

Original Research Article

A prospective study of outcome and monitoring of patients with perforation peritonitis by using APACHE 2 score

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ABSTRACT

Background: Perforation peritonitis is very common surgical emergency and despite newer and advanced technology as a monitoring system APACHE 2 score have a good predictive power to predict outcome and monitoring in such patient

Methods: This is a prospective study by which APACHE 2 score was applied over the patient before the surgery and after the surgery at first post operative day and score was calculated in selected preformed and result was concluded

Results: The outcome of the Patients largely depends on age, perforation size, duration of presentation, and duration of hospitalization all these are well correlated with APACHE 2 score to predict outcome and monitoring.

Conclusions: The accuracy of APACHE 2 score to predict the outcome in perforation peritonitis increases when the result of score was combined which was applied two time prior to surgery and after the surgery.

Keywords: Perforation peritonitis, Outcome, APACHE 2 score, Surgical emergency

INTRODUCTION

Perforation peritonitis is a surgical emergency where we need a preoperative strategic plan for management of the patient to prevent operative complications. Here a scoring system can play a crucial role to exclude high-risk patients. APACHE 2 score can differentiate the level of severity prior to surgery and can direct the plan of the management accordingly original APACHE score (APACHE 1 score) was first used in 1981 and it scored for three patient factor that influence the score illness outcome.²

Pre-existing disease, patient reserve, severity of acute illness.

The APACHE II is measured during the first 24 h of ICU admission. The maximum score is 71. The APACHE II severity score has shown a good calibration and

discriminatory value across a range of disease processes and remains the most commonly used international severity scoring system worldwide. APACHE II is a very affordable, assessable and easily applicable tool in the ICU. In perforation peritonitis, within first 24 hr of admission patients remain in ebb phase (first phase of the stress response). Here the APACHE 2 score can be applied to inquire about the hyper-metabolic status before surgical intervention. After that, in next 48 to 72 hr the flow phase takes place. Here the APACHE 2 score is applying again over the surgically corrected patient.

This gives two APACHE scores to predict the outcome and monitoring of the patient. The stress response nearly always resolves itself without complications. Therefore, the APACHE 2 score can be applied at 48 to 72 hr after the post-operative period to know the severity of the catabolic process. At this point, the plan of management can be modified as per the score severity.

To reduce the mortality and post-operative complication, dual application (preoperative and postoperative score) of APACHE 2 score may help to improve the outcome and monitor the crucial period so that the patient can make an early and rapid recovery.

METHODS

This is a teaching institute based prospective study performed in the department of general surgery, GMC Bhopal & associated Hamidia Hospital. The study was started after approval from the Ethical Committee from September 2018 till August 2020.

A total of 100 consecutive patients diagnosed with perforation peritonitis secondary to hollow viscus perforation and treated surgically were included and statistical testing was conducted with the statistical package for the social science system version statistical package for social sciences (SPSS) 17.0. Continuous variables are presented as mean \pm SD, and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. A receiver operating characteristics (ROC) analysis was calculated to determine optimal cut-off value for APACHE 2 score. The area under the curve, the sensitivity, and the specificity was also calculated to analyze the diagnostic value of APACHE2 score correlating with outcome. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Inclusion criteria

Those who gave written consent for the surgery. Who were morbid to severely symptomatic and had an indication for surgery. Age more than 14 years.

Exclusion criteria

Age of less than 14 years. Who did not give consent for surgery. Those who presented with a traumatic cause.

The patient who belongs to inclusion criteria were admitted in the surgical emergency ward with the complaints of abdominal pain, abdominal distension, fever, nausea, vomiting and not passing flatus and motion. Detailed history was taken and evaluated to exclude blunt trauma abdomen and associated comorbidities. APACHE II score were collected on admission. After general and abdominal examination was done and clinically the patient was diagnosed as acute abdomen, the vital signs were assessed and the patient was resuscitated with crystalloid infusion and blood transfusion (if necessary) along with broad spectrum antibiotic coverage. Stomach decompression was done with nasogastric tube insertion and vital organ perfusion was monitored by urine output

after urinary catheterisation. After resuscitation emergency blood investigations were sent including complete blood picture, renal function test, serum sodium, serum potassium, random blood sugar and viral markers. Rectal temperature was noted after taking informed consent and arterial blood gas analysis was done along with Calculation of Glasgow Coma Scale. Once the patient was stabilised, the following radiological investigations were done: -after the surgery (first post-operative day) again all variables of the APACHE 2 score were filled in selected proforma and APACHE 2 score was calculated. Both score (first prior to surgery and second at first post-operative day) was filled in master chart in excel sheet along with other parameter and statistical analysis was done with significance test and result and observations was obtained.

RESULTS

The age factor is significantly associated with the outcome in current study as group 41-68 years more belongs to deaths group and the age group 26-54 years more belongs to recovery group. P-value of correlation between age an outcome is significant (p-value < 0.05).

Table 1: Age distribution among study groups.

	Outcome		P value
	Deaths	Recovery	
	Mean \pm SD	Mean \pm SD	
Age	54.68 \pm 13.62	40.70 \pm 14.18	0.000

Table 2: Duration of presentation among study group.

	Outcome		P value
	Deaths	Recovery	
	Mean \pm SD	Mean \pm SD	
Duration of presentation in days	5.42 \pm 1.12	3.69 \pm 1.54	<0.001

Table 3: Distribution of perforation size among study group.

	Outcome		P value
	Deaths	Recovery	
	Mean \pm SD	Mean \pm SD	
Perforation size in cm	3.32 \pm 1.29	1.71 \pm 1.13	0.000

Table 4: Distribution of duration of hospitalization among study group.

	Outcome		P value
	deaths	Recovery	
	Mean \pm SD	Mean \pm SD	
Duration of hospitalization	3.63 \pm 2.24	9.91 \pm 2.33	<0.001

The duration of presentation is another factor in current study that significantly influenced the outcome as mean of

the duration of presentation was 5.4 days in deaths group and 3.6 days in recovery group. These findings are significant as p value<0.001.

The perforation size also influenced the outcome the current study showed that as larger the size of perforation

the patient tends to belongs to the death group. In current study the perforation size ranged from 2.03–4.61 cm belongs to deaths group and 0.58 – 2.84 cm belongs to recovery group which is significant as p value 0.000. (Table 3).

Table 5: Test characteristic of APACHE 2 in first 24 hour.

	Sensitivity	Specificity	PPV	NPV	Accuracy
Apache score 2 in first 24 hr	94.7%	91.4%	72.0%	98.7%	92.0%

Table 6: Test characteristic of APACHE 2 on first post-operative day.

	Sensitivity	Specificity	PPV	NPV	Accuracy
Apache 2 score on first post-operative day	100.0%	100.0%	100.0%	100.0%	100.0%

Table 7: APACHE II score.

Physiologic Variable	Points								
	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (°C)	≥41	39-40.9		28.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<29.9
Mean Arterial Pressure (mmHg)	≥160	130-159	110-129		70-109		50-69		≤49
Heart rate (/ min)	≥180	140-179	110-139		70-109		55-69	40-54	≤ 39
Respiratory rate (/min)	≥ 50	35-49		25-34	12-24	10-11	6-9		≤ 5
Oxygenation (mmHg)									
a. A-aDO ₂ if FiO ₂ ≥0.5	500	350-499	200-349		<200 >70	61-70		55-60	<55
b.PaO ₂ if FiO ₂ <0.5									
Acid Base Balance									
a) Arterial pH		7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
b) Serum HCO ₃ (mEq/l) if no arterial blood gas	≥ 52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
Sodium (mEq/l)	≥ 180	160-179	155-159	150-154	130-149		120-129	111-119	≤ 110
Potassium (mEq/l)	≥ 7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Creatinine (mg/dl)	≥ 3.5	2-3.4	1.5-1.9		0.6-1.4		≤0.6		
Hematocrit (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		<2.5
White blood count (x1000/mm ³)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
Glasgow coma score (GCS)	Score - 15 minus actual GCS								
Total acute physiology score (sum of 12 above points)									
Age points (years)	≤44=0; 45 to 54=2, 55 to 64=3, 65 to 74=5, ≥75=6								
Chronic health points*									
Total APACHE II score (add together the points from A+B+C)									

The mean duration of hospitalisation was 1.39–5.87 in deaths group and mean duration of hospitalisation was 7.58 to 12.24 in recovery group in current study is the

significantly associated with outcome as in both recovery and deaths group as p value is<0.001 (Table 4).

The cut-off value of APACHE 2 score prior to surgery is 13 and at first post-operative day is 14 in current study. With the cut-off value 13 the accuracy rate of APACHE 2 score in first 24 hours is 92% with the sensitivity 94.7%, specificity 91.4%, PPV 72.0%, NPV 98.7% (Table 5).

With the cut-off value 14 on first post-operative day in current study the accuracy rate of APACHE 2 score is 100% with the sensitivity 100%, specificity 100%, PPV 100% and NPV 100% (Table 6).

DISCUSSION

This was a prospective study where we assessed the outcome of the patients and correlated it with APACHE 2 scores and other parameters of the study. The APACHE 2 score was applied two times, first at the time of admission (before the surgery) and second on first post-operative day. In our study, we tried to strengthen the power of APACHE 2 score by dual application of it for better classification and management of the patients. This study included 100 patients where 27 females and 73 males were examined.

The numbers of patients with recovery was higher in males than in female but in our study the impact of gender over the outcome and APACHE score correlation was statistically insignificant. Kathleen M. Akgün and their colleague's 2010 support our finding.³ The outcome of the patient is greatly impacted by the time of presentation and its impact is more over deaths than recovery. Longer the duration of presentation, higher is the incidence of mortality. This is the most significant finding in our study with a p value of <0.001 (p value <0.05 is significant). The maximum percentage of deaths (42.1%) occurs on 5th day of onset of a symptom and minimum percentage of deaths (5.3%) on 3rd day of onset of a symptom. This implies that if the patient of perforation peritonitis presents in surgical emergency with a longer history (4.3-6.54 mean days in our study), she/he should put in a high-risk category, with a high risk of mortality. Xiaoming et al suggest the same finding in their study.⁴ The size of perforation has also great significance in our study. We also found that both duration of presentation and size of perforation together can be a major factor to decide the high-risk patient. In our study, the perforation size range from 2.03 cm to 4.61 cm increase the chance of non-survival of the patient whereas the perforation size range from 0.58cm to 2.84cm has a better prognosis. In our study the p-value of perforation size is 0.000 which is highly significant (p value <0.05 significant). Munghate et al showed in their study that perforation size along with APACHE 2 score can be guided for surgical correction rather than the outcome of the patient.⁵ The patients in recovery group had longer duration (7.58 12.24 mean days) of the stay in the hospital which was significant in our study p value <0.001 (p value <0.05 is significant). Similar finding was observed in a study of Handyal 2019. The application of APACHE 2 score over the morbid patient and who require urgent surgical correction can help many aspects of clinical management like the reduction of a prolonged stay in

hospitalization, reduce resource utilization, identification of the high-risk patient, decreases bias regarding the surgical correction. The mean value of APACHE 2 score in our study prior to surgery was 17.58 in the deaths group and 8.80 in the recovery group. There was a statistically significant difference between the two groups (p=0.001).

This indicated that the APACHE 2 score was higher in the deaths group than in recover group. This leads to the inference that higher APACHE 2 score correlates with a higher incidence of morbidity and mortality. In our study, we also applied the APACHE 2 score at the first post-operative day to assess the outcome and monitor the clinical status of the patient. We found that patient who were in deaths group had APACHE 2 score 21.05 ± 3.61 (Mean \pm SD) and those who were in recovery group the APACHE 2 score was 6.60 ± 2.01 (Mean \pm SD). P value was (<0.001) which is significant and similar to first APACHE 2 score which was applied prior to surgery. We observed that double application of APACHE 2 score (first time prior to surgery and the second time at first operative day) had similar calibration (both p value <0.001) to assess the outcome in a patient of perforation peritonitis.

We also tried to perform model discrimination of this scoring system in a patient of perforation peritonitis by calculating the area under the curve in receiving operator curve which is 0.966 (AUC of APACHE 2 score prior to surgery) and 1.000 (AUC of APACHE 2 score at first postoperative day) both calculation are more than 0.07 (AUC) so we found in our study that both APACHE 2 score nicely discriminate the group of the death from recovery group there was no significant difference if we apply APACHE 2 score prior to surgery or the first post-operative day the core time of application of APACHE 2 score remain the same as previously proven (within 24 hr of admission). This value is higher when compared to values found by another worker, who evaluated APACHE 2 scoring system in ICU patient including both surgical and medical patients in their study group (0.89 in Hong Kong 6, 0.86 in Canadian 7, 0.83 in the UK 8, 0.78 in Japan 9 studies. In our study higher deaths were associated with higher mean APACHE 2 score because we included hollow viscus perforation peritonitis with various pathologies whereas in Schein study included only gastric and duodenal perforation which showed lower deaths rate with lower mean APACHE score of the study group. We couldn't compare our observed deaths rate with other deaths rate who evaluated the APACHE 2 score in ICU patient in their study because they performed APACHE system over both medically and surgically ill patient whereas we perform APACHE system only on the surgical patient. As a medical patient has higher APACHE 2 score than a surgical patient.

CONCLUSION

In our study we conclude that APACHE 2 score can be a very important tool to assess the outcome and monitoring of the patient with perforation peritonitis when it is used

along with other factors like duration of the presentation, perforation size and hospitalisation stay. Its accuracy increases when dual score is applied (on admission and the first post-operative day). We observed in our study that APACHE 2 score become more accurate to predict the outcome after surgical correction rather than prior to surgery. The cut-off APACHE 2 score on first post-operative is 14 in the current study where sensitivity, specificity, PPV, NPV and accuracy are 100%. Other following conclusions were drawn. As the patient's age increases there is a higher chance of worse score and higher chance to fall in the high-risk group. As the duration of presentation increases, it leads to derangement of the acute physiological score and worse score which leads to the patient in the high risk group. As size of the hollow viscus perforation increases, it leads to increased contamination of the peritoneal cavity which leads to an increase of acute physiological score and worse APACHE 2 score which stratifies the high-risk patient. When we apply APACHE 2 score prior to surgery (in first 24 hr) the sensitivity, specificity, PPV, NPV of APACHE 2 score is less than the APACHE 2 score performed on the first post-operative day. We can say that on the basis of the current study in the patients of perforation peritonitis the outcome and monitoring of the patient can be better assessed by application of APACHE 2 score on first post-operative day (after surgical correction). The limitation of our study was a small sample size; it should be evaluated on a larger population.

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