

## Pre-operative Apache II score as a tool to predict outcome in patients with gastrointestinal perforation at RIMS, Ranchi.

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### Abstract:

**Background:** Perforation peritonitis is one of the most commonly encountered surgical emergencies by a resident surgeon. Many scoring systems have been used to predict the mortality and the outcome of the patients presenting with secondary peritonitis. The study aims at using APACHE II score preoperatively and correlate with post-operative outcomes in patients with gastrointestinal perforation and to observe its accuracy and limitations in predicting post-operative morbidity and mortality.

**Material and Methods:** This was a prospective cross sectional study which was carried out in the department of surgery at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand (India) from November 2015 to October 2017 on 52 patients admitted for gastrointestinal perforation. The objective was to evaluate APACHE II score in predicting outcome of patients having gastrointestinal perforation.

**Results:** The mortality rate in the study was 15.4%, all patients having APACHE II score  $\geq 21$  with mean APACHE II score  $26.3 \pm 3$ . The most common morbidity faced was surgical site infection and wound failure. The average hospital stay was  $11.5 \pm 4.9006$  days, maximum being 14.33 days in the middle group. The area under the ROC curve for mortality prediction by APACHE II score was 0.966 with 100% sensitivity and 90.91% specificity. Other components contributing to increased mortality include increasing age,  $GCS < 15$ , pre-operative renal failure, tachycardia, hyponatremia, hyperkalaemia and acidic pH.

**Conclusion:** The outcome can range from uneventful discharge to death. Patients with score  $\geq 11$  were at a risk of developing complications and a rise of score to more than 20 carries a very high risk of mortality. The sensitivity of APACHE II score to predict post-operative mortality ranges between 92.31-100%. Thus it is a good tool for guiding management. However APACHE II score cannot specifically predict the morbidity of the patients. Individual components of APACHE II also give a rough idea and forms risk factors in mortality prediction.

**KEY WORDS:** Gastrointestinal perforation, secondary peritonitis (SP), APACHE II score, mortality, outcome.

Date of Submission: 02-11-2018

Date of acceptance: 16-11-2018

### I. Introduction:

Perforation peritonitis is one of the common encountered surgical emergencies which requires early diagnosis and prompt initiation of resuscitative measures and timely surgical intervention. (1) The prognosis depends on many factors in cases of secondary peritonitis. The factors that independently influence the outcomes are; abdominal abscess formation; advanced age; malignancy; development of sepsis, Systemic Inflammatory Response Syndrome (SIRS); MODS; interval between onset of symptom and time of surgery; persistent infection, recovery of *Enterococci*; multidrug-resistant gram-negative organism; fungal etiology. Although the exact outcome can never be assumed, yet many scoring systems have been used to predict the mortality and the outcome of the patients presenting with secondary peritonitis (SP) many of which have shown encouraging results. (2) APACHE II score is applied within 24 hours of admission of a patient to an intensive care unit (ICU): an integer score from 0 to 71 is computed based on several measurements. The first APACHE model was presented by Knaus et al. in 1981. The point score is calculated from a patient's age and 12 routine physiological parameters. The values are put in an equation and the score is calculated. Higher scores correspond to more severe disease and a higher risk of death. (3) The study intends applying pre-operative APACHE II score in patients with secondary peritonitis and stratify their risks and predict their post-operative outcomes and mortality.

## II. Materials and methods:

Keeping above objectives in mind the study was carried out at RIMS in state of Jharkhand from November 2015 to October 2017 (two years) after taking permission from the institutional ethical committee. The study observed 52 patients admitted for gastrointestinal perforation in emergency of RIMS. Clinical and laboratory work up were done and preoperative APACHE II score was calculated using medical calculator (Medical Tools app) software and patients were divided in three groups and were followed post operatively for various outcomes. The statistical calculations were done using MedCalc software (version 148.1). Patients below 12 years of age and those who did not undergo surgical intervention were excluded from the study. The clinical parameters and laboratory parameters including arterial blood gas were noted and preoperative APACHE II score was calculated and patients were divided in three groups A with score 5-11, B score 12-20 and C of score more than 21. The patients were followed post operatively for following outcomes: uneventful Discharge, surgical site infection/ wound failure, post-operative septicemia, death or others.

## III. Results:

The minimum age in the study was 12 years while the oldest studied patient was a 78 years old male. The mean age in the study was 44 years with standard deviation (SD) of  $\pm 17.8$  years. There were 40 males (76.92%) and 12 females (23.02%) with male to female ratio of 3.3:1. Around 54% of the patients were between 26 to 55 years of age group. (Fig 1).

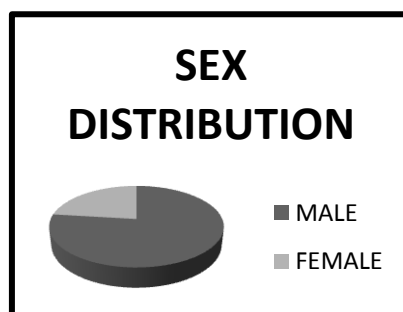


Figure 1

The most common etiology was gastric and duodenal ulcer perforation with traumatic perforations being the next most common. The most common site was anterior wall of first part of duodenum. A single case of malignancy seen was the carcinoma stomach of distal part and the patient underwent gastrojejunostomy. Most of the traumatic perforations were mainly iatrogenic and the most common site was ileum with the next common etiology being road traffic accident. [Table 1]

**Table1. Etiology behind gastrointestinal perforation**

Etiology	No. of cases (%)
Peptic ulcer perforation	33 (63.46)
Traumatic perforations	09 (17.30)
Gangrenous Appendicular perforation	06 (11.53)
Enteric perforation (Ileal)	03 (5.76)
Malignant perforation	01 (1.92)
Total	52

APACHE II score was calculated pre-operatively for each patient and they are categorized in three groups. As all the patients underwent emergent surgical procedure, therefore minimum APACHE II score was 5 while maximum observed score was 37. The mean APACHE II score of the study was 14.769 with a standard deviation of  $\pm 7.6584$ . Most patients'  $\sim 42.3\%$  fell in Group 1. The study has used the model proposed by Knaus et al. (1985) to calculate APACHE II score. [Table 2]

**Table2**

APACHE II Score	Group	No. of Patients	Sex Distribution
5-11	A	23 (42.3%)	Male: 20 Female: 3
12-20	B	17 (34.61)	Male: 10 Female: 7
$\geq 21$	C	12 (23.07%)	Male: 10 Female: 2
Total		52	52

Each patient was thoroughly followed after the surgery and was looked for the following complications i.e. surgical site infection including wound failure (SSI/WF), post-operative septicemia (POS) and complications related to it, other complications (OC) like anastomotic leak, dyselectrolytemia, renal failure, and death. The patient was labeled uneventful if does not suffer the above complications. Nearly 50% (26 out of 52) of patients were discharged without any complications and the mortality rate in the study was 15.39% (8 out of 52 patients) all patients belonging to group C with Apache II score  $\geq 21$  with mean score  $26.33 \pm 3$ . Most common complication observed was surgical site infection and wound failure (50%). Post-operative septicemia was diagnosed on the basis of blood picture and patient fulfilling criteria for SIRS or MODS. [Table 3]

**Table3.**

Event	Group A	Group B	Group C	p value and (contingency coefficient)
Uneventful (UE) Discharge	20	6	0	0.0005 (0.480)
SSI/ WF	2	9	2	-
POS	0	0	2	-
Other Complications	0	3	0	-
Death	0	0	8	0.0003 (0.552)

The mean hospital stay was 11.05 days SD  $\pm 4.9006$  days with minimum stay of 2 days and a maximum of 24 days. We can infer that Group B had patients with maximum morbidity and thus maximum hospital stay whereas due to increased death rate in group C the hospital stay was shortened. Group had the most significant result in comparing the hospital stay. On performing chi-square test ( $\chi^2$ ) we got p value 0.067 for the trend with contingency coefficient as 0.294. In our center uneventful discharge took place between eighth and ninth post-operative day. [Table 4]

**Table 4.**

Group	Average Hospital Stay (Days) (p value with degree of freedom (51))
A	10 (0.1285)
B	14.33 (<0.0001)
C	8.08 (0.0001)

The age is the first parameter which was used to calculate APACHE II score. It is to highlight that mortality is proportional with the age and maximum mortality was seen in age group 56-70 years 40% while 25% in age group >70 years. p value was most significant for the age group 56-70 years. Morbidity was 50% in age group >70 years while 43% in 26-40 years. There is a near linear pattern observed for mortality and advanced age group. Glasgow Coma Scale (GCS) is a clinical scoring system which is calculated on the scale of 15 for appreciation of central nervous system response. The range of GCS in our study was from 10 to 15. For each score less than 15, a point is added to APACHE II score. We appreciated that lower Glasgow coma score raises APACHE II score and thereby the complications. 8 out of 12 (66.7%) patients in Group C had GCS <15 out of which 6 patients died. On calculation of relative risk (RR) for mortality and morbidity it came out to be 2.3295 for GCS<15 with p-value 0.0001. For only mortality RR reaches 44.2 with p-value 0.0071 with 95% confidence limit. [Table 5]

**Table 5**

GCS	No of Patients in Group A with outcomes	No of Patients in Group B with outcomes	No of Patients in Group C with outcomes
10	0	0	2 (D / SSI)
11	0	0	1 (D)
12	1 (UE)	0	2 (D/D)
13	0	2 (SSI/SSI)	2 (POS/D)
14	0	0	1 (D)
15	21 (SSI: 2 UE: 19)	16 (SSI/WF: 7 OC: 3 UE:6)	4 (SSI: 1 POS: 1 D: 2)

Pre-operative Renal Failure and Serum Creatinine were very crucial parameters in deciding the outcome of the patients as raised creatinine in presence of renal failure (oliguria/anuria) raised the APACHE II

score with 2-4 points more of the same value than without renal failure. All the patients had raised serum creatinine (>1.4 mg/dl) except one patient who had normal serum creatinine. The inference drawn was that in patients having renal failure at the time of presentation have almost 80% mortality (8 out of 10 patients) whereas it falls to as low as 5% in patients without renal failure. Overall 19 patients had raised serum creatinine of which 10 patients did not have pre-operative renal failure. 8 patients suffered morbid outcome and 1 patient died in the group. So, mortality amongst these patients was 10%. Isolated raised creatinine is not an independent indicator of mortality. [Table 6]

**Table 6.**

Outcome	Patients with Renal Failure	Patients without Renal Failure
UE	0	26
SSI/WF	3	10
OC	0	3
POS	1	1
Death	6	2
	<b>10</b>	<b>42</b>
Relative risk for all adverse outcomes (p value)	<b>2.4876 (&lt;0.0001)</b>	
Relative risk for mortality (p value)	<b>15.9714 (&lt;0.0001)</b>	

Arterial pH is an important parameter in evaluating APACHE II score. This was the privilege as compared to other studies done in the same perspective where Arterial Blood Gas analysis machine was not available. The normal range in this study was 7.33-7.49. The mean pH observed was 7.36 ±0.13. 50% patients had pH in normal range with minimum mortality (7.7%), whereas acidic pH carried increased mortality rates. The receiver operative characteristic (ROC) curve for the APACHE II score vs. mortality and morbidity was extrapolated and the following conclusions were drawn. [Table 7]

**Table 7**

Area under the ROC Curve Analysis (AUC)	
AUC	<b>0.933</b>
Standard Error	<b>0.0319</b>
Sensitivity	<b>92.31</b>
Specificity	<b>80.77</b>

The receiver operative characteristic (ROC) curve for the APACHE II score vs. only mortality was extrapolated and the following conclusions were drawn. [Table 8]

**Table 8**

Area under the ROC Curve Analysis (AUC)	
AUC	<b>0.966</b>
Standard Error	<b>0.0228</b>
Sensitivity	<b>100</b>
Specificity	<b>90.91</b>

#### **IV. Discussion:**

The mean age group in this study was 44 years with majority of patients between age group 26-55 years. The study comprised 77% male patients (n=40). In a study carried out by Rajender et al. on 504 patients in Chandigarh the mean age group was 37 years having 84% male patients. (4) In another study carried out by Rajandeeep et al. at Delhi, the mean age group was 37.8 years with 68.5% male patients. (5) Hence it can be inferred that secondary peritonitis due to gastrointestinal perforations mainly occurs during middle age with male preponderance.

The most common etiology which was observed in the study was perforated peptic ulcer in 63.46% of cases with duodenum and prepyloric region being the most common [Table 1]. The pattern observed in a study by Partha et al. carried on 545 cases was similar with 264 (48.44) patients had gastroduodenal perforations. (6) Janardhana et al. in his study on 603 patients observed 343 patients had gastroduodenal perforation due to acid peptic disease. (7, 8) It can be noticed that gastroduodenal perforation is secondary to acid peptic disease is the most common cause of secondary peritonitis.

On calculation of preoperative APACHE II score the patients were categorized in three groups and 42.3% of patients had score ≤11 and the outcomes of the patients were analysed [Table 3]. The mortality rate in the study was 15.39%, all the patients having APACHE II score ≥21 [Table 3]. In a study carried out by Anand et al. on 100 patients with mortality rate 8% in the group with mean APACHE score 16. (9) In a study by Reddy et al. on 50 patients, the observed mortality was 14% with all deaths occurring in patients with APACHE II

score  $\geq 17$ . (10) It can be understood that higher APACHE II score at the time of admission carries a very high risk of mortality.

The morbidity parameters taken into consideration were surgical site infection (including wound failure), post-operative septicemia and other complications.

The most common complication seen in this study was surgical site infection/ wound failure in 50% patients [Table 3]. In a study carried out by Abdul et al. the most common observed complications was wound dehiscence and wound infections (71%) patients. (11) A study done by Sahu et al. on 50 patients, it was observed that wound infection was the most common morbidity (40%). (12) It can be said that surgical site infection leading to wound complications is the most common post-operative comorbid condition seen in the survivors.

The average hospital stay of patients followed in this study was 11.05 days with mean hospital stay of 8.08 days in Group C (APACHE II score  $\geq 21$ ). In a study carried out by Sarabjeet et al. on 60 patients the average hospital stay was more in patients with APACHE II score  $\geq 10$  (20.96  $\pm$  5.09 days). (13) In another study by Ahuja et al. the mean hospital stay was 12 days in survivors. (14) It can be appreciated that a rise in APACHE II score causes prolonged hospital stay due to increased complications, however a further rise in score causes increased risk of mortality and thus a *paradoxical dip* is seen in the duration of stay [Table 4].

On extrapolating the receiver operating characteristic (ROC) curve for pre-operative APACHE II score for morbidity and mortality, the area under the curve (AUC) was 0.933 with a sensitivity and specificity of 92.31% and 80.77% respectively whereas extrapolating the curve only for mortality fetched 0.966 area under the curve with sensitivity and specificity of 100% and 90.91% respectively [Table 7, 8]. In a study carried out by Kulkarni et al. in 2007 on 50 patients the ROC analysis for mortality by APACHE II score had AUC of 0.984 and 100% sensitivity of score with 73.8% specificity. (15) A study carried out by Das et al on 34 patients for comparing various scores in SP had 0.958 AUC with 100% sensitivity and 85.2% specificity. (16)

It can be concluded that sensitivity of APACHE II score reaches 100% for mortality although its specificity is little low for both mortality and morbidity.

The limitations of the study were in prediction of morbidity. When used with mortality the validity of the score reduced. However a large sample might overcome this problem. Not all components of the score have equal significance and hence a modification of the score is required for precision. The etiology and time since presentation have not been taken into consideration which does influence the outcome.

## V. Conclusion:

Secondary peritonitis due to GI perforation is a surgical emergency requiring prompt resuscitation and timely intervention. APACHE II score can be used as a tool to predict outcome in the patients with secondary peritonitis. Higher scores are associated with increased mortality and morbidity. Thus it is a good tool for stratifying patients and guiding management warranting from resuscitation to multimodality ICU management involving various disciplines.

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