Section: General Surgery

Original Research Article

STUDY OF CORRELATION BETWEEN PREDICTIVE EVALUATION OF APACHE II AND SAPS II SCORING SYSTEM IN CASE OF SMALL BOWEL PERFORATION

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Abstract

Background: To study the correlation between predictive evaluation of Acute physiology and chronic health evaluation II (APACHE II) and simplified acute physiology score II (SAPS II) scoring system in patient with small bowel perforation with objectives to identify patients at higher risk by comparing both the scores and to evaluate the factors affecting morbidity and mortality rate in patients with small bowel perforation treated with operative intervention. **Materials and Methods:** This Cross-sectional study was conducted in the Department of General surgery, Govt. Medical College & STM hospital, Haldwani, India, on 100 with the diagnosis of small bowel perforation whose plain x-ray abdomen and per operatively have features of hollow viscera perforation were scored according to APACHE II and SAPS II scoring system using Combination ICU Mortality Calculator by Clincalc.com. Post-operatively, complications and mortality outcome were recorded and was noted in terms of survivors and non-survivors. **Result:** Out of hundred, 30 patients did not survive. Factors such as Late presentation, higher age group, duodenal perforation, perforation as a complication of enteric fever and features of dehydration at time of presentation carried poorer prognosis. Additionally, it was observed that higher the score, higher was the mortality, we also observed that SAPS II is better predictor (AUC 0.868) of patient outcome than APACHE II (AUC 0.791). Also, SAPP II better corelated with correlated with patient's outcome with correlation coefficient of 0.586 than APACHE II 0.462. **Conclusion:** In both APACHE II, SAPS II less mortality rate was noted than predicted percentage at lower scores. However, SAPS II better correlated with patient's outcome (mortality) than APACHE II and also, SAPS II better predicted patient's outcome than APACHE II.

INTRODUCTION

A potentially fatal consequence that can arise from intestinal perforation, which is defined as the loss of continuity of the intestine wall. Common triggers for perforation include injury, instrumentation, inflammation, infection, malignancy, ischemia, and blockage. Small bowel perforation is one of the common surgical emergencies in India. Early recognition and prompt treatment are critical to prevent the morbidity and potential mortality of peritonitis and its systemic sequelae that result from the spillage of intestinal contents.[1] With the use of adjunctive studies, a comprehensive history, physical examination and use of various scoring systems can help quickly establish the diagnosis and better direct treatment plan. India continues to have a distinct range of aetiologies for perforation peritonitis than western nations and there is a dearth of information on its aetiology, prognostic markers, morbidity, and death pattern there is paucity of data regarding its aetiology, prognostic indicators, morbidity and mortality pattern.[2]

The severity of acute peritonitis and abdominal sepsis is rated using a variety of scoring systems that have been developed. The APACHE (acute physiology and chronic health evaluation system) and the SAPS (simple acute physiology score) are the two scoring systems that are most frequently utilized. These systems were designed to predict outcomes in form of mortality and morbidity in critically ill patients when compared with the

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outcome of other patients and uses some common variables that include age; vital signs; assessments of respiratory function, liver function, renal function, and neurologic function; and evaluation of chronic medical illnesses.[3]

APACHE II (Acute Physiology and Chronic Health Evaluation II) is one of the intensive care unit (ICU) scoring system used to estimate severity-of disease. The first APACHE model was presented by Knaus et al. in 1981.[4] The APACHE II score is very popular and has been used in both surgical and non-surgical patients, it has also been validated using many patients over several years in many centers in the developed countries. The sum of patients age score, the chronic health score, and acute physiology score constituting 12 other physiological parameters constituting 12 routine physiological measurements which include: AaPO2 or PaO2 (depending on FiO2), temperature (rectal in ℃), mean arterial pressure (mm Hg), pH arterial/HCO3(Venous mmol/L if no ABG), heart rate, respiratory rate, serum sodium, serum potassium, creatinine, hematocrit, white blood cell count and Glasgow coma scale are used to calculate a total score ranging from 0 to 71 within first 24 hour of their ICU admission. The score is not recalculated during the stay. If a patient is discharged from the ICU and readmitted, a new APACHE II score is calculated.

SAPS II (Simplified Acute Physiology Score) is a severity of illness classification system and was designed to determine how severe the condition is in patients who have been hospitalized to intensive care units and are at least 15 years old during the first 24 hours of their stay in the ICU, with scores ranging from 0 to 163, and predicting death ranging from 0% to 100%. During the stay, no new score is computed. A fresh SAPS II score may be computed if a patient is released from the ICU and then readmitted. The total score is calculated only once by adding age score from 12 routine physiological measurements during the first 24 hours, type of admission, information about previous health status which includes history of metastatic cancer, haematological malignancy and HIV status of the patient are obtained at time of admission.[5]

The difference between these two scores can be attributed to the fact that APACHE II assigns weightage to diagnostic categories whereas in SAPS II, the type of admission, such as scheduled surgical, unscheduled surgical, or medical case, affects the score.

MATERIALS AND METHODS

The data for the study was collected by taking detailed history, careful clinical examination, appropriate radiological, and serological investigation, per operative findings of the all the patients with the diagnosis of perforation peritonitis meeting inclusion and exclusion criteria admitted in scheduled unit under the Department of General Surgery, Government medical college (Dr Susheela Tiwari Government Hospital) Haldwani between 21 months January 2021 – September 2022 were included in the study after taking their informed consent. Ethical clearance was obtained from our institutional Ethical Committee. Inclusion criteria were Patients with features of small bowel perforation whose plain x-ray abdomen showed features of hollow viscera perforation, Patients with blunt or penetrating injury of the abdomen with signs of small bowel perforation. Exclusion Criteria were Patient who presented with features of peritonitis and had no evidence of perforation radiologically and per operatively, Patients with post-operative peritonitis as a complication of surgery, Patient with iatrogenic perforation during laparotomy or endoscopy, patient with esophageal gastric and large bowel perforation and patient not giving consent. Surgical management of each of these cases was done appropriate to the site of perforation, type and pathology involved. All investigations necessary to obtain the two scores (APACHE II, SAPS II) for each patient was done once within 24 hour of ICU admission and were scored according to APACHE II and SAPS II scoring system using Combination ICU Mortality Calculator by Clincalc.com. Post-operatively, complications and mortality were recorded and outcome was noted in terms of survivor and non-survivor.

Statistical Analysis

Data was analysed using parametric or non-parametric tests based on the distribution of the values obtained. Results were expressed as frequency, percentages, mean and Standard deviation. Chi-Square Test was applied. Spearman's rho was used for assessment of correlation. P value less than 0.05 was considered significant.

RESULTS

Demographic outcomes are depicted in table 1. Out of the 100 patients, 77 were males and 23 females comprising of 77% and 23% respectively. 85% of the patients were below 60 years of age whereas 15% belonged to age group above 60 years.

Table 1: Demography and Outcome

Gender	Variables	Patient outcome		Total	P value
		Survivor	Non-Survivor		
Female	Count	15	8	23	0.568
	%	65.2%	34.8%	100.0%	
Male	Count	55	22	77	

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	%	71.4%	28.6%	100.0%	
Total	Count	70	30	100	
	%	70.0%	30.0%	100.0%	

As shown in [Table 2] most of the patients i.e., 76% were diagnosed as a case of illeal perforation followed by duodenal (19%) and jejunal perforation 5% respectively. In this group maximum mortality was seen in patients with duodenal perforation i.e., 36.8% (7/12) followed by illeal perforation 30.3% (23/53) and whereas in patients with jejunal perforation no mortality was seen 0% (0/5) which is exhibited in [Table 3].

Table 2: Assessment of Diagnosis and Patient Outcome

Diagnosis	Variables	Patient outcome		Total	P value
		Improved	Non-Survivor		
Duodenal perforation peritonitis	Count	12	7	19	0.277
	%	63.2%	36.8%	100.0%	
Illeal perforation peritonitis	Count	53	23	76	
	%	69.7%	30.3%	100.0%	
Jejunal perforation peritonitis	Count	5	0	5	
	%	100.0%	.0%	100.0%	
Total	Count	70	30	100	
	%	70.0%	30.0%	100.0%	

Table 3: day of presentation and patient outcome

Day of presentation	Variables	Patient outcome		Total	P value
		Survivor	Non-Survivor		
<3	Count	49	5	54	0.001
	%	90.7%	9.3%	100.0%	
>3	Count	21	25	46	
	%	45.7%	54.3%	100.0%	
Total	Count	70	30	100	
	%	70.0%	30.0%	100.0%	

Of all, 54% of patients presented within 3 days of onset of symptoms were as 46% after 3 days of onset of symptoms. Overall, 30 patients among the 100 did not survive, maximum mortality was seen in patients belonging to age group more than 60 years i.e., 53.3 % (8/15) and also in patients who presented after 3 day of onset of symptoms comprising of 54.3% of all 46 patients presenting late as depicted in [Table 4].

Table 4: Assessment of Age Group and Patient's Outcome

Age group	Variables	Patient outcome		Total	P value
		Survivor	Non-Survivor		
<60	Count	63	22	85	
	%	74.1%	25.9%	100.0%	0.03
≥60	Count	7	8	15	
	%	46.7%	53.3%	100.0%	
	Count	70	30	100	
	%	70.0%	30.0%	100.0%	

Of the 30 non survivor 8 34.8% were females and 30 (28.6%) were males but this difference was not significant as P value was found out to be >0.05. Out of the 100 patients 33% had associated illness of Koch's abdomen, whereas enteric fever, trauma, and peptic ulcer disease each was found to be associated in 15% of the patients out of which perforation following enteric fever and peptic ulcer disease had poor prognosis accounting for 33.3% mortality in total of 15 patients each who had associated illness of enteric fever and peptic ulcer disease. Individual patient APACE II and SAPS II score with estimated mortality percentage was calculated using Combination ICU Mortality Calculator by Clincalc.com. As depicted in table 5 it was found that mean APACHE II score in survivor and non-survivor was 15.6±10.9 and 27.9±8.27 with mean estimated mortality percentage of 29.16% and 60.8% respectively, whereas in SAPS II scoring average score in survivor vs non-survivor was found to 38.4±16.3 and 70.1±20.2 with estimated mortality of 28.1% and 74.4% respectively.

Table 5: Mean score observed and mean expected mortality percentage

APACHE II Score	Survivor	70	15.66	10.994	0.000
	Non-Survivor	30	27.90	8.727	
	Total	100	19.33	11.762	
APACHE II Estimated Mortality percentage	Survivor	70	29.164286	28.3408551	0.000
	Non-Survivor	30	60.863333	24.1131168	
	Total	100	38.674000	30.7128000	
SAPS II Score	Survivor	70	38.40	16.323	0.000
	Non-Survivor	30	70.10	20.269	
	Total	100	47.91	22.786	

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SAPS II Estimated Mortality percentage	Survivor	70	28.162857	27.3428960	0.000
	Non-Survivor	30	74.473333	25.8951058	
	Total	100	42.056000	34.2407912	

Finally, Correlation between the two-scoring system with patient outcome was determined as depicted in table 6 using spearman's rho method shows correlation coefficient of SAPS II is 0.586 as compared to 0.462 of APACHE II.

Table 6: Correlation between apache II score, saps II score and patient outcome

		Patient outcome	APACHE II Score	SAPS II Score
Patient outcome	Correlation Coefficient	1.000	0.462	0.586
	Sig. (2-tailed)	.	0.00	0.00
	N	100	100	100
APACHE II Score	Correlation Coefficient	.0462	1.000	0.825
	Sig. (2-tailed)	.000	.	0.00
	N	100	100	100
SAPS II Score	Correlation Coefficient	0.586	0.825	1.000
	Sig. (2-tailed)	0.00	0.00	.
	N	100	100	100

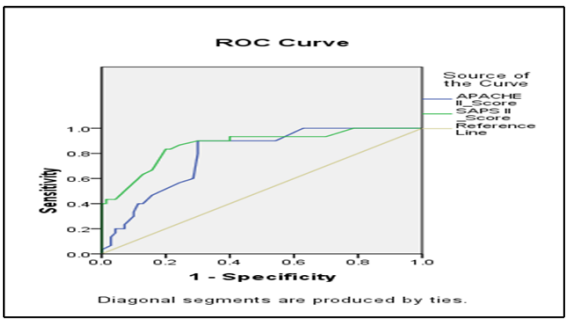

Figure 1: Recipient Operator Curve

DISCUSSION

Peritonitis has been locus for the surgeons despite advancements in surgical technique and intensive care treatment. In order to help stratify patients and, more accurately target treatment procedures, numerous scoring systems have been devised.

William A. Knaus et al,[4] conducted a study on the form and validation results of APACHE II. APACHE II uses a point score based upon initial values of 12 routine physiologic measurements, age, and previous health status to provide a general measure of severity of disease and concluded that this scoring index can be used to evaluate the use of hospital resources and compare the efficacy of intensive care in different hospitals or over time.

J R Le Gall et al,[5] conducted a study to develop and validate a new Simplified Acute Physiology Score, the SAPS II, from a large sample of surgical and medical patients, and to provide a method to convert the score to a probability of hospital mortality and concluded that the SAPS II, based on a large international sample of patients, provides an estimate of the risk of death without having to specify a primary diagnosis and this being starting point for future evaluation of the efficiency of intensive care units.

C Mani et al,[6] conducted a prospective study to discover the utility of APACHE-II triaging in small bowel perforations and they concluded that there was significant reduction in mortality and cost-effective utilization of scarce intensive care unit.

In our study of 100 patients with small bowel perforation meeting inclusion and exclusion criteria 70 patients survived and 30 patients did not survive. Males (77%) outnumbered females (23%) with male: female ratio being 3.3:1 of which 28.6% of male and 34.8% of females did not survive with 15 patients belonging to age group ≥60 years and 85 patients with <60 years of age with mortality being 53.3% and 25.9% respectively in both age group. The mean age was 42.73 ± 1.5. Intra-operatively, illeal perforation was found in 76 patients whereas 19 had duodenal perforation followed by 5 patients having jejunal perforation with (63.2%) cases of duodenal perforation peritonitis, 52 (69.7%) cases of illeal perforation peritonitis and 5 (100%) cases of jejunal perforation peritonitis survived while 7 (36.8%), 23 (30.3%) and 0 (0%) respectively did not survive though this difference was found to be non-significant as P was >0.05.Contrary to study done by M. Venkat Reddy et al,[7] who found duodenum (58%) to be the most common site of perforation followed by ileum (19%) and 6% had jejunal perforation and keshri et al,[8] found duodenal perforation, was seen in 49% of patients, followed by, ileal (24%), appendicular (20%) and others (jejunal and colonic) (7%) but in there study duodenal perforations included cases with both gastric and duodenal perforations. In this study associated chronic illness/disease or specific intra-op finding were looked for and its was found that 1 patient had colonic mass, 15 had enteric fever, 3 had ileocaecal mass, 3 had ileocaecal stricture, 33 patients had Koch's abdomen, 4 had mickel's diverticulum, 1 patient had history of NSAID abuse, 15 patients had history of peptic ulcer disease, 10 had history of trauma in 10 patients no specific cause for perforation was found with mortality being 100%,33.3% 66.7%, 33.3%,30.3%, 0%, 0%, 33.3% 13.3%, and 40% respectively in each. In this study HIV status and patient's outcome was also assessed, 10 patients out 100 had positive HIV status of which

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40% patients did not survive and of 90 patients with negative HIV status 28.9% did not survive but this difference was non- significant (P >0.05). Both APACHE II and SAPS II core was calculated within 24 hours of admission of patient in ICU. Mean APACHE II in 100 patients was 19.33 ± 10.9 with mean score in patient who survived and did not survive came out to be 15.6 ± 11.7 and 27.90 ± 8.7 respectively, with APACHE II mean estimated mortality percentage overall and in survivor and non-survivor came out to be 38.6±30.7, 29.1±28.3, 60.8±24.1 respectively. Observed mean SAPS II score with SAPS II estimated mortality percentage in overall 100 patients, and in survivor and non-survivor was found to be 47.9±22.7 (42.05±34.2%), 38.4±16.3 (28.1±27.3%) and 70.1±20.2 (74.4±25.8). All these observed values are significant (p<0.005). It was also observed in accordance with the previous studies that in proportion to a rise in score, death rates rise. It was also observed that correlation coefficient of SAPS II was 0.586 as compared to 0.462 of APACHE II score hence SAPS II scoring system was found to better correlate with patient outcome (mortality) than APACHE II.

Also, SAPS II area under curve of receiver operator curve was 0.868 with respect to APACHE II (0.791). This is in line with study by J R Le Gall et al,[5] concluded that the SAPS II provided an estimate of the risk of death without having to specify a primary diagnosis hence this is a starting point for future evaluation of the efficiency of intensive care units.

Limitation of Study

The shortcomings in this study are, the patients were managed by different surgical teams, operative duration and procedure were dependent on the skill of operating surgeon, Also, duration between patient presentation and operative intervention was dependent on availability of operation theater, Due to covid-19 flow of patients was limited for time being which made it difficult to design our study on a greater number of patients.

CONCLUSION

With these results, I conclude that, late presentation, higher age group, illeal perforation, perforation as a complication of enteric fever and features of dehydration at time of presentation were the most frequent factor affecting morbidity and mortality. Also, there is a correlation between higher scores and expected mortality percentage, and this was true for both scoring systems however this does not hold true at lower scores as mortality was lesser than estimated mortality percentage of both APACHE II and SAPS II scoring system. However, SAPS II better correlated with patient's outcome (mortality) than APACHE II.

Consistent with prior researches, it is observed that both the scoring systems can be used for evaluation of group outcome of patients with small bowel perforation. However, SAPS II is found be better predictor of patient outcome than APACHE II.

Also, further studies are need to with higher sample size of patients to get a better correlation between predicted and observed outcome in both APACHE II and SAPS II scoring system.

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