivity and specificity of also 93%. Between x = 21 and x = 29 prognosis of the MPI was correct in at least 65%. The MPI is shown as a prognostic index for peritonitis with high accuracy in individual prognosis, that could be easy routinely documented.38

A S Ermolov, V E Bagdat'ev, E V Chudotvortseva, A V Rozhnov. A retrospective analysis of 100 case histories of patients with diffuse peritonitis was made in order to evaluate the prognostic significance of the Mannheim Peritonitis Index (MPI). The patients were divided into 3 groups according to the amount of scores: in the first group (12 - 20 scores) there were no lethal issues, in the second group (21 - 29 scores) 42% of the patients died, 100% lethality was noted in the third group when MPI was 30 scores or more.39

Kusumoto yoshiko and Nakagawa masayuki et al. evaluated the reliability of the Mannheim Peritonitis Index (MPI) in predicting the outcome of patients with peritonitis. Method: Subjects were 108 patients operated on for intraabdominal infection and excluded subjects with appendicitis. Results: Overall mortality was 5.3% in men and 15.2% in women, with death occurring only in patients older than 50 years. A comparison of MPI and mortality

showed patients with a MPI score of 26 or less to have mortality of 3.8%, where as those with a score exceeding 26 had mortality of 41.0%.40

Qureshi AM, Zafar A, Saeed K, Quddus A. et. al. One hundred and twenty - six patients who presented to the department with secondary peritonitis were included in the study. Mortality rate for MPI score > or = 26 was 28.1% while for scores less than 26 it was 4.3%. For MPI scores pound 20 mortality rates was 1.9%, for scores 21 - 29 it was 21.9% and for score 30 or more it was 28.1%. 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.43

5. Conclusion

Peritonitis remains a hot spot for the surgeons despite advancements in surgical technique and intensive care treatment. Various factors like age, sex, duration, site of perforation, extent of peritonitis and delay in surgical intervention are associated with morbidity and mortality. Duodenal perforation is the most common etiology of peritonitis followed by appendicular perforation, gastric, ileal, Colon and jejunal perforation in this study. Males are commonly affected compared to females in this study. Emergency laparotomy and primary repair of the hollow viscus perforation is more effective in patients with secondary and tertiary peritonitis. In the management of patients with generalized peritonitis, scoring the patients into various risk groups can be beneficial. MPI scoring system is easy score to apply, the determination of risk is available during operation and surgeon can know about the possible outcome and the appropriate management can be decided. MPI is more effective in predicting the mortality in peritonitis due to hollow viscous perforation.

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