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Validation of the Use of Modified POSSUM Score in Enteric Perforation.

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ABSTRACT

Background: The Physiological and Operative Severity Score for the enumeration of Mortality and morbidity (POSSUM) model, its Portsmouth (P-POSSUM) modification are two surgical risk-scoring systems used extensively to predict post-operative morbidityand mortality in general surgery. The aim was to undertake the study of validity of these models in Indian patients undergoing exploratory laparotomy for perforation peritonitis. **Methods:** A prospective study was performed, in which a total of 103 patients undergoing exploratory laparotomy for perforation peritonitis were included during the period of January 2015 to May 2016. The morbidity and mortality risks were calculated using the POSSUM and P-POSSUM. **Results:** Around 44/103 patients developed complications (total morbidity rate of 42.72%) in post-operative period; this wascompared with POSSUM predicted morbidity. There was no statistical difference between observed and predicted morbidity ($\chi 2$ = 45.607; df = 1; observed/expected ratio (O:E) = 0.82; P value = 0.000). Ten patients died (total mortality rate of 9.7%).The P-POSSUM expected mortality rate was compared. There was no statistical difference between the observed and P-POSSUM predicted mortality rates ($\chi 2$ = 17.444, df = 1; P value = 0.000). However, P-POSSUM over predicts mortality in our study (O:E =0.25; P value = 0.000). **Conclusion:** POSSUM and P-POSSUM appear to be good and valid indices for use in risk prediction of morbidity and mortality, respectively (surgical outcome in perforation peritonitis) in the Indian population. We found that POSSUM accurately predicts morbidity but P-POSSUM is not able to predict mortality accurately.

Keywords: Morbidity, mortality, perforation peritonitis, POSSUM, P-POSSUM.

INTRODUCTION

The outcome of surgical intervention is not solely dependent on the abilities and techniques of the surgeon. The patients' physiological status and the peri-operative services affect the ultimate outcome. Crude morbidity and mortality rates can be misleading when results of emergency surgery are compared between different units and hospitals. The determination of outcome of surgery helps to plan and implement more effective treatment regimen.

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Perforation peritonitis is the most common surgical emergency encountered by surgeons all over the world as well as in India. Common causes of peritonitis are peptic ulcer perforation (Duodenal and Antral), ileal perforation, appendicular perforation, gastric perforation, jejunal perforation, and large gut perforation. If properly treated mortality is <10% in typical cases of surgically correctable peritonitis in otherwise healthy patients. Mortality rises to above 40% in elderly and in those with significant comorbidities (cardiac, respiratory, renal, etc.) as well as cases that present late (>48 hours).[1]

Many surgical risk scoring systems are available but the Physiologic and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) model by Copeland et al,[2] was recommended as the most appropriate for general surgery.[3,4] This model, utilizing scores relating to 12 physiological and 6 operative variables, was developed to predict hospital mortality and morbidity postoperatively. However, POSSUM was then reported as over predicting postoperative mortality, particularly in patients at low risk. This led to a revision: The Portsmouth modification (P-POSSUM) by Whiteley et al.[5] Few studies have been taken up in developing countries regarding risk adjusted audits of emergency exploratory laporotomy patients. Keeping in mind the different category of patients at our hospital (delayed presentation, malnutrition and limited resources), it was felt that POSSUM and P-POSSUM scoring could be used to assess the healthcare provided, outcome, and compare with others. Hence, this prospective study was taken.

MATERIALS AND METHODS

This study was carried out in Department of surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad. Data was collected prospectively for all peritonitis cases admitted in Department of General Surgery from JAN 2015 to MAY 2016. All preoperative, intraoperative, and post-operative patient data were collected and entered into a computer database prospectively. The morbidity risk was calculated using the POSSUM equation. The mortality risk was calculated using the P-POSSUM equation. The in-hospital mortality was recorded for each patient.

Statistical analysis

Continuous data was presented as mean ± standard deviation (SD). For calculation of significance between continuous variables between two separate groups, unpaired t-test was used. For calculation of significance between two proportions and percentages, Chi-square and Fischer's test were used.

POSSUM equation for morbidity

Logn R/(1-R) = –5.91 + (0.16 × physiological score) + (0.19 × operative severity score) Where R = predicted morbidity.[8]

P-POSSUM equation for mortality

Logn R/(1-R) = –7.04 + (0.13 × physiological score) + (0.16 × operative severity score) Where R = predicted mortality.[8]

Using outcome (dead/alive or complicated/uncomplicated) as a dichotomous-dependent variable, we have derived multiplelogistic regression equations for both morbidity and mortality. Significance was assessed using model $\chi 2$. Differences between observed and expected outcomes were assessed using $\chi 2$ tests. Statistical calculations were carried out with statistical package of social sciences (SPSS) computer software 16.0 (SPSS, Chicago, Illinois, United States). A value of $P < 0.05$ was considered statistically significant.

RESULTS

Observations and outcome

A total of 103 emergency laparotomies (satisfying study criteria) were performed for perforation peritonitis between Jan 2015 and May 2016. Duodenal perforation (58.25%) was the most common cause of perforation peritonitis followed by ileal perforation (27.18%) and gastric perforation (8.73%) [Table 1].

[Table 2] shows the pre-operative parameters of the patients. Where Hypotension is defined by Blood Pressure <110/70 mmHg, hypokalaemia is serum potassium <3.5 meq/dl, dyspnoea on exertion is mild COAD = chronic obstructive airway disease, limiting dyspnoea is moderate COAD and dyspneaatrest, fibrosis, or consolidation is severe COAD.

Out of 103 patients of perforation peritonitis, 102 cases were having free bowel content with or without pus and blood as peritoneal contaminant, only one was having local pus collection [Table 3].

Primary repair of intestinal perforation was most common surgery performed, followed by ileostomy, resection, and anastomosis. Almost all duodenal perforations were of size 0.5 cm × 0.5 cm and was repaired by modified Graham omental patch technique, i.e., primary repair was done. Commonly performed operative procedure for ileal perforation was ileostomy in our study [Table 4]. Total number of patients with complications was 44 which also include 10 patients who died after surgery. More than one complication was observed in many postoperative patients. Most common complication was wound infection (26.21%) [Table 5].

POSSUM and P-POSSUM

Statistically significant differences were detected in the postoperative morbidity or in-hospital mortality rate using.

Table 1: Site of Perforation.

Indications	No. of patients	Percentage
Duodenal perforation	60	58.25
Ileal perforation	28	27.18
Jejunal perforation	02	1.9
Gastric perforation	09	8.73
Appendicular perforation	03	2.9
Cecal perforation	01	0.97
Total	103	100

Table 2: The preoperative parameters of patients.

Parameter	No. of cases	No. of patients developing complication (%)
Hypotension	50	42 (84)
Hypokalemia	41	22 (53)
GCS <15	13	09 (69)
Hemoglobin <10 gm/dl	62	39 (63)
Dyspnoea		(100)
Mild COAD	1	1
Moderate COAD	1	1
Severe COAD	5	5

GCS = Glasgow Coma Score, COAD = Chronic obstructive airway disease (mild = dyspnoea on exertion; moderate = limiting dyspnoea; severe = dyspnoea at rest, fibrosis, or consolidation

Table 3: Type of peritoneal contamination.

None	—	—	—	
Local pus	1	0	1	1
Free bowel content with/ without pus and blood	102	10	92	43

Table 4: Type of repair

Types of surgeries	No. of patients	Percentage
Primary repair	78	75.72
Ileostomy	20	19.41
Resection and anastomosis	05	4.85

Table 5: Post-operative complications

Complications	No. of cases	(%)
Wound infection	27	26.21
Chest infection	07	6.79
Anastomotic leak	02	1.9
Deep dehiscence	04	3.88
Urinary tract infection	03	2.9
Septicemia	03	2.9
Total	57	

The $\chi 2$ goodness-of-fit test. When comparing predicted morbidity with observed morbidity by POSSUM score, an overall O:E (observed/expected) ratio of 0.82 was found. When linear analysis was used to predict the morbidity, the O:E ratio was 0.61 and it significantly over-predicted morbidity ($\chi 2$ = 11.48, df = 9, P = 0.025), but when the same data was used in exponential analysis, the O:E ratio was 0.82. There was no significant difference between the observed and predicted values ($\chi 2$ = 9.684, df = 1, P = 0.000). P-POSSUM over-predicted mortality when the linear method was used with an O:E ratio of 0.25 ($\chi 2$ = 7.806,df = 1, P = 0.000).

DISCUSSION & CONCLUSION

The basic tenet in the healthcare is to provide quality healthcare with reduction in adverse outcome. Comparison of adverse outcome rates is necessary to assess the adequacy of care provided and to evolve new strategies for better outcome. The accurate prediction of outcomes after a high-risk procedure such as surgical treatment of perforation peritonitis can early detect postoperative complications, and early referral to a higher medical facility. Better planning and precision can improve individual prognosis and it can help in implementing a tier based medical services in 3rd world countries with each tier having a predefined permission for surgical intervention. POSSUM and P-POSSUM, a modification of POSSUM, were proposed to overcome shortcomings of crude mortality rates-based comparison.

Post-operative complications and death may result depending on three major factors: The quality of the surgical team, the patient's physiological status, and the degree of surgical stress.[6] But POSSUM and P-POSSUM has to be correlated to the general condition of the local population for it to be effective.[7-9] This is important for patients in developing countries like India where the general health of the population is variable and presentation frequently delayed.[7,8]

With a post-operative morbidity rate of 42.72% and an in-hospital mortality rate of 9.7%, our institution lies within the accepted range of complications after emergency laparotomy for perforation peritonitis. In this study, POSSUM has generally over-predicted morbidity significantly when linear method of analysis was used, and though over-prediction of morbidity was insignificant with exponential method of analysis, it was comparable with other studies.[10-12]

Tekkis and others obtained mortality rate in elective surgery at 3.9% and in emergency 25%, overall mortality rate of 11.1%.[11] P-POSSUM the predicted mortality was 40, an O:E ratio of 0.25 was obtained in this study. This is in contrast to the findings obtained by Yii MK and Ng KJ (O:E = 1.28),[13] Tekkis (O:E = 0.98).[11]

To conclude, POSSUM predicted morbidity well and can be used as a tool to assess level of healthcare provided. But-POSSUM, in our study, over-predicted mortality; hence, it cannot be recommended for mortality assessment in Indian population.

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