International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

A Comparative Study between Elebute and Stoner Grading and Mannheim Peritonitis Index in Prognostic Evaluation of Intraperitoneal Sepsis Due to Perforation Peritonitis in Suburban Teaching Hospital

Yogendra Kumar[1], Rajiv Verma[2*]

[1]**Assistant Professor, Dept. of General Surgery, Rama Medical College and Hospital, Hapur, Uttar Pradesh, India.**
[2*]**Associate Professor, Dept. of General Surgery, Santosh Medical College, Ghaziabad, Uttar Pradesh, India.**

ABSTRACT

Background: Peritonitis is one of the most common surgical emergencies with significant morbidity and mortality. Multiple scoring systems have been proposed and assessed in predicting the outcome in patients with peritonitis. A scoring system should be able to assess the need, type, and quality of the care required for a particular patient. Realizing the need for a simple and accurate scoring system in these conditions, the present study was undertaken to evaluate the Prognostic evaluation of intraperitoneal sepsis in perforation peritonitis by evaluating the efficacy of Elebute and Stoner grading and Mannheim peritonitis index (MPI) in predicting the overall risk of morbidity and mortality in patients with peritonitis. This study was conducted to identify the predicting ability of both these scores and to compare MPI with Elebute and Stoner grading (ESG) system.

Aim: To predict outcome of patients with peritonitis using the Elebute and Stonjej grading of sepsis and Mannheim peritonitis index in these patients and to predict the possible clinical outcome and to compare the results of both the scoring systems.

Patients & Methods: The present work is based on the observations made in 48 patients of perforation peritonitis admitted in surgical ward of Rama Medical College Hapur, Uttar Pradesh, India from March 2017 to March 2018. The diagnosis of perforation peritonitis was made on the basis of detailed history, physical examination, investigations and operative findings. A detailed record was maintained carefully for every patient and evaluation of Elebute and Stoner grading of sepsis and Mannheim peritonitis index were made and then results of both the scoring systems are compared.

Results: Comparison of both the scoring systems showed that sensitivity was almost equal in both the scoring systems (80%). But specificity and accuracy were slightly improved with Elebute and Stoner grading of sepsis (89.42% and 87.36% Vs 84.16% and 83.22%) respectively. This may be because of more organ systems incorporated in Elebute and Stoner grading of sepsis like hepatobiliary system, temperature, bleeding diathesis, central nervous system which had not been incorporated in Mannheim Peritonitis index.

Conclusion: In the univariate analysis both scoring systems studied, were relatively accurate for identifying patients at higher risk for dying from peritonitis. It was found that prediction among the dead was better than survived in both the scoring systems.

Key Words: Elebute and Stoner Grading (ESG), Mannheim Peritonitis Index (MPI), Perforation Peritonitis.

***Correspondence to:**

Dr. Rajiv Verma,
Associate Professor,
Department of General Surgery,
Santosh Medical College,
Ghaziabad, Uttar Pradesh, India.

Article History:

Received: 09-12-2019, **Revised:** 05-01-2020, **Accepted:** 29-01-2020

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2020.6.1.037	

INTRODUCTION

peritonitis is the generic name for inflammation of the peritoneum, irrespective of underlying cause that may be bacteria, virus, fungus or a chemical irritant. The important prototype of the condition that forms the bulk of our emergency admissions is secondary bacterial peritonitis caused by acute spontaneous gastrointestinal tract perforation. The gastrointestinal tract perforations account for approximately 8.4 to 6.2% of emergency admissions for acute abdomen. Sepsis is a complex and increasing global health problem.[1-5]

International consensus currently uses the working definition of sepsis as life-threatening organ dysfunction caused by a deregulated host response to infection.[2] The number of cases per year is estimated as approaching 18–19 million worldwide.[4-6] In the most severe cases, mortality rates approach 30–40% when shock is present[2,7,8], although may be 80% in the developing world.[9] When the focus of infection is located within the abdominal cavity, a particularly severe form of sepsis may result in association with the anatomy and physiology of the abdominal

cavity and the viscera within.[10,11] Cases of intra-abdominal sepsis (IAS) may be defined as complicated when the inflammation or contamination spreads beyond a single organ.[12,13] Sepsis after gastrointestinal tract perforations were graded by the degree of wound infection and did not take into account the systemic effect which was often produced. Most of the fatalities are undoubtedly due to multi-organ failure. Hence, it is not enough to know only the degree of wound infection or even the intra-peritoneal sepsis but also to take into account the function of vital organs to assess the severity of infection.

Many scoring systems have been proposed for use in predicting clinical outcomes in the critically ill. Potential systems that have been suggested include the Acute Physiology and Chronic Health Evaluation (APACHE II)[14-17], multiple organ failure (MOF) scores[18], P-POSSUM[15,19], Therapeutic Intervention Scoring System (TISS-28)[20,21], and the National Early Warning Score (NEWS) definitions of sepsis[22,23]; some are more intended for sepsis specifically such as the Sepsis Severity Score[16] and those specifically intended to consider intra-abdominal pathology such as the Mannheim Peritonitis Index[24], the World Society of Emergency Surgery Sepsis Severity Score (WSESSSS)[7], and even systems intended for pancreatitis such as the Ranson[25,26] and Imrie[27] scores.[28] By standardizing the sepsis scoring system for example Elebute and Stoner grading of sepsis and Mannheim peritonitis index and then evaluating and comparing the prognostic predictions made by these scoring systems in patients of intra-peritoneal sepsis following perforation peritonitis, may enable us to apply an easy and reliable mean, to institute scarce medical facilities to most needy patient.

MATERIALS AND METHODS

The present work is based on the observations made in 48 patients of perforation peritonitis admitted in surgical ward of Rama Medical College and Hospital, Hapur, Uttar Pradesh, India from March 2017 to March 2018. The diagnosis of perforation peritonitis was made on the basis of detailed history, physical examination, investigations and operative findings. A detailed record was maintained carefully for every patient and each patient was awarded scores under different attributes of both, Elebute & Stoner grading of sepsis and Mannheim peritonitis index. A detailed history of present illness was taken either from the patient himself or the attendants. A detailed history was asked about analgesics intake, previous episodes of epigastric pain (ulcer disease) typhoid fever, dysentery, malignancy, tuberculosis or previous admission for any gastrointestinal cause. History was also taken for associated illness like diabetes, hypertension, and malignancy. A thorough general examination and local examination was done in order to assess the severity and extent of peritonitis. Systemic examination was also done to assess the state of intra-peritoneal sepsis and general condition of the patient. All cases were resuscitated preoperatively in the causality and in surgical ward. Resuscitation was done with intravenous fluid to correct dehydration and electrolyte imbalance, nasogastric aspiration for gastrointestinal decompression, Foley's catheterization to measure urine output and antibiotics including 2nd generation cephalosporin and metronidazole. Blood transfusion was also done in required patients. Decision for exploratory laparotomy or conservative management was made on the basis of abdominal and general condition of the patient and also his willingness to undergo operative treatment. In few desperately ill patients, being unfit for operation conservative management was planned till condition improved. Abdominal drains were put intra-peritoneally in both the flanks under local anesthesia and simple drainage or normal saline irrigation was performed.

Every patient was awarded scores under different attributions of scoring index on the basis of physical examination, investigation and operative findings. Scoring systems taken in this study were Elebute & Stoner grading of sepsis and Mannheim peritonitis index, with slight modifications to suit the patient requirement and local facilities, for instance blood gas analysis was not taken as criteria for respiratory system dysfunction because of its unavailability in this hospital and high cost outside.

1. For the objective evaluation of both the above scoring systems, patients were divided into two categories according to the site of perforation. Group –I includes Upper gastrointestinal tract perforation (above ligament of Trietz) n= 2I cases; IA: Survivors (n=20 cases) and IIB: Non-survivors (n=1 cases). Group-II includes Lower gastrointestinal tract perforation (below ligament of Treitz) n=27 cases; IIA: Survivors (n=18 cases) IIB: Non-survivors (n=9 cases)

2. For predication of death or survival, the threshold index score (cut-off score) was taken 20 for Elebute & Stoner grading of sepsis and 26 for Mannheim peritonitis index and then patients were grouped as following for both the systems.

Predicted survivors are patients having score <20 for Elebute and Stoner grading of sepsis and <26 for Mannheim Peritonitis index.

Predicted Non-survivors are patients having score >20 for Elebute and Stoner grading of sepsis and >26 for Mannheim peritonitis index.

3. The evaluation and comparison of both scoring systems was made in terms of sensitivity, specificity and accuracy as per their standard definitions.

Sensitivity implies for percentage of correct predications in the subgroup of patients who died. **Specificity** implies for percentage of correct predictions in the subgroup of patients who survived and **Accuracy** is the degree to which the prediction represents the true value of reference threshold index score. The significance (p) of the date was analyzed statistically by using students T test.

Table 1: Distribution of patients in different age group

Age Group (Years)	Upper G.I.T. perforation (n = 21)		Lower G.I.T. perforation (n = 27)		Total (n = 48 cases)	
	No.	%	No.	%	No.	%
0-10	-	-	-	-	-	-
11-20	-	-	12	44.45	12	25.00
21 -30	4	19.05	7	25.93	11	22.92
31-40	5	23.81	6	22.23	11	22.92
41-50	5	23.81	1	3.78	6	12.50
>51	7	33.34	1	3.78	8	16.67

Table 2: Various causes of perforation peritonitis and mortality rate.

Cause of perforation	Number (n)	%	Expired	Mortality %
Gastric perforation	3	6.24	-	-
Duodenal perforation	18	37.44	1	5.55
Typhoid (enteric)	15	31.20	6	40
Appendicular	5	10.40	-	-
Tubercular stricture perforation	3	6.24	-	-
Ischemic necrosis	1	2.08	-	-
Ascariasis	1	2.08	-	-
Cause unknown	2	4.16	-	-

(Mortality rate is not listed where n < 10).

Table 3: Scoring of various attributes in survivors of Upper G.I.T. perforation group (n = 20 cases)

S. No.	Elebute and Stoner grading of sepsis					MPI
	Local Effect	Pyrexia	Secondary effect	Laboratory data	Total	
1	10	0	0	4	14	20
2	6	1	0	2	9	20
3	6	1	0	3	10	20
4	8	1	0	4	13	25
5	10	3	3	5	21	27
6	10	3	3	7	23	32
7	6	2	0	4	12	20
8	8	1	0	4	13	20
9	8	3	0	7	18	25
10	6	4	0	4	14	20
11	6	2	0	2	10	19
12	8	2	0	2	12	20
13	6	3	1	2	12	20
14	8	2	0	2	12	19
15	6	3	0	2	11	19
16	6	1	0	4	11	20
17	8	4	0	6	18	27
18	6	2	0	2	10	20
19	6	1	0	4	11	20
20	8	1	0	4	13	20
Mean	7.30	2.00	0.35	3.70	13.3	21.65
S.D.	1.46	1.12	0.9	1.623	3.5.18	3.56

(MPI: Mannheim Peritonitis index)

Table 4: Scoring of various attributes in Non-survivors of Upper G.I.T. perforation group (n = 1 case)

S. No	Elebute and Stoner grading of sepsis					MPI
	Local Effect	Pyrexia	Secondary effect	Laboratory data	Total	
1	10	3	3	7	23	32

Table 5: Scoring of various attributes in survivors of Lower G.I.T. perforation group (n = 18 cases)

S. No.	Elebute and Stoner grading of sepsis					MPI
	Local Effect	Pyrexia	Secondary effect	Laboratory data	Total	
1	2	0	0	3	5	19
2	6	1	0	4	11	15
3	10	3	4	5	22	27
4	8	1	0	3	12	26
5	6	2	0	3	11	28
6	2	1	0	2	5	15
7	2	1	0	2	5	15
8	6	1	0	4	11	26
9	8	2	0	4	14	28
10	8	3	6	4	21	28
11	8	2	0	1	11	20
12	6	2	0	4	12	26
13	2	2	2	4	10	20
14	6	1	0	4	11	26
15	8	2	0	4	14	26
16	8	2	0	3	13	26
17	6	2	0	4	12	20
18	8	2	0	4	14	26
Mean	5.88	1.55	0.14	3.41	10.6	22.35

Table 6: Scoring of various attributes in Non-survivors of Lower G.I.T. perforation group (n = 9 cases)

S. No.	Elebute and Stoner grading of sepsis					MPI
	Local Effect	Pyrexia	Secondary effect	Laboratory data	Total	
1	10	3	5	5	23	33
2	10	4	3	6	23	38
3	8	2	8	5	23	33
4	10	1	4	4	19	33
5	8	2	4	7	21	33
6	10	2	4	5	21	38
7	8	4	5	4	21	26
8	10	4	10	4	28	38
9	10	2	2	5	19	26
Mean	9.33	2.66	5.00	5.00	22.00	33.11
S.D.	0.99	1.12	2.51	1.CO	2.74	4.65

Table 7: Sensitivity specificity and Accuracy of both scoring systems at threshold index score.

	Elebute and Stoner grading of sepsis threshold index score (20)			Mannheim peritonitis index threshold index score (26)		
	Combined	Upper GIT Perforation	Lower GIT Perforation	Combined	Upper GIT Perforation	Lower GIT Perforation
Sensitivity	80	100	77.78	80	100	77.78
Specificity	89.42	90	88.80	84.16	85	83.25
Accuracy	87.36	90.44	85.10	83.22	85.68	81.40

Table 8: Multivariate analysis of Elebute and Stoner grading of sepsis (mean + S.D.) and p value.

Category		Local effect of tissue infection	Pyrexia	Secondary effects of sepsis	Laboratory data
Upper G.I.T. Perforation	Survivor	7.3 + 1.46	2.0 + 1.12	0.35 + 0.93	3.7 + 1.623
	Non-Survivor	10 + 0	3.0 ±0	3 + 0	7 + 0
Student "t" test		3.10	4.10	12.75	3.32
p value		<.01	<.01	<.01	<.01
Lower G.I.T. Perforation	Survivor	5.88 + 2.32	1.55 + 0.62	0.11 +0.47	3.39 + 0.95
	Non-Survivor	9.33 + 0.99	2.66 + 1.12	5.0 + 2.5	5.0 + 1
Student "t" test		3.67	3.52	13.81	4.21
p value		<.01	<.01	<.01	<.01

Table 9: Mortality rate of patients with reference threshold index score.

	Elebute & Stoner grading of sepsis	Mannheim Peritonitis Index
Score	>20	>26
No. of predicted non-survivor	12	14
Mortality rate	83.33%	71.40%

RESULTS

The present clinical study included 48 cases of perforation peritonitis (acute spontaneous gastrointestinal tract perforation) who were admitted in Rama Medical College and Hospital, Hapur, Uttar Pradesh. Out of the total 48 cases, 21 had upper gastrointestinal tract perforations (above ligaments of Treitz), of these 20 survived (Group 1A) and 1 expired (Group 1B). 27 patients had lower gastrointestinal tract perforations, of which 18 survived (Group IIA) and 9 succumbed to their illness (Group IIB).

In the present study, maximum number of cases of upper gastrointestinal tract perforation fall in age group > 51 (7 cases), whereas in lower gastrointestinal tract perforation group, maximum number of cases were in age group 11-20 (12 cases). However, almost 75% of cases of perforation peritonitis were between the ages of 11 years to 40 years.

In present study mean age of the patient was 31.89 years. The oldest patient in this study was of 64 years old who was a case of duodenal perforation and the youngest patients was 13 years old where the cause of perforation was enteric perforation. The mean age of upper gastrointestinal tract perforation group was found higher (39.08 years) than lower gastrointestinal tract perforation group (25.69 years). In present study the male: female ratio was 19:5. In present study, out of 48 cases of perforation peritonitis, maximum cases were of duodenal perforation 18 cases (37.44%) and enteric perforation 15 cases (31.20%). Table 2 shows various causes of peritonitis in present study. There were 3 cases of gastric perforation (6.24%), 5 cases of appendicular perforation (10.40%), 3 cases of perforation with tubercular stricture (6.24%), 1 case of ischemic necrosis of small bowel (2.08%) and 1 case of perforation caused by ascariasis (2.08%). In 2 cases (4.16%), the cause could not be ascertained as patients were treated conservatively and the operation could not be done.

Table 3 to 6 shows the detail scores allotted to each patient under various attributes for both Elebute and Stoner grading of sepsis and Mannheim peritonitis index. The scoring was based on the findings at admission, intra-operative and of first 24 hours of admission. Threshold index score was taken 20 for Elebute and Stoner grading of sepsis and 26 for Mannheim peritonitis index.

Among the survivors of upper gastrointestinal tract perforation group (Group - IA) (Table - 3), for Elebute and Stoner grading of sepsis all the cases had score < 20 except 2 cases with mean of

score gained by these patients was 13.3+ 3.52 whereas for Mannheim peritonitis index out of 20 cases, 3 cases had more than 26 score with mean score 21.65 + 3.56.

Similarly, in survivors of lower gastrointestinal tract perforation group (Group - HA) (Table 4) for Elebute and Stoner grading of sepsis out of 18 cases, all but 2cases had score >20 with mean score 10.66+ 3.07whereas for Mannheim peritonitis index. Scases had score more than 26 with mean score 22.35+ 4.31.

Among non-survivor group of upper gastrointestinal tract perforation (Table 5), all cases had score > 20 and > 26 for both Elebute and Stoner grading of sepsis and Mannheim peritonitis index respectively whereas for non-survivors of lower G.I.T. perforation group (Table 6) out of 9 cases only 2 case had score lower than threshold index score for both the scoring systems. The mean score in this group was 22 + 2.74 for Elebute and Stoner grading of sepsis and 33.11 ± 4.65 for Mannheim peritonitis index.

Table 7 shows the sensitivity, specificity and accuracy in both the scoring systems at threshold index score (cut-off score) 20 for Elebute and Stoner grading of sepsis and 26 for Mannheim peritonitis index. The sensitivity was equal in both the scoring systems (80%), and the specificity and accuracy for Elebute and Stoner grading of sepsis were 89.42% and 87.36% respectively but the specificity and accuracy were slightly lower 84.16% and 83.22% respectively) for Mannheim peritonitis index.

Table 8 shows multivariate analysis of various attributes of Elebute and Stoner grading of sepsis, the local effect of tissue infection, pyrexia, and secondary effect of sepsis and laboratory data. Though there were significant difference between scores of survivors and non survivors under different attributes, there was very much significant difference in score gained for attribute secondary effect of sepsis ($p < 0.001$). In upper gastrointestinal tract perforation, it was 0.35 ± 0.93 for survivor whereas 3 ± 0 for non survivors and similarly in lower G.I.T. perforation group it was .11 ± .47 for survivors and 5.0 ± 2.5 for non survivors.

Table 9 shows the mortality rate at reference threshold index score for both scoring systems. In the score range > 20 in Elebute and Stoner grading of sepsis, the mortality rate was 83.33% and similarly with score range > 26 for Mannheim peritonitis index, the mortality rate was 71.40%.

DISCUSSION

Perforation peritonitis is by far the resultant of hollow visceral perforation in most instances. Peritonitis, inflammation of serosal membrane lining the abdominal cavity and abdominal viscera, is associated with high mortality rate.[29] The subject of acute abdomen which is mostly caused by perforation peritonitis is one of ever increasing importance and it is essential that emergency surgeon dealing with such cases, should have a clear understanding and up to date knowledge for proper assessment of patient as a whole and risk stratification so that a prompt and aggressive surgical care can be provided to the most needy patient.

In the present study, we have analyzed 48 cases of perforation peritonitis admitted in general surgical ward. The incidence of upper gastrointestinal tract perforation and lower gastrointestinal tract perforation in our study was 21 & 27 respectively. There is no age bar for the perforation peritonitis. Mean age in this study was 31.89 years. (13 - 64 years) which is comparable with Dorairajan L.N. et al[24] study on perforation peritonitis (37.8 years 13 - 80 years). Maximum numbers of cases in this study fall between ages 11 to 40 years. However, the incidence of upper gastrointestinal tract perforation was more common in 6th decade (33.34%) as compared to lower gastrointestinal perforation, in which highest incidence was found in 2nd decade of life (25.00%) (Table-1). It is probably due to longer duration of peritoneal contamination before treatment, when the sepsis becomes more pronounced and established and gram, negative septicemia sets in, after a critical time lag following perforation. In the literature also, the available data for the mortality in cases of peritonitis points that mortality rate increases with delay in treatment (Schoeffel U. et al.[32], Koperna T. et al[33]).

In present study both the survivors and non-survivors had identical age, which therefore reflect the role of sepsis as the predominant cause of death, not the age.

In present study the length of hospital treatment was higher in the survivors of lower G.I.T. perforation group than the upper G.I.T. perforation group and this is undoubtedly due to a greater bacterial contamination of the peritoneal cavity in lower gastrointestinal tract perforations where aerobes particularly gram negative organism and anaerobes abound in plenty and it also takes a longer time to control and eradicate the infection.

Length of hospital treatment was very less in the non-survivor groups obviously because all succumbed to illness early in their disease process.

In present study, the number of perforations, above and below the ligament of Treitz was comparatively equal 21:27. The maximum number of cases encountered were of duodenal perforations 18 cases (37.44%) followed by ileal (enteric) perforation 15 cases (31.20%). Other important cause of perforation peritonitis were gastric perforation 3 cases (6.24%), appendicular perforation 5 cases (10.40%), tubercular stricture perforation 3 cases (6.24%), ischaemic necrosis small bowel 1 case (2.08%) and perforation because of ascariasis 1 case (2.08%). In 2 cases etiology could not be settled because their general condition did not permit the operation and they expired during conservative phase of management (Table - 2).

A retrospective study done in AIIMS by Dorairajan LN. et al[24] on 250 patients of perforation peritonitis reported 30% cases of duodenal perforation, 28% enteric perforation, 15% appendicular perforation and 15% of tubercular perforation. The incidence in present study was more or less comparable.

In present study perforations of stomach, duodenum and ileum were eight times as common as perforations of appendix, a ratio similar to that has been observed in a study from South Africa (Schein M. et al[35]). This is in sharp contrast to studies from developed countries like Canada (Bohnen J. et al[34]) where colonic and appendicular perforations were in equal proportion to more proximal bowel perforations.

Duodenal ulcer perforations far outnumbered perforations of the gastric ulcer as has been noted in a earlier studies from India (Sharma L. et al[37], Dorairajan L.N. et. al.[24]). This is in sharp contrast to studies from South Africa (Scheini M et al[35]) and to studies from the United States and United Kingdom where the two conditions were roughly equal.

While analyzing disease specific mortality, the mortality rate for patients of duodenal perforation was 5.55%. The mortality rate for perforation is 10.9% by Wysocki A et al[36] and 20% by Lawal O.O.

et al. The mortality rate of ileal perforation was 40.0% (Table-2). Nguyen V.S. 1994 has reported 18% mortality rate in typhoid perforation.

The scoring of each patient under various attributes for both scoring systems was carried out on the basis of physical finding at time of admission, intra-operative findings and investigation done within first 24 hours of admission. Critically analyzing table 3 to 6, at reference threshold index score for both the scoring systems, patients were predicted for their survival or death.

In present study, we had taken 20 as a threshold index score for evaluation of Elebute and Stoner grading of sepsis[40] and 26 for Mannheim peritonitis index. At or below this cut-off score the survival had been very bright. In other studies, for evaluation of Elebute and Stoner grading of sepsis[40], it was put at 30 by Knaus W.A. et al. and at 40 by Stevens I.E. et al. Whereas in the multicentric study done by Billing A. et al[31], the evaluation of Mannheim peritonitis index was done at different cut-off score rending from 20 - 30 at different centers of the study.

The present study was a comparative study of Elebute and Stoner grading of sepsis (Elbute E.A. and Stoner H.B.[40]) and Mannheim peritonitis index (Wacha H. et al[39].), which were slightly modified to suit the local need for its brief and easier application. It had been shown that arterial pH and arterial oxygenation were not essential for risk stratification in perforation peritonitis (Agarwal S. et al[38]). So, PO_2 and PCO_2 were not taken as a criteria for respiratory system dysfunction in both the scoring systems because of its unavailability in this hospital.

In present study the sensitivity for Elebute and Stoner grading of sepsis[40] was 80% as a whole. Prediction among dead was found better for upper gastrointestinal perforation group (100%) in comparison to lower gastrointestinal group (77.78%). The specificity was 89.42%, which signifies that the predictions made among survivors is slightly superior to predictions among expired. For upper G.I.T. perforation group it was 90% and for lower G.I.T. perforation group it was 88.80% (Table - 7).

At cut-off score 20, the accuracy was 87.36%, denoting that at this reference threshold index score, in 87.36% of patient's accurate predictions were made. The cut-off point in present study was similar to that of the author (Elebute E.A. and Stoner H.B.[40]) who had found the overall accuracy 84% for this cut-off score. In other studies, when cut-off score was put at 40 by Stevens L.E. et. al. (1986), the accuracy was 77% and at cut-off score 30 by (Knaus W.A. et al. 1985a), the accuracy was 82%.

In multivariate analysis, after critical scrutiny of the various attributes under Elebute and Stoner grading of sepsis[40] (Table - 8) which are local effect of tissue infection, pyrexia, secondary effect of sepsis and laboratory data, it was found that there is significant difference in scores between survivor and non-survivor groups for the attribute secondary effect of sepsis ($p < 0.001$). Thus, it was concluded that the secondary effect of sepsis was the real determinant for organ failure and concomitant fatal outcome. But in the study of Elebute and Stoner (1983) the local effect of tissue infection was considered as a major determinant for the prognostic outcome.

However, secondary effect of sepsis did not always reflect in blood culture because only 33% of patients in upper gastrointestinal tract perforation group and 40.74% of lower gastrointestinal perforation group had positive blood culture. This supports the study of Ramsay G. et al., who stated that patients with multiple organ failure secondary to intra-peritoneal sepsis are often blood culture negative despite exhibiting the features of septic shock. Also, the organism found in blood did not correspond to the organism cultured from peritoneal cavity (Table-9). Same experience has also been shared in different studies suggesting that microorganism has not definite correlation with severity of disease, (Schoeffel U et al.[41], Chalfine A et al.[42]).

Evaluation of Mannheim Peritonitis index:

In present study the sensitivity for Mannheim peritonitis index was 80%. For upper and lower gastrointestinal perforation groups separately, sensitivity was 100 and 77.78% respectively. But the correct prediction among survivors that is specificity was 84.16%. The accuracy in the study at threshold index score 26 was found 83.22%. For different subgroups it was 80% and 82.75% respectively. Similar sensitivity, specificity and accuracy have been reported in different studies done time to time, for evaluation of this scoring system.

Table 10: Sensitivity, Specificity and Accuracy at Threshold Index Score

Study	Sensitivity	Specificity	Accuracy
Present study	80%	84.16%	83.22%
Van Larhoven C.J. et al 1988	87.00%	83.00%	87.00%
Fuegger R. et al 1990	54.00%	81.00%	76.00%
Krenjien J. et al 1990	69.00%	97.00%	94.00%
Billing A. et al. 1992	70.00%	67.00%	68.00%
Demmel N, 1994	93.00%	16.00%	-
Billing A. et al. 1994	86.00%	74.00%	83.00%
Dau H. et al. 1994	85.00%	61 .00%	70.00%
Labus H.N. 1994	98.00%	76.00%	83.00%
Nitsche D. 1994	76.00%	58.00%	68.00%

Comparison of both the scoring systems (Table-7) showed that sensitivity was almost equal in both the scoring systems (80%). But specificity and accuracy was slightly improved with Elebute and Stoner grading of sepsis (89.42% and 87.36% Vs 84.16% and 83.22 %%) respectively. This may be because of more organ systems incorporated in Elebute and Stoner grading of sepsis like hepatobiliary system, temperature, bleeding diathesis, central nervous system which had not been incorporated in Mannheim Peritonitis index.

In the univariate analysis both scoring systems studied, were relatively accurate for identifying patients at higher risk for dying from peritonitis. It was found that prediction among the dead was better than these survived in both the scoring systems. Similar results have been shown in other studies also.

The mortality rate was also found significantly high in the patient with score greater than the cut-off score, in both the scoring systems (Table-9). In the study of Billing A. et al[31]. the mortality rate was 55% for those who had score > 26 for Mannheim

peritonitis index. In present study, it was found 71.40%. So, for these methods to come into general use, large bodies of data should be built up, not only for intra peritoneal sepsis but also for sepsis in other situations such as multiple trauma and burns. This would test the general validity of these systems and allow more sophisticated methods to be used to determine the best value for the scores. It would also enable one to see if it was necessary to score all the attributes listed in respective scoring system to get meaningful score and whether the same system was equally useful for all purposes, So to achieve these goals, work on this topic will require the study of large number of patients, and is still going on throughout the world.

CONCLUSION

The present study was a clinical study of 48 patients of intra-peritoneal sepsis following acute spontaneous gastrointestinal tract perforation, admitted in General surgical ward of Rama Medical College and Hospital, Hapur, Uttar Pradesh, India.

A brief review of etiology of perforation peritonitis, their incidence and mortality rate has already been given. Effect of intra-peritoneal sepsis in the development of organ failure has been assessed in brief and need for scoring system and their serial development have been discussed.

Evaluation of Elebute and Stoner grading of sepsis and Mannheim peritonitis index were made and then results of both the scoring systems are compared. The incidence of upper gastrointestinal tract perforation and lower gastrointestinal tract perforation were 21:27. Though no age is immune for perforation peritonitis, no case below 13 years of age was found in present study. Upper gastrointestinal tract perforation (peptic) was found more prevalent among higher age group (64).

Duration of illness clearly affects the survival. Increasing delay in treatment guards the prognosis. Maximum number of cases in this study where of duodenal perforation followed by ileal (enteric) and appendicular perforation.

Mortality rate of perforation peritonitis is high in spite of aggressive surgical treatment in present study it was found 20.08% But it was found lower (4.26%) in upper gastrointestinal tract perforation in comparison to lower gastrointestinal tract perforation (33%). The mortality rate of ileal perforation (40%) was found higher than that of duodenal perforation (5.55%). In univariate analysis, at threshold index score 20, for Elebute and Stoner grading of sepsis the sensitivity was 80% specificity was 89.42% and accuracy was 87.36%. At threshold index score 26, Mannheim peritonitis index the sensitivity was 80%, specificity was 84.16% and accuracy was 83.22%. Sensitivity was same for both the scoring systems but specificity and accuracy were found slightly improved with Elebute and Stoner grading of sepsis.

Both the scoring system were found accurate for identifying higher risk of dying patient, as prediction among dead was better than among survivor. Quality of prediction was not found helpful in determining the therapeutic decisions.

In multivariate analysis of the Elebute and Stoner grading of sepsis, the component secondary effect of sepsis was found the real determinant for survival of patients.

Peritoneal microorganisms were not found an important contributing factor for severity of sepsis. Elebute and Stoner grading of sepsis had slight improved results but it was found to be a lengthy procedure and also takes time before predictions were made. Mannheim peritonitis index was found more disease specific, easy to apply and quick because determination of risks was readily available during initial phase of treatment.

REFERENCES

1. Shankar-Hari M, Phillips GS, Levy ML, Seymour CW, Liu VX, Deutschman CS, et al. Developing a new definition and assessing new clinical criteria for septic shock: for the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):775–87.

2. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for Sepsis and septic shock (Sepsis-3). JAMA. 2016;315(8):801–10.

3. Marshall JC. Sepsis definitions: a work in progress. Crit Care Clin. 2018;34(1):1–14.

4. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcomes, and associated costs of care. Crit Care Med. 2001;29:1303–10.

5. Lagu T, Rothberg MB, Shieh MS, Pekow PS, Steingrub JS, Lindenauer PK. Hospitalizations, costs, and outcomes of severe sepsis in the United States 2003 to 2007. Crit Care Med. 2012;40(3):754–61.

6. Lagu T, Rothberg MB, Shieh MS, Pekow PS, Steingrub JS, Lindenauer PK. What is the best method for estimating the burden of severe sepsis in the United States? J Crit Care. 2012;27(4):414 e1–9.

7. Sartelli M, Abu-Zidan FM, Catena F, Griffiths EA, Di Saverio S, Coimbra R, et al. Global validation of the WSES Sepsis Severity Score for patients with complicated intra-abdominal infections: a prospective multicentre study (WISS Study). World J Emerg Surg. 2015;10:61.

8. Szakmany T, Lundin RM, Sharif B, Ellis G, Morgan P, Kopczynska M, et al. Sepsis prevalence and outcome on the general wards and emergency departments in Wales: results of a multi-centre, observational, point prevalence study. PLoS One. 2016;11(12):e0167230.

9. Jawad I, Luksic I, Rafnsson SB. Assessing available information on the burden of sepsis: global estimates of incidence, prevalence and mortality. J Glob Health. 2012;2(1):010404.

10. Roberts DJ, Ball CG, Kirkpatrick AW. Increased pressure within the abdominal compartment: intra-abdominal hypertension and the abdominal compartment syndrome. Curr Opin Crit Care. 2016;22(2):174–85.

11. Leligdowicz A, Dodek PM, Norena M, Wong H, Kumar A, Kumar A, et al. Association between source of infection and hospital mortality in patients who have septic shock. Am J Respir Crit Care Med. 2014;189(10):1204–13.

12. Sartelli M, Abu-Zidan FM, Ansaloni L, Bala M, Beltran MA, Biffl WL, et al. The role of the open abdomen procedure in managing severe abdominal sepsis: WSES position paper. World J Emerg Surg. 2015;10:35.

13. Sartelli M, Viale P, Catena F, Ansaloni L, Moore E, Malangoni M, et al. 2013 WSES guidelines for management of intra-abdominal infections. World J Emerg Surg. 2013;8(1):3.

14. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification. Crit Care Med. 1985;13:818–29.

15. Das K, Ozdogan M, Karateke F, Uzun AS, Sozen S, Ozdas S. Comparison of APACHE II, P-POSSUM and SAPS II scoring systems in patients underwent planned laparotomies due to secondary peritonitis. Ann Ital Chir. 2014; 85(1):16–21.
16. Elebute EA, Stoner HB. The grading of sepsis. Br J Surg. 1983;70(1):29–31.
17. Gauzit R, Pean Y, Barth X, Mistretta F, Lalaude O, Top Study T. Epidemiology, management, and prognosis of secondary non-postoperative peritonitis: a French prospective observational multicenter study. Surg Infect. 2009;10(2):119–27.
18. Goris RJ, te Boekhorst TP, Nuytinck JK, Gimbrere JS. Multiple-organ failure. Generalized autodestructive inflammation? Arch Surg. 1985;120(10):1109–15.
19. Copeland GP, Jones D, Walters M. POSSUM: a scoring system for surgical audit. Br J Surg. 1991;78(3):355–60.
20. Delibegovic S, Markovic D, Hodzic S. APACHE II scoring system is superior in the prediction of the outcome in critically ill patients with perforative peritonitis. Med Arh. 2011;65(2):82–5.
21. Lefering R, Zart M, Neugebauer EA. Retrospective evaluation of the simplified Therapeutic Intervention Scoring System (TISS-28) in a surgical intensive care unit. Intensive Care Med. 2000;26(12):1794–802.
22. Szakmany T, Pugh R, Kopczynska M, Lundin RM, Sharif B, Morgan P, et al. Defining sepsis on the wards: results of a multi-centre point-prevalence study comparing two sepsis definitions. Anaesthesia. 2018;73(2):195-204. https://doi.org/10.1111/anae.14062. Epub 2017 Nov 17.
23. McGinley A, Pearse RM. A national early warning score for acutely ill patients. BMJ. 2012;345:e5310.
24. Dorairajan LN, Gupta S, Deo SVS, Chumber S, Sharma L. Peritonitis in India-A decades experience. Tropical Gastroenterology. 1995;16:33–38.
25. Linder MM, Wacha H, Feldmann U, Wesch G, Streifensand RA, Gundlach E. The Mannheim peritonitis index. An instrument for the intraoperative prognosis of peritonitis. Chirurg. 1987;58(2):84–92.
26. Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Localio SA. Objective early identification of severe acute pancreatitis. Am J Gastroenterol. 1974;61(6):443–51.
27. Imrie CW, Benjamin IS, Ferguson JC, McKay AJ, Mackenzie I, O'Neill J, et al. A single-centre double-blind trial of Trasylol therapy in primary acute pancreatitis. Br J Surg. 1978;65(5):337–41.
28. 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(11):1532–4.
29. Seiler CA, Brügger L, Forssmann U, Baer HU, Büchler MW. Conservative surgical treatment of diffuse peritonitis. Surgery. 2000;127:178–84.
30. Budhraja SN, Chidambaram M, Perianayagam WJ. Peritonitis (An Analysis of 117 cases). Ind J Surg. 1973;35:456-64.
31. Billing A, Frohlich D, Schildbery FW. Peritonitis Study Group. Prediction of outcome using the Mannheim Peritonitis Index in 2003 patients. Br J Surg 1994;81:209-13
32. Schoeffel U, Jacobs E, Ruf G, et al. Intraperitoneal micro-organisms and the severity of peritonitis. Eur J Surg. 1995;161:501–8.
33. Koperna T, Schulz F. Prognosis and treatment of peritonitis. Arch Surg. 1996;131:180–6.
34. Bohnen J, Boulanger M, Meakins J, et al. Prognosis in generalized peritonitis: relation to cause and risk factors. Arch Surg. 1983 Mar;118(3):285-90.
35. Schein M. Management of severe intra-abdominal infection. Surg Annu. 1992; 24(Pt 1):47–68.
36. Wysocki A, Budzyński P, Kulawik J, Drożdż W. Changes in the localization of perforated peptic ulcer and its relation to gender and age of the patients throughout the last 45 years. World J Surg. 2011;35:811–6.
37. Lalit Sharma, Sanjay Gupta, A. S. Soin, Sadiq Sikora, Vinay Kapoor. Generalized peritonitis in India—The tropical spectrum. Japanese J Surgery, vol. 21, no. 3 pp. 272-277, 1991.
38. Agarwal S, Sharma D, Raina VK. Arterial pH and arterial oxygenation are not essential for risk stratification in perforation peritonitis. Indian J Gastroenterol. 1999;18:5-6.
39. H. Wacha, T. Hau, R. Dittmer, C. Ohmann and the Peritonitis Study Group. Risk factors associated with intraabdominal infections: a prospective multicenter study. Langenbeck's Arch Surg (1999) 384: 24–32.
40. Elebute, E.A. and Stoner, H.B. (1983), The grading of sepsis. Br J Surg, 70: 29-31.
41. Chalfine A, Carlet J. Antibiotic treatment of peritonitis. Journal de Chirurgie, 01 Mar 1999, 136(1):15-20.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Copyright: © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882.
This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Cite this article as: Yogendra Kumar, Rajiv Verma. A Comparative Study between Elebute and Stoner Grading and Mannheim Peritonitis Index in Prognostic Evaluation of Intraperitoneal Sepsis Due to Perforation Peritonitis in Suburban Teaching Hospital. Int J Med Res Prof. 2020 Jan; 6(1):146-53. DOI:10.21276/ijmrp.2020.6.1.037