

## Evaluation of Prognosis in Patients' with Perforation Peritonitis Using Mannheim's Peritonitis Index

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### Abstract

*Background:* Perforation peritonitis is quite common surgical emergency in India as well as worldwide. There are various prognostic indexes available for evaluation of prognosis in patients with peritonitis but none of them is ideal and universally accepted. Our study is to evaluate prognosis in patient with perforation peritonitis using Mannheim's peritonitis index. *Material and Methods:* A prospective observational study of 100 patients with secondary peritonitis due to hollow viscous perforation was conducted at J.L.N. Medical College, Ajmer, Rajasthan (India). Evaluation of prognosis was done using Mannheim's Peritonitis Index, after dividing the patients into three categories according to the total score. *Results:* In our study of 100 patients, 19% patients were having MPI Scores > 29 and mortality rate among these patients was 68.4%, 29% patients were having MPI 21-29 with mortality of 10.3% and 52% patients were having MPI Score < 21 and mortality rate was ZERO% , which is statistically significant with Chi-square value 51.656 and p-value 0.001 (< 0.05). In our study, total 18% patients developed wound infection, out of these 16.7% patients were having MPI Score < 21, 55.6% patients were having MPI Scores between 21-29, while 27.7% patients were having MPI Score > 29. *Conclusion:* We concluded that MPI is accurate, reliable and simple scoring index for evaluation of the patients with peritonitis and for estimating their mortality and

morbidity risk. Our study differs in two adverse outcome variables, female sex & non-colonic origin of sepsis and we advocate need for further studies on Mannheim Peritonitis Index to include colonic origin of sepsis and to remove female sex as variables of adverse outcome in Mannheim Peritonitis Index.

**Keywords:** Peritonitis; Mannheim's Peritonitis Index; Sepsis; Organ Failure; Exudates.

### Introduction

Perforation peritonitis is most common surgical emergency in India and worldwide. In spite of advanced surgical techniques, sophisticated intensive care units, new generation antibiotics and better understanding of pathophysiology, management of peritonitis continue to be highly demanding, difficult and complex and mortality rate is still high. Mannheim's Peritonitis Index score is a simple, more practical and reproducible scoring system that allow a surgeon to determine the severity of intra-abdominal infections are essential to rectify the effectiveness of different treatment regimens, to scientifically compare surgical intensive care units, to select a more aggressive surgical approach for high risk patients and able to inform the prognosis to patient's relatives [1].

Mannheim's Peritonitis Index was developed by Wacha and Linder [2] in 1983, in which 20 possible risk factors were considered, of these only 8 were proved to be of prognostic relevance and were entered into Mannheim's Peritonitis Index [Table 1].

Definition of organ failure-

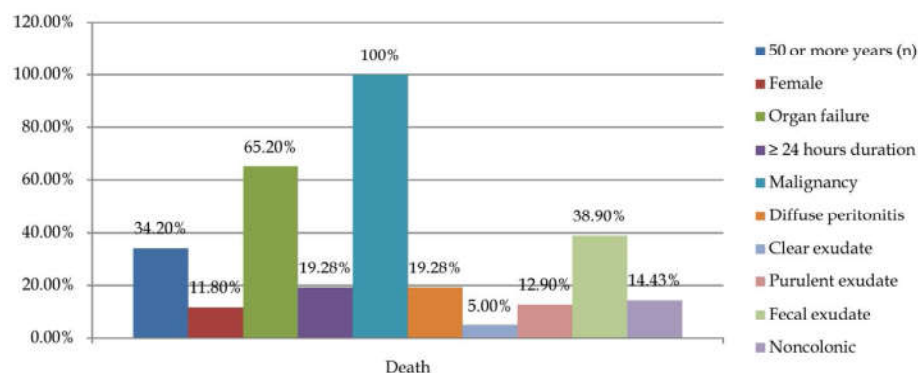
Kidney = Creatinine level greater than or to 2.0 mg

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**Table 1:** Mannheim's peritonitis index

Study Variable	Adverse Factor	Points	Favourable Factor	Points
1	Age	> 50 yrs	< 50 years	0
2	Sex	Female		
3	Organ Failure	Present		
4	Malignancy	Present		
5	Evolution time	> 24 hrs		
6	Origin of sepsis	Non-colonic		
7	Extension of peritonitis	Generalized	Localised	0
8	Character of exudate	Purulent	Clear	0
		Fecal		12

**Fig. 1:** Bar diagram showing distribution of MPI variables and outcome of patients

/dl (177 mmol / L), Urea level greater than or equal to 90 mg/dl (167 mmol / L), Oliguria- urine output less

Lung = If PO<sub>2</sub> less than 50 mmHg, PCO<sub>2</sub> more than 50 mmHg

Intestinal obstruction = Paralysis greater than or equal to 24 hr or complete mechanical ileus.

Maximal possible score is 47 and minimal possible score is zero. Patients were divided in three categories according to MPI scores:

1. Score less than or equal to 21
2. Scores between 21 to 29
3. Score equal to or greater than 29

And mortality and mortality among these three groups were observed, and prognosis is evaluated.

### Material and Methods

A prospective observational study of 100 patients with secondary peritonitis due to hollow viscous perforation was conducted at J.L.N. Medical College, Ajmer, Rajasthan (India) during the period of 1 January 2015 to 31 December 2016. Evaluation of prognosis was done using Mannheim's Peritonitis Index, after dividing the patients into three categories according to the total score. Patients with hollow viscous perforation due to trauma, associated injuries

to other organs, associated vascular and neurogenic injuries, patients with primary peritonitis, and acute appendicitis without perforation were excluded from our study.

The individual score of each parameter is added to calculate Mannheim Peritonitis Index score of each case. Patients were divided into three

categories according to the score:

1. Score less than 21
2. Scores between 21 to 29
3. Score more than 29

### Results

In our study of 100 patients with diagnosis of secondary peritonitis M:F ratio was 1.94. The mean age was 45.72 years. The commonest symptom was abdominal pain seen in 97% patients followed by abdominal distension in 81%, not passing flatus and motion in 79%, vomiting in 62% and fever present in 28%. Maximum number of patients (79%) had peptic perforation (duodenal 75% and gastric 4%) followed by Ileal 12%, Jejunal 3%, Appendicular 4% and caecal perforation 2%.

Most common procedure performed for peptic perforation was exploratory laparotomy with Omental patch repair in 79% of the total patients, for small bowel perforation exploratory laparotomy with ileostomy in 7%, resection and anastomosis 4%, primary closure 4% and resection anastomosis with ileostomy in 1% of the patients. Appendectomy in 4% patient and 1% patient with colonic perforation underwent exploratory laparotomy with hemicolectomy.

In patients with age less than 50 years of age

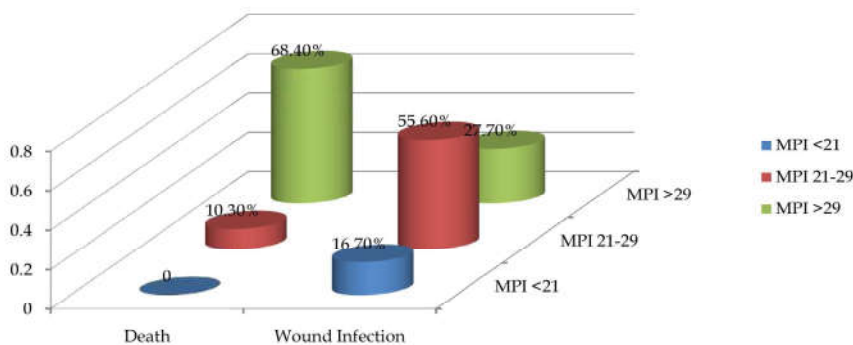
mortality was 4.8 % and in age group of > 50 years it was 34.2%. Mortality in male patients was 18.2% as compared to 11.8% in female patients. In patients who presented to the hospital after 24 hrs of onset of symptoms had mortality rate of 19.28% as compared to the zero mortality (0%) in patients who presented on the first day of onset of symptoms. Total 23% patients showed evidence of organ failure and mortality rate of 65.2% was observed in these patients as compare to patients without evidence of organ failure had mortality of 1.3%. Patients without malignancy had mortality of 15.15% as compared to mortality rate of 100% in cases with malignancy. There was no mortality in patients with localized peritonitis while in patients with diffuse peritonitis mortality was 19.28%. In patients who had colonic

origin of sepsis mortality rate was 66.67% while in non colonic origin of sepsis the mortality rate was 14.43%. Patients with clear exudates had 5% mortality as compared to 12.9% mortality in patients with purulent exudates and 38.9 % mortality in patients with faecal exudates (Table 2, Figure1).

Total 19% of patients were having MPI Scores >29 and mortality rate among these patients was 68.4% as compared to 52% of patients who were having MPI Score < 21, in whom mortality rate was ZERO % and 29% cases with MPI Score 21 -29, in whom mortality was 10.3%. Total 18% patients developed wound infection, out of these 16.7% patients were having MPI Score < 21 while 55.6%) patients were having MPI Scores between 21-29 and 27.7% patients were having MPI Score > 29 (Figure 2).

**Table 2:** Showing distribution of MPI variables and outcome of patients

S. N.	MPI variables	Discharged	Outcome Death	p-value	
1	<b>Age (year)</b>	<50	59 (95.2%)	3 (4.8%)	0.001
		≥50	25 (65.8%)	13 (34.2%)	
2	<b>Gender</b>	Male	54 (81.8%)	12 (18.2%)	0.407
		Female	30 (88.2%)	4 (11.8%)	
3	<b>Organ failure</b>	Absent	76 (98.7%)	1 (1.3%)	0.001
		Present	8 (34.8%)	15(65.2%)	
4	<b>Preoperative duration</b>	<24 hours	17 (100%)	0 (0%)	0.048
		>24 hours	67 (80.72%)	16 (19.28%)	
5	<b>Malignancy</b>	Absent	84 (84.85%)	15 (15.15%)	0.019
		Present	0 (0%)	1 (100%)	
6	<b>Type of peitonitis</b>	Localised	17 (100%)	0 (0%)	0.048
		Diffuse	67 (80.72%)	16 (19.28%)	
7	<b>Type of exudate</b>	Clear	19 (95%)	1 (5%)	0.010
		Purulent	54 (87.1%)	8 (12.9%)	
		Fecal	11 (61.1%)	7 (38.9%)	
8	<b>Origin of sepsis</b>	Non-colonic	83 (85.57%)	14 (16.47%)	0.0151
		Colonic	1 (33.33%)	2 (66.67%)	
9	<b>MPI scores</b>	<21	52 (100%)	0 (0%)	0.001
		21-29	26 (89.7%)	3 (10.3%)	
		>29	6 (31.6%)	13 (68.4%)	



**Fig. 2:** Bar diagram showing percent of mortality and wound infection in different group based on MPI

## Discussion

Mannheim's Peritonitis Index provides objective description of the patient's conditions at specific points in the disease process [2]. This is important in determining the course of the disease in a particular patient, whether the line of management taken is appropriate or need to be changed. Despite advances,

mortality from many forms of intra-abdominal infection remains unacceptably high. Substantial differences between conventional and more recently developed therapy has been found in randomized prospective studies. It has become apparent that approaches for managing patient profoundly ill from intra-abdominal infection require further critical review at the new methods for analyzing the results of various therapeutic intervention must be found.

**Table 3:** Showing spectrum of perforation peritonitis

S.N.	Variables	Dr. Tushar Dani <sup>5</sup>	Rajendra Singh Jhobta <sup>4</sup>	Authors Rodolfo L <sup>3</sup>	Our study
1.	<b>Mean age ( years )</b>	43.74	36.8	34.6	45.72
2.	<b>&lt; 50 years ( % )</b>	59.5	84	20.69	62
	<b>&gt; 50 years ( % )</b>	40.5	16	79.31	38
3.	<b>Female ( % )</b>	32	16	48.28	34
	<b>Male ( % )</b>	68	84	51.72	66
4.	<b>Site of perforation ( % )</b>				
	Gastric	6.5	8	-	4
	Duodenal	33.5	57	-	75
	Jejunal	3.5	3	-	3
	Ileal	25.5	15	-	12
	Appendicular	8	12	-	4
	Caecal /Colonic	12.5	4	-	2
5.	<b>Clinical Features ( % )</b>				
	Abdominal pain	97	98	-	97
	Distension	53	44	-	81
	Not passed flatus	41	-	-	79
	Not passed motion	40.5	-	-	79
	Fever	58	25	-	28
	Vomiting	61.5	59	-	62
6.	<b>Operative procedure ( % )</b>				
	EL & Omental Patch Repair	31.5	-	-	79
	EL & RA	13.5	9	-	4
	EL & Primary Closure	28.5	60	-	4
	EL & RA with Ileostomy	1.5	-	-	1
	EL & Hemicolectomy	2	-	-	1
	Appendectomy	6.5	11	-	4
	EL & Ileostomy	1	-	-	7
7.	<b>Organ failure ( % )</b>	22.5	-	17.24	23
8.	<b>Preoperative duration ( % )</b>				
	< 24 hours	16	-	50.57	17
	> 24 hours	84	-	49.43	83
9.	<b>Malignancy ( % )</b>	7	4.56	1.15	1
10.	<b>Origin of sepsis ( % )</b>				
	Colonic	12.5	-	6.9	3
	Non-colonic	87.5	-	93.1	97
11.	<b>Type of Exudate ( % )</b>				
	Clear	20	15	69.54	20
	Purulent	62	71	21.16	62
	Fecal	18	13	2.29	18
12.	<b>Type of Peritonitis ( % )</b>				
	Localised	13	17	65.52	17
	Diffuse/ Generalised	87	83	34.48	83
13.	<b>Outcome ( % )</b>				
	Discharge	84	90	93.68	84
	death	16	10	6.32	16
14.	<b>MPI scores ( % )</b>				
	<21	43.5	-	79	52
	21-29	35	-	13	29
	> 29	21.5	-	8	19

In our study of total 100 patients, the highest numbers of patients (38%) were found in the age group of 46-60 years and mean age was 45.72 years, which is higher than the study by Rajendra Singh Jhobta [3] et al and Rodolfo [4] et al where mean age was 36.8 years and 34.6 years respectively. Age distribution of our study are in consistent with study of Dr. Tushar Dani [5] et al which had mean age of 43.74 years (Table 3).

In our study, commonest symptom was abdominal pain seen in 97% followed by abdominal distension in 81%, not passing flatus and motion in 79%, vomiting in 62% and fever in 28% patients, which are compared with study of Dr. Tushar Dani [5] et al and Rajendra Singh Jhobta [3] et al (Table 3).

In our study, maximum number of patients (79%) had peptic perforation (duodenal 75% and gastric 4%) followed by Ileal 12%, Jejunal 3%, Appendicular 4% and caecal perforation 2%, which are compared with study of Dr. Tushar Dani [5] et al and Rajendra Singh Jhobta [3] et al (Table 3). The increased number of duodenal perforations in our study is due to increased prevalence of the acid peptic disease. The perforations of the proximal gastro-intestinal tract were five times commoner than perforations of the distal gastrointestinal tract, which is in sharp contrast from the developed countries where distal gastrointestinal tract perforations are more common [6] and this difference is seen probably because of dietary variation between two world, Asian population eats more spicy food as compared to developed.

Most common procedure performed in our study for peptic perforation was exploratory laparotomy with omental patch repair in 79% of the total patients and for small bowel perforation, exploratory laparotomy with ileostomy in 7%, resection and anastomosis in 4%, primary closure in 4% and resection anastomosis with ileostomy in 1% of the patients were done. Appendectomy in 4% patients and 1% patient with colonic perforation underwent exploratory laparotomy with hemicolectomy, which are compared with study of Dr. Tushar Dani [5] et al and Rajendra Singh Jhobta [3] et al (Table 3).

The our study, patients in the age group of <50 years were 62% with 4.8% mortality and 38% patients were in the age group of >50 years with 34.2% mortality and the p-value was <0.001, which is in consistent with the study by Dr. Tushar Dani [5] et al, where 59.5% patients were in the age group of <50 years with 5.9% mortality and 40.5% patients were in the age group of >50 years with 30.9% mortality and p-value <0.001. Result of our study are in contrast with study by Rajendra Singh Jhobta [3] et al, where

84% patients were in the age group of <50 years and 16% patients were in the age group of >50 years. The increased prevalence of the perforation in the age group of <50 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 and in this age group there is increased prevalence of the risk factors of peptic ulcer disease such as smoking, alcoholism and NSAID abuse. After the availability of proton pump inhibitors the incidence of peptic ulcer disease has decreased during the last few decades.

In our study, 66% patients were male with 18.2% mortality and 34% patients were female (M:F=1.9:1) with 11.8% mortality and p-value 0.407, which is consistent with the study by Dr. Tushar Dani [5] et al where 68% patients were male with 17.6% mortality and 32% patients were female (M:F=2.12:1) with 12.5% mortality and p-value 0.858. Result of our study is in contrast with study by Rajendra Singh Jhobta [3] et al, in which 84% patients were male and 16% patients were female (M:F=5.25:1). The increased prevalence of perforation peritonitis in male patients may be due to more numbers of risk factors for peptic ulcer disease in males like smoking, alcohol consumption, NSAIDs abuse, stressful life etc.

In our study, 23% patients of the patients had evidence of organ failure at presentation with 65.2% mortality as compared to 77% patients without organ failure with 1.3% mortality and p-value <0.001, which is consistent with study by Dr. Tushar Dani [5] et al where 22.5% patients were presented with organ failure had 66.7% mortality and 77.5% patients were presented without organ failure had 1.3% mortality and p-value <0.001. Our study has contrast result with study by Rodolfo L [4] et al, where 17.24% patients presented with organ. The high rate of organ failure in our study denotes a delay in presentation of cases.

In our study, 17% presented within 24 hours of onset of symptoms with ZERO% mortality while 83% patients presented after 24 hours of onset of the disease with 19.28% mortality and p-value 0.048, which is consistent with study by Dr. Tushar Dani [5] et al where 16% patients presented within 24 hours of disease onset with ZERO% mortality and 84% patients presented after 24 hours of disease onset with 19% mortality and p-value 0.007. Our results are in contrast to study of Rajendra Singh Jobhta [3] et al, where 47% patients presented within 24 hours of onset of symptoms while 53% patients presented after 24 hours of onset of the disease, our results are also in contrast to study by Rodolfo L [4] et al, where 50.57% patients presented in less than 24 hours of onset of

disease and 49.43% patients presented after 24 hours. In our institute the cause of delayed presentation more than 24 hours was mainly related to the illiteracy among the rural population, lack of proper referral services, due to diagnostic dilemma which demands early use of more sophisticated investigations like CT scan, which is not available at the peripheral hospitals.

In our study, 1% patients with malignancy had 100% mortality while 99% patients without malignancy had 15.15% mortality and p-value 0.0212, which is in consistent with study by Dr. Tushar Dani [5] et where 7% patients with malignancy had 64.3% mortality while 93% patients without malignancy had 12.4% mortality and p-value <0.001. Our results are also in consistent with study by Rudolf L [4] et al, in which 1.15% patients had malignancy, and this is lower than study by Rajendra Singh Jobhta [3] et al where 4.56% patients had malignancy. Chronic use of NSAIDs in patients of malignancies to relieve pain exposes them to an increased risk of perforation.

In our study, 3% patients with colonic origin of sepsis had 66.67% mortality while 97% patients with non-colonic origin of sepsis had 16.47% mortality and p-value 0.0151, which is in contrast with study of Dr. Tushar Dani [5] et al where 12.5% patients had colonic origin of sepsis with 28% mortality while 87.5% patients with non-colonic origin of sepsis had 14.3% mortality with p-value 0.145. Our results are also in contrast with the study by Rudolf L [4] et al where 6.9% of patients had colonic origin of sepsis and consistent with in the study by Rajendra Singh Jobhta [3] et al where 3.76% of patients had colonic origin of sepsis. Our study shows that colonic origin of sepsis is a adverse variable as compare to non-colonic origin of sepsis which is contrast with MPI as colonic perforation presents with faecal exudates and a severe form of peritonitis.

In our study, 83% patients presented with a diffuse form of peritonitis had 19.28% mortality while 17% patients presented with localized peritonitis had ZERO% mortality with p-value 0.0482 which is consistent with study of Dr. Tushar Dani [5] et al where 13% patients were presented with localised peritonitis had ZERO% mortality and 87% patients were presented with generalised peritonitis had 18.4% mortality and p-value 0.017, these results are similar to study by Rajendra Singh Jobhta [3] et al, where also 17% patients presented with localised peritonitis and 83% patients presented with generalised peritonitis, but this is in contrast to study by Rudolf L [4] et al, where 65.51% patients presented with localised peritonitis and 34.49% patients presented with generalised peritonitis. Diffuse

peritonitis is associated with a severe inflammatory reaction, development of sepsis and multi-organ failure. Localization of peritonitis is body's defence mechanism and will lead to formation of abscess.

In our study, 20% patients with clear exudates had 5% mortality, 62% patients with purulent exudates had 12.9% mortality and 18% patients with faecal exudates had 38.9% mortality with p-value 0.010, which is consistent with study by Dr. Tushar Dani [5] et al where p-value was <0.001, which is in contrast to study by Rudolf L [4] et al, where 69.5% had clear exudates, 28.16% had purulent exudates and 2.29% cases had faecal exudate, this may be due to earlier presentation of the patents in that study, but this is consistent with study by Rajender Singh Jhobta [3] et al, where 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.

#### *MPI Scores*

In our study, 52% patients with MPI score less than 21 had ZERO% mortality, 29% patients with MPI score between 21-29 had 10.3% mortality and 19% patients with MPI score >29 had 68.4% mortality with p-value 0.001 which is consistent with study of Dr. Tushar Dani [5] et al where 43.5% patients with MPI scores <21 had ZERO% mortality, 35% patients with MPI scores 21-29 had 4.3% mortality and 21.5% patients with MPI scores > 29 had 67.4% mortality and p-value <0.00. Our results are in contrast to study by Rudolf L [4] et al where 39% patients had MPI score <21, 13% patients had MPI score between 21 to 29 and 8% patients had MPI score >29.

Out of the present prognostic scoring systems like APACHE II Score [7], MPI Score, Gori's Score, Sepsis severity Scores [8], Multiple Failure Score [9], Simplified Acute Physiology Score [10], Combined Peritonitis Scores, ALTONA II, the Mannheim Peritonitis Index is one of the easiest to apply and the determination of risk is easily available during the initial operation. Retrospective data collection is possible and valid, as only standard information available from the operation report of the patient's record is required.

#### *Outcome*

In our study, 16% patients died thus mortality rate was 16%, which is consistent with study of Dr. Tushar Dani [5] et al evaluation of prognosis in patients with perforation peritonitis using Mannheim's Peritonitis

Index where mortality was 16%, these result is in contrast to study by Rodolf L [4] et al where 6.32% patients died The mortality rate in perforation peritonitis ranges between 20 to 30%, despite improvement in the medical management, availability of new broad spectrum antibiotics and vast development in the field of intensive care with easy availability of intensive care and life support. Development of organ failure and sepsis are important determinants of mortality. Therefore research and development should be directed in the understanding of pathogenesis and evolution of these factors so that new and more effective treatment strategies could be evolved. Delay in the presentation for appropriate treatment should be addressed by means of strengthening the referral services and improving the means of transportation.

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 weight , each of risk factors as follows:

1. Presence of organ failure, Malignancy, Age > 50yrs, Type of exudates, Preoperative duration of peritonitis; Type of peritonitis (diffuse or localised ) are adverse risk factor with statistically significant result.
2. Non colonic origin of sepsis and female sex is also considered as a adverse prognostic factor by Linder and Waccha [2] but in our study these variable are not statistically significant.
3. Colonic origin of sepsis is adverse risk factor with statistically significant result.

#### *Statistical Validation of Mannhiems Peritonitis Index*

In our study of 100 patients, the mortality rate is 11.8 % for female ( 34 / 100 ) and 18.2 % for male ( 66 / 100 ) & was statistically not significant with p-value of 0.407 (> 0.05), which highlights the fact that female sex is not an adverse prognostic factor.

In our study, the mortality rate is 66.67% for colonic origin of peritonitis ( 3 / 100 ) and 16.47 % for non-colonic origin of peritonitis ( 97 / 100 ) and p-value is 0.0151. Colonic origin of sepsis is a adverse factor rather than non-colonic origin of sepsis, probably due to presence of faecal exudates which was more commonly associated with colonic origin of sepsis.

#### **Conclusion**

Mannheim Peritonitis Index is a useful method to

determine outcome in patients with perforation peritonitis. All the MPI variables shows adverse outcome namely, presence of organ failure; time elapsed > 24hrs; presence of malignancy; age>50 years, generalized extension of peritonitis and type of exudates behaved as expected, except the non-colonic origin of sepsis in peritonitis and female sex.

The MPI is one of the simplest scoring system 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 MPI cut off points should be adjusted for each hospital on individual basis as in our study it was divided into 3 groups, <21, 21-29, >29. Death rate in patients with MPI score < 21 was 0%, with MPI Score 21-29 was 10.3 , and with MPI Score >29 was 68.4%. The simplicity of MPI makes ideal for hospitals with serious shortages of staff and resources.

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