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Original article

Study of evaluation of accuracy of APACHE-II SCORE in predicting the outcome in patients with peritonitis secondary to hollow viscous perforation

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ABSTRACT

Background: *Peritonitis is defined as inflammation of the peritoneal cavity and the organs contained therein. Perforation peritonitis is one of the most common surgical emergencies in India and is associated with significant mortality, up to 60%. Severity and prognosis of acute peritonitis have been graded with many scoring systems, of which APACHE II is the most widely used. The purpose of this study was to find out the level of accuracy of APACHE-II scoring system in the prediction of outcome in critically*

Methods: *A prospective analytical study, including 50 patients with perforative peritonitis was done. Pre-operative APACHE-II scoring was calculated. Each variable in the scoring system was taken as an independent predictor of complications, morbidity and mortality. The significance of difference between mean scores among survivors and non-survivors was compared using unpaired student t-Test for significance. Predictive accuracy of APACHE II scoring was calculated by Receiver Operating Characteristic.*

Results: *Patients were divided among 3 groups with APACHE- II score ranging from 0-10, 11-20, 21-30. Out of total 50 patients, 30 patients were in 1st group, 10 in second and 10 in third. The correlation between APACHE-II scores and mortality was found to be statistically significant. With 0% mortality in 1st group, 10% in second and 70% in third group. The mean APACHE II score of the overall study group was 11.18, score of the survivors was 8.55 and of the non-survivors was 30.50. The ROC curve was analysed to estimate the cut off value of APACHE II score in predicting the mortality and it was found that the cut off value of APACHE II score in our study was 18.50 with a sensitivity of 87.5% and specificity was 92.9%. Area Under Curve was 0.987, Positive Predictive value was 70.1% and Negative Predictive value was 97.5%.*

Conclusions: *This study concludes that in patients of perforation peritonitis, mortality increased significantly as pre-operative APACHE II score increased, particularly in patients having score of 21 and above. APACHE II score can hence be used as a good stratification tool in patients of perforation peritonitis. It can help to decide procedure to be performed, necessary pre-operative preparation, counselling of the patient and care takers and optimisation in high-risk patients. This can be beneficial in predicting the outcome so that better risk assessment, prognostication of patients, decision making and hence, proper resource allocation can be done.*

Keywords: *Perforation peritonitis, APACHE-II, Mortality*

INTRODUCTION

Peritonitis is defined as inflammation of the peritoneal cavity and the organs contained therein.1 Perforation peritonitis is one of the most common surgical emergencies in India and is associated with significant mortality, ranging from 20-60%.[1] The prognosis and outcome of peritonitis depends upon the interaction of many factors, and predictive prognostic scoring has helped to manage patient load.[2]

Many scoring systems have been designed and used successfully to grade the severity of acute peritonitis and intraabdominal sepsis. Amongst them are Acute physiological and chronic health evaluation score (APACHE II), Mannheim Prognostic Index (MPI), Peritonitis Index Altona (PIA), Physiological and Operative severity score for enumeration of mortality and morbidity (POSSUM).[3]

Of the present prognostic scoring systems, APACHE II is the most widely used. Developed in 1981 by Knaus et al at the George Washington University Medical Centre, APACHE was based on 34 physiological parameters, later simplified in 1985 as a clinically useful system in the form of APACHE II. APACHE II required only 12 physiological variables. APACHE-II takes into account different variables related to acute physiology of the patient in first 24 hours of admission, age of the patient and few chronic conditions related to health of the patient. Worst readings of these variables in first 24 hours of admission are used in APACHE II to predict the outcome of the patient in the form of expected mortality rate. APACHE II parameters have been shown to have a strong relationship to the outcome in patients of perforation peritonitis, and is therefore very popular and has been used in both surgical and non-surgical patients.[4]

The purpose of this study was to find out the level of accuracy of APACHE-II scoring system in the prediction of outcome in critically ill patients with perforation peritonitis.[4]

MATERIAL AND METHOD:

The present study was done on 50 patients who presented with perforation peritonitis to department of surgery Pt BDS PGIMS, Rohtak from July 2022 to July 2023. Patients with primary or tertiary peritonitis or compromised immunity were excluded. A detailed history was recorded in all patients.

Pre-operative APACHE-II scoring was done after recording necessary physiological and biochemical parameters. The surgical procedure employed was simple closure/ Graham's patch repair for the duodenal and gastric ulcer perforation, end to end anastomosis for jejunal perforation, primary repair/resection and anastomosis/end or loop ileostomy for ileal perforation, appendectomy in perforation due to appendicitis, and end or loop colostomy for colonic perforation.

The details of surgical procedure, intra-operative findings, any surgical complication and final outcome was recorded. Each patient was followed up till discharge or death (if occurred). Time duration from the initial diagnosis and the final event was noted. Each variable in the scoring system was taken as an independent predictor of complications, morbidity and mortality and analysis was done for the estimation of the same.

The operative procedure and related operative factors were observed directly and recorded in the proforma in a systematic way. Data analysis was done both manually and by using computer. Calculated data was arranged in systematic manner in the forms of various tables and figures. Statistical analysis was done to evaluate the objectives of this study with the help of MS Excel and SPSS (Statistical Package for Social Science).

Score was assigned to patients using APACHE II scoring system. The significance of difference between mean scores among survivors and non-survivors was compared using unpaired student t-Test for significance. Predictive accuracy of APACHE II scoring was calculated by Receiver Operating Characteristic.

RESULTS

The study was done in 50 patients of perforation peritonitis who were admitted in surgical ward. Mortality increased as the age increased (p-value=0.008). Mortality increased in patients with more than 50 years of age. The mean age of the overall study group was 40.74 ± 16.03 years, of the survivors was 37.54 ± 14.2 years and of non-survivors was 57.5 ± 15.28 years. The association of age group and outcome was found to be statistically significant (p value=0.001).

The male to female ratio was 4.5:1. All of the 8 patients who died were males. The male to female ratio among the survivors and non-survivors was 3.7:1 and 8:0 respectively. The association between sex of the patient and their outcome was found to be statistically insignificant. All the patients (100%) of them presented with the complaint of pain abdomen and had abdominal tenderness. 92% had abdominal guarding while only 34% patients had vomiting and 30% patients had constipation.

Seventy four percent of the total patients in our study presented within 3 days after onset of symptoms, 20% within 3-6 days while only 6% presented after 7 days. All the 3 patients who presented more than 7 days, died. Fifty percent of patients who presented between 3-6 days of onset of symptoms, survived. The mean duration of illness of the overall study group was 3.08 ± 2.30 days, of the survivors was 2.33 ± 1.10 days and of the non-survivors was 7.00 ± 3.02 days. The association between duration of presentation and the outcome of the patient was found to be statistically significant (p-value<0.001). (Table 1)

Table 1: Distribution of cases according to duration of illness and clinical outcome. (N = 50)

Duration of illness	Number of cases	Survived	Not survived	p-value
Less than 3 days	37 (74%)	37 (100%)	0 (0%)	<0.001
3 – 6 days	10 (20%)	5 (50%)	5 (50%)	
7 days or more	3 (6%)	0 (0%)	3 (100%)	
Total	50	42	16	
Mean duration of illness in days ± SD	3.08 ± 2.30	2.33 ± 1.10	7.00 ± 3.02	<0.001s

In our study, 28% of patients had perforation in the stomach out of which 2% was due to traumatic cause, rest were peptic perforation. Twenty percent patients had duodenal peptic perforations, 22 patients had perforation of the small intestine, 2% of which were located at duodeno-jejunal junction, 8% were in jejunum and 34% were in the ileum. Six percent of patients had perforation in the colon while only 2% had perforation in the gall bladder. (Table 2)

Table 2: Distribution of cases according to site of perforation. (N = 50)

Site of perforation		Number of cases
Stomach	Peptic	13 (26%)
	Traumatic	1 (2%)
Duodenum	Peptic	10 (20%)
Small Intestine	DJ Junction	1 (2%)
	Jejunum	4 (8%)
	Ileum	17 (34%)
Colonic		3 (6%)
Gall Bladder		1 (2%)

The mean body temperature of the study group was 38.07°C, of the survivors was 37.93°C and of non-survivors was 38.82°C. The cut-off value for body temperature was 38.85°C. The association between body temperature and clinical outcome of the patient of perforation peritonitis was found to be statistically significant. The mean arterial pressure of the study group was 77.04 mmHg, of the survivors was 80.93 mmHg and of non-survivors was 56.67 mmHg. The cut-off value for mean arterial pressure was 65.65 mmHg. The association between the mean arterial pressure and clinical outcome of the patient of perforation peritonitis was found to be statistically significant.

The mean heart rate of the study group was 110 bpm, of the survivors was 104 bpm and of non-survivors was 141 bpm. The cut-off value for heart rate was 135 bpm. The association between the heart rate and clinical outcome of the patient of perforation peritonitis was found to be statistically significant.

The mean respiratory rate of the study group was 23/min, of the survivors was 21/min and of non-survivors was 35/min. The cut-off value for respiratory rate was 27/min. The association between the respiratory rate and clinical outcome of the patient of perforation peritonitis was found to be statistically significant. (Table 3)

Table 3: Comparison of mean hemodynamic parameters according to clinical outcome. (N = 50)

Hemodynamic parameters	Mean ± SD			cut-off value	p-value
	Number of cases (N=50)	Survived (N=42)	Not survived (N =8)		
Body temperature (°c)	38.07 ± 0.82	37.93 ± 0.73	38.82 ± 0.84	38.85	0.003
Mean arterial pressure(mmHg)	77.04 ± 15.12	80.93 ± 13.03	56.67 ± 6.28	65.65	<0.001
Heart rate (bpm)	109.72 ± 20.03	103.76 ± 15.81	141 ± 3.54	135	<0.001
Respiratory rate (/min)	22.92 ± 6.29	20.71 ± 3.38	34.5 ± 5.2	27	<0.001

The mean FiO_2> 0.5 (A-aDO_2) of the study group was 91.52, of the survivors was 65.42 and of non-survivors was 228.53 while the cut-off value was 145.65. The mean FiO_2 <0.5 (PaO_2) of the study group was 85.21, of the survivors was 91.83 and of non-survivors was 50.46 and the cut-off value was 71.3. The mean arterial pH of the study group was 7.35, of the survivors was 7.37 and of non-survivors was 7.25 with its cut-off value being 7.31. The mean serum bicarbonate level of the study group was 18.37, of the survivors was 19.19 mEq/L and of non-survivors was 14.03 mEq/L while its cut-off value being 16.1 mEq/L. The association between all the above mentioned parameters and clinical outcome of the patient of perforation peritonitis was found to be statistically significant. (Table 4)

Table 4: Comparison of mean arterial blood gases according to clinical outcome. (N = 50)

Arterial Blood Gases	Mean ± SD			cut-off value	p-value
	Number of cases (N=50)	Survived (N = 42)	Not survived (N = 8)		
FiO_2> 0.5 (A-aDO_2)	91.52 ± 66.79	65.42 ± 25.89	228.53 ± 41.91	145.65	<0.001
FiO_2 <0.5 (PaO_2)	85.21 ± 17.16	91.83 ± 5.73	50.46 ± 15.03	71.3	<0.001
pH	7.35 ± 0.06	7.37 ± 0.04	7.25 ± 0.03	7.31	<0.001
Serum Bicarbonate (mEq/L)	18.37 ± 3.25	19.19 ± 2.74	14.03 ± 2.08	16.1	<0.001

The association between clinical outcome of the patient and Serum Sodium, Serum Potassium and haematocrit was found to be statistically insignificant while that between Serum Creatinine and Total Leucocyte Count was found to be significant. The mean Serum creatinine of the study group was 1.32 mEq/L, of the survivors was 1.13 mg/dL and of non-survivors was 2.3 mg/dL, with its cut-off value being 1.85 mg/dL. The mean Total Leucocyte count of the study group was 9777.40/microlitre, of the survivors

was 7950.47/microlitre and of the non-survivors was 19368.75/microlitre, respectively which was statistically significant. The cut-off value of TLC was 13450/microlitre.(Table 5)

Biochemical parameters	Mean +- SD			cut-off value	p-value
	Number of cases (N = 50)	Survived (N = 42)	Not Survived (N = 8)		
Serum Sodium (mEq/L)	134.60 ± 8.71	133.56 ± 6.85	140.03 ± 14.69	139.35	0.053
Serum Potassium (mEq/L)	3.89 ± 0.71	3.87 ± 0.69	3.97 ± 0.86	3.89	0.723
Serum Creatinine (mg/dL)	1.32 ± 0.61	1.13 ± 0.36	2.3 ± 0.7	1.85	<0.001
Hematocrit (%)	37.28 ± 8.58	38.26 ± 7.92	32.13 ± 10.59	34	0.064
TLC (/microlitre)	9777.40 ± 5974.07	7950.47 ± 4265.93	19368.75 ± 4251.46	13450	<0.001

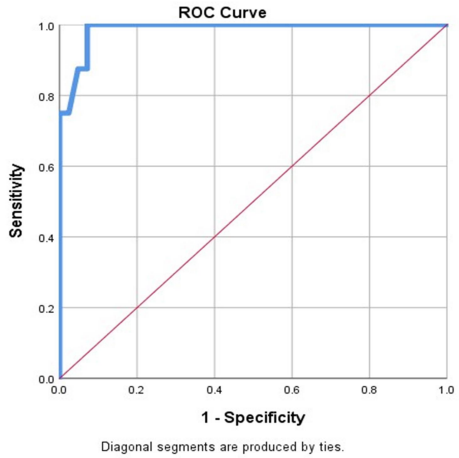
Table 5: Comparison of mean biochemical parameters according to clinical outcome. (N = 50)

Patients were divided among 3 groups with APACHE- II score ranging from 0-10, 11-20, 21-30. Out of total 50 patients, 30 patients were in 1st group, 10 in second and 10 in third. The correlation between APACHE-II scores and mortality of the patient of perforation peritonitis was found to be statistically significant. With 0% mortality in 1st group, 10% in second and almost 70% of patients in third. The mean APACHE II score of the overall study group was 11.18, of the survivors was 8.55 and of the non-survivors was 30.50. (Table 6)

Table 6: Association of APACHE-II score with clinical outcome. (N = 50)

APACHE II Score	Number of cases	Survived	Not survived	p-value
0 – 10	30 (60%)	30 (100%)	0 (0%)	<0.001
11 – 20	10 (20%)	9 (90%)	1 (10%)	
21 and above	10 (20%)	3 (30%)	7 (70%)	
Total patients	50	42	8	
Mean APACHE score ± SD	11.18 ± 10.01	8.55 ± 5.84	30.50 ± 6.50	

Receiver operating characteristics curve to identify cut-off value for APACHE-II score in diagnosing cases according to clinical outcome. (N = 50)



The ROC curve was analyzed to estimate the cut off value of APACHE II score in predicting the mortality and it was found that the cut off value of APACHE II score in our study was 18.50 with a sensitivity of 87.5% and specificity was 92.9%. Area Under Curve was 0.987, Positive Predictive value was 70.1% and Negative Predictive value was 97.5%.

DISCUSSION

Perforation peritonitis is a frequently encountered surgical emergency in tropical countries like India, most commonly affecting young men compared to western countries. We evaluated patients having perforation peritonitis and various factors like age, sex, duration, site of perforation and delay in surgical intervention affecting outcome of the patients. The parameters of APACHE-II scores were assessed, recorded and calculated before surgery and post operative complications were observed. Each patient's post operative mortality was compared to determine the significance of the severity of illness on patients of perforation peritonitis using APACHE II score. Observations drawn from the study were compared with the findings in previous literature.In the present study, 40% of the patients were in the age groups of 21 to 40 years. Overall, the mean age of the study population was 40.74 years, of the survivors was 37.54 years and of the non-survivors was 57.5 years. Age of the patient was found to be significantly affecting the mortality. The most common presenting complaint was pain abdomen, (100% of the patients) followed by vomiting (34%). In a study done by Bylapudi et al, mean age of the study population was 43.63 years, of the survivors was 41.58 years and of the non-survivors was 56.57 years. It was found that age was a significant factor in determining the survival of the patient.[12] In a study by Das et al, mean age of the study population was 46 years, of the survivors was 43.22 years and of the non-survivors was 59.43 years. It was found that the impact of age on survival is significant. [13]

In the present study, out of 50 patients, 41 (82%) were males and 9 (18%) were females. Males were predominantly affected in this study and male to female ratio was 4.5:1. Among the survivors, 33 (78.6%) were males and 9 (21.4%) were females, and the male to female ratio was 3.7:1. Among the non survivors, 9 were males while none of the females died.

In a study done by Gupta et al on 100 patients, 84 were males and 16 were females. Male to female ratio was 5.25:1.[156] Among the survivors, 71 (83.5%) were males and 14 (16.5%) were females, and the male to female ratio was 5.7:1. Among the non-survivors, 13 (86.7%) were males, 2 (13.3%) were females, and the male to female ratio was 6.5:1. [7]In a study done by Agarwal et al on 100 patients, 76 (76%) were males and 24 (24%) were females. Male to female ratio was 3.1:1. Among the survivors, 71 (77.2%) were males and 21 (22.8%) were females, and the male to female ratio was 3.38:1. Among the non-survivors, 5 (62.5%) were males, 3 (37.5%) were females, and the male to female ratio was 1.6:1. [5] Hence in the literature also mortality was more in males.In the present study, the most

common presenting complaint was pain abdomen, which was present in 100% of the patients. The second common symptom was vomiting which was present in 34% patients, followed by constipation which was present in 30% patients. In the study done by Gupta et al, the most common symptom was pain abdomen present in 100% of the patients, followed by vomiting in 43% and constipation in 31% and fever in 18.8%. [7] In the study done by Agarwal et al, the most common symptom was pain abdomen present in 100% of the patients, followed by vomiting in 57% and constipation in 24%. Fever was present in 20% patients and 19% had diarrhea.[5] In a study done by Jhobta et al, 98% patients had pain abdomen, 59% had vomiting and 38% had constipation.[14] In a study done by Malik et al on 50 patients, 48 patients (96%) had pain abdomen, 46 patients (92%) had vomiting and 45 patients (90%) had constipation. Fever was present in 64% patients and 10% had diarrhea.[15]

In the present study 74% of patients presented within 3 days, 20% patients presented between 3-6 days and nearly 3% of the patients took 7 days or more after onset of symptoms to present to the hospital. The mean duration of illness among the overall study group was 3.08 ± 2.30 days, among the survivors was 2.33 ± 1.10 days and among the non- survivors was 7.00 ± 3.02 days. Duration of illness was found to be significantly correlated with the mortality of the patients. As the duration of presentation increased, the mortality and morbidity also increased. Agarwal et al in their study reported that 80% patients presented within 3 days to the hospital, 15% patients took 4-6 days and 5% patients took more than 7 days to present to the hospital. The mean duration of illness was 2.59 days among the survivors and 3.25 days among the non-survivors. It was concluded that presentation of onset of symptoms of illness for more than one week was significantly associated with high morbidity and high mortality.[5]

In a study done by Singh et al, the mean duration of presentation of the total study group was 2.9 days, of the survivors was 2.6 days and of non-survivors was 3.8 days. It was observed that majority of patients (78%) presented after 24 hours of the onset of symptoms and mortality was higher in them. [6]

The study done by Singh et al showed that mean duration of illness among the overall study group was 3.42 ± 1.85 days, among the survivors was 2.78 ± 1.15 days and among non-survivors was 6.4 ± 1.55 days. The association between duration of illness and mortality of the patients was found to be significant (p-value <0.001).[16]

In the study done by Ahuja et al, around 50% of patients presented within 3 days and nearly one third presented after one week of presentation of symptoms. As the duration of symptoms increased, the mortality and morbidity also increased.[1]In the present study, the most common cause of perforation peritonitis was peptic perforation (46%). The second most common cause being ileal perforation (34%) followed by jejunal perforation (8%), gall bladder perforation (2%) and colonic perforation (6%).

In a study conducted by Gupta et al, peptic perforation (53%) was found to be the most common cause of perforation followed by ileal perforation (20%) and 1% were due to Meckel's diverticulum perforation. Out of the total, 4% cases were due to appendicular perforation, 9% were due to perforations in the large bowel and 13% were due to traumatic perforation.[7]

Study conducted by Agarwal et al showed that peptic perforation (39%) was most common cause of perforation in their study followed by tubercular perforation (24%) and typhoid perforation (19%). Six percent cases were due to blunt injury, 5% due to gangrenous bowel and 4% were due to stab injury.[5]

In the study conducted by Sahu et al, 42% cases were due to peptic perforation and 13% were due to ileal perforation, 16% were due to blunt trauma abdomen, 4% were due to meckel's diverticulum perforation, 4% were due to colonic perforation, 2% were due to GB perforation, 2% were due to appendicular perforation, 2% were due to stab injury and 2% were due to uterine perforation.[18] Yelamanchi et al showed in their study that 26.78 % cases were due to peptic perforation and 33.93% cases were due to ileal perforation, 12.5% cases were due to caecal perforation and 5.35% were due to appendicular perforation.[19]

In the present study, the mean body temperature of the overall study group was 38.07 ^{o}C, of survivors was 37.93 ^{o}C and of non-survivors was 38.82 ^{o}C. It was found that body temperature was significantly associated with the mortality of the patients. In a study done by Khan et al, the mean body temperature was found to be a significant factor for the development of complications but it did not produce a statistically significant effect on the mortality.[8]

Karvellas et al in their study reported the relation of the body temperature with mortality and it was found to be statistically significant.[9]

In the present study, the mean arterial pressure of the overall study group was 77.04 mmHg, of the survivors was 80.93 mmHg and of non-survivors was 56.67 mmHg, and its relation with the mortality of the patients was found to be statistically significant. In a study done by Gupta et al, the mean arterial pressure of the survivors was 80.35 mmHg and of the non-survivors was 80.36 mmHg. In this study also, the mean arterial pressure was found to be a significant factor for the mortality in patients of perforation peritonitis.[7]In the present study, the mean heart rate of the overall study group was 109.72 bpm, of the survivors was 103.76 bpm and of non-survivors was 141 bpm. Its association with the mortality of the patients was found to be statistically significant. In a study done by Gupta et al and Khan et al, the mean heart rate was found to be a significant factor for the mortality in patients of perforation peritonitis.[7,8]In the present study, the mean respiratory rate of the overall study group was 22.92/min, of the survivors was 20.71/min and of non-survivors was 34.5/min, which was found to be significantly associated with the mortality. In a study done by Khan et al and Karvellas et al, the mean respiratory rate was found to be a significant factor for the development of complications and death.[8,9]

In the present study, the mean PaO_2 of the overall study group was 85.21 mmHg, of the survivors was 91.83 mmHg and of non-survivors was 50.46 mmHg, which was found to be significantly associated with the mortality. In a study done by Gupta et al, the mean PaO_2 of the overall study group was 101.24 mmHg, of the survivors was 97.16 mmHg and of non-survivors was 124.38 mmHg. In this study, the mean PaO_2 was not a significant factor for the mortality in patients of perforation peritonitis.[7] In a study done by Khan et al, both morbidity and mortality were significantly affected by PaO_2 levels. A level below 60 was associated with the high morbidity and mortality.[8]In the present study, the mean pH of the overall study group was 7.35, of the survivors was 7.37 and of non-survivors was 7.25, which was found to be significantly associated with the mortality. In a study done by Gupta et al, the mean pH was a significant factor for the mortality in patients of perforation peritonitis.[7] In a study done by Khan et al, the morbidity and mortality were maximum in the group of patients with a pH of less than 7.35.[8]

In the present study, the mean serum bicarbonate of the overall study group was 18.37 mEq/L, of the survivors was 19.19mEq/L and of non-survivors was 14.03 mEq/L, which was found to be significantly associated with the mortality. In a study done by Karvellas et al, the mean serum bicarbonate was not a significant factor for mortality.[9]In the present study, the mean serum sodium of the overall study group was 134.6 mEq/L, of the survivors was 133.56 mEq/L and of non-survivors was 140.03 mEq/L, which was not found to be significantly associated with the mortality. In a study done by Gupta et al, the mean serum sodium was not a significant factor for the mortality in patients of perforation peritonitis.[7] In a study done by Khan et al, the Sodium levels were noted to be a significant factor for mortality, but did not influence the occurrence of complications significantly. Maximum morbidity and mortality were noted in the patients who had sodium levels of lower than 135 mEq/L.[8]In the present study, the mean serum potassium of the overall study group was 3.89 mEq/L, of the survivors was 3.87 mEq/L and of non-survivors was 3.97 mEq/L, which was not found to be significantly associated with the mortality. In a study done by Gupta et al, the mean serum potassium was not a significant factor for the mortality in patients of perforation peritonitis.[7] In a study done by Khan et al, the potassium levels were not a significant factor for mortality.[8] In the present study, the mean serum creatinine of the overall study group was 1.32 mg/dL, of the survivors was 1.13 mg/dL and of non-survivors was 2.3 mg/dL, which was found to be significantly associated with the mortality. In a study done by Gupta et al and Karvellas et al, the mean serum creatinine was a significant factor for the mortality in patients of perforation peritonitis.[7,9] In the present study, the mean haematocrit of the overall study group was 37.28%, of the survivors was 38.26% and of non-survivors was 32.13%, which was not found to be significantly associated with the mortality. In a study done by Gupta et al, also the mean hematocrit was not a significant factor for the mortality in patients of perforation peritonitis.[7]In the present study, the mean TLC of the overall study group was $9.77x10^3$/microlitre, of the survivors was $7.95x10^3$/microlitre and of non-survivors was $19.36x10^3$/microlitre, which was not found to be significantly associated with the mortality. In a study done by Gupta et al, the mean TLC was not a significant factor for the mortality in patients of perforation peritonitis.[7]

In the present study, the mean APACHE II score of the overall study group was11.18, of the survivors was 8.55 and of non-survivors was 30.50. It was found to be significantly associated with the mortality. In the present study, patients were divided into 3 groups of APACHE II score 0-10 (low-risk), 11-20 (medium risk) and 21 or more (high risk). In low-risk group of APACHE II score 0-10, there were 60% patients. In this group all the patients survived and no mortality was observed in this group. In medium risk group having APACHE II score of 11-20 score, there were 10 patients. In this group, 90% patients survived while 10 % died. In high risk group of patients having APACHE II score of 21 and above there were 10 patients. Out of these, 70% patients died while only 30% survived. We had very high mortality rate in this group, as most of the patients presented late after onset of symptoms. In a study done by Gupta et al, the mean APACHE II score of the overall study group was 13.13, of the survivors was 10.99 and of non-survivors was 25.27. In this study, patients were divided among 8 groups according to APACHE II score. In the group of APACHE II score 0-4, there were 14 patients and all these patients survived (observed mortality 0%). In the group of APACHE II score 5-9, there were 24 total patients out of which only 1 died (observed mortality 4.17%). In the group of APACHE II score 10-14, there were 25 patients out of which only1 died (observed mortality 4%). In the next group of APACHE II score 15-19, there were 17 patients out of which 3 died (observed mortality 17.65%). In the APACHE II score group of 20-24, there were 10 patients out of which 3 died (observed mortality 30%). In the group of APACHE II score between 25-29, only 3 patients were present out of which 2 died (observed mortality 66.67%). In the group having APACHE II score between 30-34, 6 patients were present out of which 2 died (observed mortality 66.67%). Only 1 patient had APACHE II score >34 and this patient died (observed mortality 100%). It was concluded that mortality is directly linked with higher scores.[7]

In a study done by Singh et al, the mean APACHE II score of the overall study group was 8.712, of the survivors was 6.1 and of non-survivors was 16.5. In this study, patients were divided into 3 groups based on their APACHE II score. In the first group, patients having APACHE II score less than 10 were included. In this group, total numbers of patients in this group were 57 and observed mortality rate was 3.50%. The next group had 19 patients with APACHE II score between 10-20 and their observed mortality rate was 73.6%. The third group had 4 patients with APACHE II score >20 and all these patients died .i.e. observed mortality rate was 100%. It was observed that mean APACHE II Score was very higher in patients who died of perforation peritonitis as compared to those patients who survived.[6]In a study done by Agarwal et al, the mean APACHE II score of the overall study group was 4.75, of the survivors was 4.05 and of non-survivors was 12.75. In current study, 69 patients were in the low risk group (apache score 0-5) and 24 patients were in the medium risk group (Apache score 6-10) and 7 patients were in the high-risk group (apache score 11-16). Of these 100% patients in low risk group and 95.8% patients in medium risk group were discharged in satisfactory manner and 100% patients expired in high risk group, indicating that mortality increased as APACHE II score increased.[5]

In a study done by Kulkarni et al, the mean APACHE II score of the overall study group was 11.38, of the survivors was 9.88 and of non-survivors was 19.25. In this study, the cases were divided into 3 main groups according to APACHE-II score. The first group consisted of patients with APACHE-II scores less than 10. In this group, the mean APACHE-II score was 5.613 and none of the 31 patients who scored less than 10 died. The second group of 16 patients had APACHE-II scores between 11 and 20. In this group, the mean APACHE-II score was 14.18 and the death rate was 31.25%. The third group included patients with APACHE-II scores greater than 20, with a mean APACHE-II score of 22.33 and the death rate in this group was 100%, as none of the 3 patients who scored greater than 20 survived. This study showed the APACHE-II scores system to be an accurate predictor of outcome in patients with peritonitis due to hollow viscus perforation.[11]In a study done by Gupta et al, the mean APACHE II score of the survivors was 12.10 and of non-survivors was 21.50. In this study, patients were divided in 3 groups based on APACHE II score. In the first group, patients having APACHE II score upto 10 were included. In this group, there were total 16 patients and all of them survived. In the next group, patients having APACHE II score between 10-20 were included. In this group, there were 25 patients out of which only 3 died. The third group had 9 patients with APACHE II score more than 20, out of which 7 patients died. It was observed that patients having APACHE II score more than 10 seemed to be of high risk group. As the score increased, the no. of complications increased. It was

observed that outcome as death of patients seems to be directly proportional to APACHE II score.[19]In a study done by Reddy et al, the mean APACHE II score of the survivors was 9.13 and of non-survivors was 16.67. In this study, patients were divided into 4 groups based on APACHE II score. There was no mortality in groups having APACHE II score of 0-4 and 5-9. However, there was 6.25% mortality in the group having APACHE II score between 10-14 and 33% mortality in group having APACHE II score between 15-20. Thus, groups having higher APACHE II score had higher mortality.[20]

In a study done by Adesunkanmi et al, the mean APACHE II score of the overall study group was 8.2, of the survivors was 7.6 and of non-survivors was 9.4. In this study, there was no death among the patients who scored 0-4, whereas mortality was 13% in patients having score between 5-9, 41.2% in patients having score between 10-14, and 50% in patients who scored 15-19. However, it was found that the APACHE II Score only predicted mortality but did not predict the incidence of other postoperative complications.[21]

CONCLUSION

Our study concludes that peritonitis secondary to hollow viscous perforation is predominantly a disease of the young males, commonest cause is peptic perforation. Factors influencing the mortality in these patients were arterial blood gases and biochemical parameters (PaO_2, pH and $HCO3^-$, S. Cr.). Mortality was found to increase significantly as APACHE II score increased, particularly in patients having score of 21 and above. APACHE II score can be used as a good stratification tool in patients of perforation peritonitis. It can help to decide procedure to be performed, necessary pre-operative preparation, counselling of the patient and care takers and optimisation in high-risk patients. It can be beneficial in predicting the outcome so that better risk assessment, prognostication of patients, decision making and hence, proper resource allocation can be done.

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