ORIGINAL ARTICLE

The Prediction of mortality using APACHE II Score in Patients Presenting with Peritonitis and Undergoing Emergency Exploratory Laparotomy

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ABSTRACT

OBJECTIVE: To Predict mortality using the APACHE II score in patients presenting with peritonitis and undergoing emergency exploratory laparotomy.

Methodology: The prospective study was conducted in Civil Hospital Karachi's surgery department from April to September 2021, with a non-probability sampling technique. A total of 84 patients of either sex between the age of 16-70 years who met the diagnostic criteria of peritonitis were included consecutively. Patients with incomplete laboratory records and uncorrectable preoperative comorbidities were excluded. The APACHE II score was categorized into three groups, and demographic details and outcomes were calculated using SPSS version 20 for the data analysis. Post-stratification Chi-square test was applied, taking a p-value of < 0.05 as statistically significant.

RESULTS: Out of 84 patients, 38 (45.2%), 37 (44%) and 09 (10.7%) had APACHE score < 10, 11-20 and ≥ 20 respectively. The total in-hospital mortality rate was 8.3%. In the patients with the lowest APACHE score < 10, a mortality rate of 2.6% was recorded. A mortality of 5.4% was recorded in patients with APACHE II group 2, while group 3 with APACHE II score > 20 had the highest mortality rate of 44%. The difference was statistically significant. (p=0.001).

CONCLUSION: The results of the APACHE II score obtained in patients classified them into three different groups based on the severity of conditions in patients with peritonitis, which validated the Prediction of increased mortality with higher scores.

KEYWORDS: Peritonitis, Exploratory laparotomy, APACHE II score, intensive care unit, outcome, in-hospital mortality.

INTRODUCTION

Peritonitis is the most common emergency encountered by surgeons all over the world. It can be severe and life-threatening in the circumstances of missed or delayed diagnosis, leaving patients untreated or severely ill individuals with late-stage presentation[1,2]. Several other factors, including old age, comorbidities, aetiology, and associated complications, can worsen the likely course of management, with the risk of mortality reaching up to 50% [3]. Moreover, in developing countries, the quality of health care, which can significantly decide the outcome, is costly and beyond the reach of low-income people, causing gaps or lack of access to high-quality health care[4]. Hospitalization is mainly delayed due to such economic constraints, which eventually results in a complex relationship between the advanced critical stage of the patient, family financial stress, the intensive care unit requirement and rising medical care expenditure[5].

To be precise, any degree of certainty with the prognosis is not only tricky, but the utilization of high technology intervention may also raise a question over the allocation of hospital resources and funds provision to terminally ill patients. Emergency laparotomy in patients for surgical causes is now a commonly performed procedure worldwide. Moreover, a mortality of 7.1 per 100,00 people has been reported, and one in six patients after emergency laparotomy die within a month of surgical intervention[6,7].

The early evaluation of functional status and accurate clinical assessment of the severity of illness in such patients is one of the critical challenges for healthcare providers to refer patients who may justify their admission to ICU to high-risk patients who are unlikely to survive[8]. Therefore, various scoring systems have been devised to assess the disease severity and predict the outcome to help clinicians determine whether aggressive management or organ support is required or decide the surgical intervention in patients, which might be futile in certain patients[9].

APACHE scoring is one of the most used scoring systems. It was initially designed three decades back by Knaus and colleagues[10]. This scoring system incorporated clinical, laboratory and physiological data and was mainly utilized at admission and during the first 24 hours after admission. APACHE scoring system quickly became the frequently applied prognostic model for its simple applicability and feasibility, and it is now widely used worldwide to predict the outcome for acutely ill hospitalized patients[11].

The evaluation of the desired outcome is based upon the accurate patient assessment and actual severity recognition of the disease. APACHE scoring system is a better indicator and can estimate the disease stratification as well as the level of accuracy of the APACHE score for predicting the death rate in patients undergoing exploratory laparotomy.[12] The rationale of utilizing scoring is primarily helpful to rethink the utilization of enormous or aggressive medical care expenditures in third-world countries. APACHE II scores can be utilized efficiently and effectively for early prognostic evaluation to identify high-risk patients undergoing emergency procedures for intensive perioperative management. Very few studies on the APACHE scoring system have been conducted in our region in patients diagnosed with perforation peritonitis undergoing exploratory laparotomy. Additionally, our study can help further future research and prediction models for decisions in difficult situations and a facet for policy making at the right time in this target group.

METHODOLOGY

The prospective study was conducted in Dr. Ruth K.M Pfau Civil Hospital Karachi's surgery department from April to September 2021. A total of 84 patients who presented to the Emergency Department and were diagnosed with peritonitis and underwent exploratory laparotomy were included after ethical committee approval from REU of the College of Physicians and Surgeons Pakistan. Patients of both genders between the ages of 16-70 were enrolled consecutively with a non-probability sampling technique after obtaining informed consent from the attendants to include them in the study project. The sample size was derived using the WHO calculator. The diagnosis of peritonitis was made clinically by history and physical examination, along with evidence of subdiaphragmatic free gas revealed on chest X-ray, followed by confirmation during exploratory laparotomy. Duty doctors assessed all patients, and in the first 24 hours, the principal investigator calculated the APACHE score under the supervision of a senior consultant with more than five years of clinical experience. The score was categorized into three groups as per operational definition. APACHE score included 12 variables based on clinical and laboratory data, including heart rate, temperature, respiratory rate, mean arterial blood pressure, arterial pH, oxygenation, serum sodium, potassium and creatinine, hematocrit, Leucocyte count and Glasgow Coma Scale. The principal researcher and mortality followed all patients labelled in each APACHE II group if death occurred within the 14 days after surgery as per operational definition. Patients with incomplete laboratory investigation records or any missing variables of APACHE score were excluded. Patients with trauma, abdominal surgery within the last three months, spontaneous bacterial peritonitis, pregnancy and severe malnutrition, renal failure, chronic obstructive pulmonary disease, asthma, congestive cardiac failure and other uncorrectable comorbidities were also excluded.

Data was analyzed using SPSS version 20, including basic demographic details, APACHE score categories, and final outcome. Descriptive data was used to summarize the categorical variables like gender, smoking status, diabetes, hypertension, anemia, obesity and APACHE categories. Post-stratification Chi-square Data was analyzed using SPSS version 20, including basic demographic details, APACHE score categories, and outcome. Descriptive data was used to summarize the categorical variables like gender, smoking status, diabetes, hypertension, anemia, obesity and APACHE categories. Post-stratification Chi-square test was applied, taking a p-value of < 0.05 as statistically significant.

RESULTS

Eighty-four patients admitted with perforation peritonitis to the Department of Surgery, Civil Hospital Karachi, who met the criteria were included in our study. Of 84 patients, 51 were male and 33 were female. Forty-two patients fell into the age group 16-45 years, and 42 patients were 46-70 years. The mean age in our study was 42.64 years (±12.28). Whereas the mean duration of surgery, BMI, height, weight and APACHE score in our study was 1.65±0.06 hours, 29.87±4.69 kg/m2, 149.6±7.28 cm, 76.9±4.64 kg and 9.94±6.04 respectively. Of 84 patients, 07 (8.3%) and 77 (91.7%) had and did not have in-hospital mortality, respectively.

Out of 84 patients, 38 (45.2%), 37 (44%) and 09 (10.7%) had APACHE scores < 10, 11-20 and ≥ 20 respectively. Stratification for APACHE score groups concerning in-hospital mortality showed that patients who had the APACHE score < 10, 01 (2.6%) had mortality, and 37 (97.36%) did not have in-hospital mortality, respectively. Patients with the APACHE score 11-20 and 02 (5.4%) had mortality, and 35 (94.5%) did not have in-hospital mortality, respectively. Finally, patients who had the APACHE score > 20, 04 (44%) had mortality, and 05 (55.5%) did not have in-hospital mortality, respectively, as summarized in **Table I** with a p-value of 0.001. In contrast, the stratification distribution of smoking status, diabetes, hypertension, anemia and obesity concerning in-hospital mortality is summarized in **Table II**.

Table I: **Categories of In Hospital Mortality According To Apache Score Groups**

Apache Score Groups	In-Hospital Mortality		Total
	Yes	No	
≤ 10	01 (2.6%)	37 (97.36%)	38(100%)
11-20	02 (5.4%)	35 (94.5%)	37(100%)
> 20	04 (44%)	05 (55.5%)	09(100%)
Total	07 (8.3%)	77 (91.6%)	84(100%)
P-value	<0.001		

Table II: In Hospital Mortality categories according to different comorbidities

	Category	In-Hospital Mortality		Total	P-value
		Yes	No		
Smoking	YES	03 (10%)	27 (90%)	30	0.48
	NO	04 (7.4%)	50 (92.5%)	54	
Diabetes	YES	04 (11.76%)	30 (88.2%)	34	0.29
	NO	03 (6%)	47 (94%)	50	
Hypertension	YES	02 (7.6%)	24 (92.3%)	26	0.62
	NO	05 (8.62%)	53 (91.37%)	58	
Anemia	YES	0 (0%)	09 (100%)	09	
	NO	07 (9.33%)	68 (90.6%)	75	0.43
Obesity	YES	01 (9.0%)	10 (8.2%)	11	0.64
	NO	06 (8.2%)	67 (91.7%)	73	

DISCUSSION

Different multicenter clinical studies have been conducted to predict mortality at admission in patients diagnosed with peritonitis using varying scoring models. To be a helpful tool, the model must work as a better clinical adjunct and guide to save limited resources and prognosticate patients accurately for the strong Prediction of the outcome observed using the APACHE scoring system[13]. It is essential to consider the dynamic nature of such scoring models. It, therefore, needs to re-examine the patients to improve healthcare delivery, monitor hospital resources for effective use and evaluate new therapies[14].

There is a shortage of clinical research in our setting regarding the utilization of APCHE scoring in patients undergoing emergency abdominal surgery who may require prolonged or extensive multidisciplinary critical care, and this is particularly useful in developing countries with an increased patient and healthcare provider ratio in surgical specialities. Our study emphasized a reliable means of risk evaluation, which determines the paradigm shift of the quality of perioperative critical care needed to the patients in a real sense and, therefore, treated adequately to improve the outcome.

A single-centre prospective study by Kulkarne[12] showed a perfect correlation between APACHE score and predicted mortality rate with r = .99 and P <.001 [R^2 = .9993]. In this study, the APACHE score consisted of 50 patients ranging between 1 and 23, with a mean of 11.38. This study demonstrated that patients with APACHE scores 11 and 15 showed a specificity and sensitivity of 73.8% and 100% respectively, while the APACHE-II scores with the range of 16 to 20 had a specificity and sensitivity of 100% and 87.5%, respectively. It was concluded that in patients presenting with peritonitis secondary to hollow viscous perforation, an APACHE score between 11 and 20 was a better predictor of the risk of mortality. Our study has similar results to this one, indicating that patients with scores less than 10 had less hospital mortality. However, the mortality in our study was higher in the group with APACHE score more than 20, which is different from the above study and correlated with the complications commonly observed in critical patients. Another comparative study was carried out by Kumar[4] et al. on 50 patients with peritonitis who underwent surgical intervention. The study's objective was to predict the outcome by calculating APACHE score and comparing it with the outcome after selecting high-risk patients so that they can be managed in intensive management. In this study, patients were categorized into three groups and results were analyzed. In patients with a low score category (score <10), a mortality rate of 8.6% was recorded; in the intermediate score category (score 11-20), the mortality rate was 36% and in the high score category (score > 20), where all patients had expired.

Another study concluded that APACHE scoring system is preferable and recommended in a particular specific category of patients with perforation peritonitis compared to other scoring models in the Prediction of approximate estimate hospital stay and mortality risk[15]. APACHE score has been studied to have a strong relationship to the outcome. The higher scores in patients with peritonitis undergoing exploratory laparotomy indicate a need for intensive medical services and expenditure for better outcomes[16-18]. Similarly, the results of another study demonstrated that a higher APACHE score was associated with increased mortality. Patients with an APACHE score of < 24 were related to a mortality of 17.4% compared to a score above 24, which had been associated with a significantly higher mortality rate of 82.6 %. The AUC (95 % CI) was 0.965 (0.928-1.000) at a cut-off value of 24; this indicates the strongest correlation of AUC in this study for demonstrating the ability of APACHE score to predict the mortality rate in patients

with perforation peritonitis[9,18,19]. The results obtained mainly in our study were comparable to earlier studies carried out in terms of outcomes related to the category of APACHE score in different patients.

CONCLUSION

APACHE II scoring system in our study reliably predicted the mortality rate in patients undergoing exploratory laparotomy in patients undergoing laparotomy diagnosed with perforation peritonitis. Higher scores identify the selected group of patients who are at risk of subsequent severe morbidity and poor prognosis, including overall in-hospital mortality. The limitation of our study was that it was a single-centre study with a small sample size over a short period addressing a targeted population in our region undergoing emergency exploratory laparotomy. However, our study can help further explore this area to strengthen our findings to improve the quality assurance of intensive care, surgical audits, and the optimum allocation of scarce healthcare resources in developing countries in the future based on the expected outcomes for sick patients.

AUTHOR CONTRIBUTION
Ashfaq H: Data Collection, Introduction Writing
Ahmed R: Introduction and discussion writing
Kumar D: Discussion writing
Kazim E: Methodology and disussion writing
Dastagir S: Reference collectiona and writng
Gul A: Technical suggestion in writing

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