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Original Research Article

Efficacy of the P-POSSUM scoring system in prediction of post-operative mortality and morbidity in patients undergoing emergency laparotomy in a tertiary institute

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ABSTRACT

Background: The Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) scoring system and its modification P-POSSUM (Portsmouth-POSSUM) has been studied in various clinical settings, with varied results. Due to its simplicity and wide application, the efficacy must be verified in individual settings. We wish to assess the system's efficacy among emergency laparotomies in a south Indian clinical scenario.
Methods: A prospective study was undertaken with a sample size of 50. All cases taken for emergency laparotomy were included. 12 physiological and 6 intra-operative characteristics were taken and according to the equation the predicted rates of mortality and morbidity were predicted. This was compared with the observed rates. With these results, the efficacy of the scoring system was assessed.
Results: Of the 50 cases included 5 expired (10%) and 29 (58%) experienced some form of morbidity. The P-POSSUM score was found to be an accurate predictor of mortality (x^2 =1.174, d.f=8) with a p-value of 0.997. The POSSUM score was not found to be an accurate predictor of morbidity (x^2 =16.949, d.f=8) with a p-value of 0.0403, as the p-value was <0.05.
Conclusions: The P-POSSUM scoring system produced accurate results even in the setting of emergency laparotomies in a south Indian setting. It has proved to be a useful tool for predicting mortality, though not completely accurate to assess post-operative morbidity (POSSUM) due to post-operative factors playing a major role in its determination.

Keywords: Morbidity, Mortality, POSSUM, P-POSSUM

INTRODUCTION

In an era where resources are constrained, and the expectations of medical personnel are insurmountable, scoring systems provide us with an indispensable tool for triage of critically ill patients, a quantitative assessment of the degree of severity of a particular condition, not merely an intuitive idea, and to provide a more realistic expectation of the patient's outcome. POSSUM stands for Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity. It was developed by Copeland et al in 1991 in an effort to normalize patient data so as to allow direct comparisons of patient outcome despite varying patterns of referral and population.[1] POSSUM is a multivariant discriminant analysis to obtain a method of risk assessment.[2] A 12-factor Physiological Score was developed that includes age, cardiac status, pulse rate, systolic blood pressure,

respiratory status, Glasgow Coma Score, serum concentrations of urea, potassium and sodium, haemoglobin concentration, white cell count and findings on electrocardiography. This was combined with a six-factor Operative Severity Score, which includes type and number of procedures, volume of blood loss, peritoneal contamination, presence and extent of malignancy, and timing of operation.[3-5]

Whitley MS from Portsmouth University, England evaluated the POSSUM scoring system in a study that included 1485 patients. They demonstrated an over prediction of mortality by a factor of 2 using the POSSUM scoring system and modified the equation using the same variables to obtain the P-POSSUM score.[5] Pryterch prospectively compared POSSUM and P-POSSUM in 10,000 general surgical patients.[6] The POSSUM scoring system over predicted the mortality rate by a factor of 2, the observed mortality being 287 deaths and predicted was 697 deaths, the P-POSSUM scoring system when applied prospectively on the subsequent 7,500 cases showed an observed to expected ratio of 0.90 (x^2=1.63, 5 d.f) and 0.85(x^2=1.35, 4 d.f). They concluded by suggesting application of P-POSSUM scoring system for predicting mortality and also emphasized the need for evaluation of geographical variation in predicting the adverse outcomes.

This study aims to assess the efficacy of the P-POSSUM score by comparing the observed and expected rates of mortality and morbidity (Factors such as wound site infection, systemic infections like urinary tract infections, pneumonia etc., deep vein thrombosis and its complications, fistula formation, burst abdomen and wound dehiscence). Morbidity though continues to be assessed by the original POSSUM scoring system as done in this study.

METHODS

This is a prospective study done at the Govt. Stanley Medical College and Hospital from October 2017 to March 2018 including a 30 day post-operative follow up of all patients undergoing emergency laparotomy till the sample size of 50 was reached. Cases that were excluded were those patients aged 12 years or less, those whose follow up period criteria were not met and patients with significant immunosuppression (HIV/Hbsag positive and those on immunosuppressive drugs/anti-cancer chemotherapeutic drugs).

Data was collected via a proforma prepared for the study from all patients undergoing emergency laparotomy in the stipulated time period. All the patients had their physiological scores recorded on admission. An operative severity score was calculated based on the intraoperative findings recorded by the operating surgeon.

Using the following equations, the morbidity and mortality rates were calculated.

Loge[R/1-R]=(0.1692xPS) +(0.155x OS)-9.065

Where R=risk of mortality

Loge [R/1-R] = -5.91 + (0.16x PS) + (0.19x OS)

Where R=risk of morbidity.

PS=physiological score and OS=operative score

Any post-operative morbidity or death in the hospital was recorded. Subsequent statistical analysis was done of the findings.

Statistical analysis:

The collected data were analyzed with IBM.SPSS statistics software. To find the significant difference between the bivariate samples in Independent groups the Unpaired sample t-test was used. The Hosmer-Lemeshow test is used for goodness of fit in logistics regression risk prediction model. A p-value of 0.05 is considered as significant level

RESULTS

Sex distribution

Of the 50 patients included in the study, 16 individuals (32%) were females and 34 individuals (68%) were males. This finding was probably due to a higher incidence of infection and alcohol induced complications which were more common in men when compared to women.

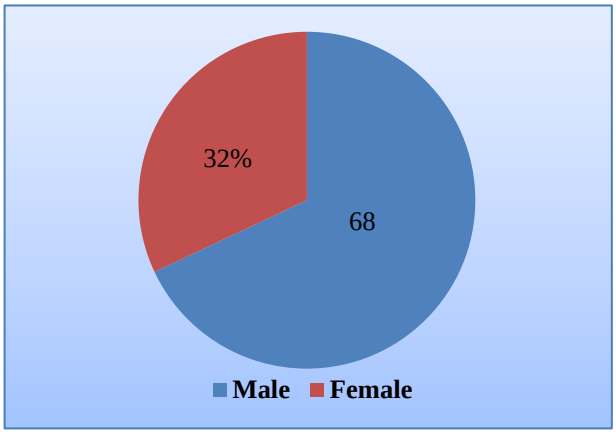

Figure 1: Sex distribution.

Age distribution

The predominant age group was 30-40 yrs constituting 22% of all patients, again owing to the fact that alcohol and infection related complications were highest in this age group. The youngest patient being 13yrs and the oldest being 73 years.

Table 1: Age distribution.

Age group	Frequency
10-20 years	04
20-30 years	10
30-40 years	11
40-50 years	09
50-60 years	09
60-70 years	03
70-80 years	04

Indications for laparotomy with corresponding procedures

The most common indication for emergency laparotomy was a duodenal perforation, which included 30% of all cases.

7 cases were due to trauma (14%) 8 were due to infectious etiologies and 17 were due to alcohol related etiologies (34%).

Table 2: Intaoperative diagnosis.

Cause	Number
Appendicitis /appendicular mass	02
Obstructed Hernia	02
Ectopic Pregnancy	02
Duodenal perforation	15
Intestinal obstruction	08
Mesentric thrombosis	01
Blunt Injury abdomen	04
Stab injury	03
Ovarian Torsion	04
Diverticulitis	02
Liver Abscess	01
Gastric Perforation	02
Ileal perforation	02
Pelvic Abscess	01

Out of the 50 cases taken for laparotomy, omental patch closure was the most commonly done procedure with a total of 17 cases (34%).

This was followed by bowel resection with ileostomy/colostomy placement in 12 cases (24%). Salpingoophorectomy was done in 6 cases (12%).

Mortality and morbidity encountered

Out of the 50 cases taken for laparotomy 16 recovered without any significant post-operative complaint (32%).

The most common post-operative complication being wound site infection which affected 22% of the patients who underwent laparotomy. 5 cases expired which was 10% of the total.

Table 3: Procedure performed.

Surgery	Frequency
Appendicectomy	01
Herniorhapphy	01
Salpingo-oophorectomy	06
Omental patch closure	17
Resection and anastomosis	05
Resection with ostomy placement	12
Splenectomy	02
Explorative laprotomy	02
Abscess drainage	03
Adhesiolysis	01
Total	50

Table 4: Complications and deaths encountered.

Complication	Frequency
No complaints	16
Wound site infection	11
Lower respiratory tract infection	04
DVT	03
Enterocutaneous Fistula	01
Delirium	01
Paralytic Ileus	04
Stomal recession	01
Urinary tract infection	04
Expired	05

Analysis of mortality

Table 5: Mortality analysis.

Mortality = No		Mortality = Yes		Total
Observed	Expected	Observed	Expected	
5	4.961	0	0.039	5
4	3.967	0	0.033	4
6	5.948	0	0.052	6
5	4.952	0	0.048	5
5	4.943	0	0.057	5
5	4.929	0	0.071	5
6	5.882	0	0.118	6
5	4.798	0	0.202	5
3	3.711	2	1.289	5
1	0.907	3	3.093	4

Table 6: Mortality analysis findings.

Chi-square	Degree of freedom	p-value
1.174	8	0.997

The above contingency table shows the observed and expected rates of mortality using the P-POSSUM score. From the interpretation of results, the P-POSSUM score was found to be an accurate predictor of mortality (x^2 =1.174, d.f=8) with a p-value of 0.997. As the p-value is >0.05 it is significant.

Analysis of morbidity

Table 7: Morbidity analysis

Morbidity = No		Morbidity = Yes		Total
Observed	Expected	Observed	Expected	
5	2.728	0	2.272	5
2	2.553	3	2.447	5
2	2.957	4	3.043	6
3	2.256	2	2.744	5
1	2.091	4	2.909	5
1	1.978	4	3.022	5
0	1.846	5	3.154	5
1	1.725	4	3.275	5
3	1.618	2	3.382	5
3	1.249	1	2.751	4

Table 8: Morbidity analysis findings

Chi-square	Degree of freedom	p-value
15.949	8	0.0403

The above contingency table shows the observed and expected rates of morbidity. From the interpretation of results, the POSSUM score was not found to be an accurate predictor of morbidity (x^2 =15.949, d.f=8) with a p-value of 0.0403. As the p-value is <0.05 which is not significant.

DISCUSSION

The aim of any surgical procedure is to cause reduction in morbidity and mortality. The outcome of surgical intervention, whether death or an uncomplicated survival, complications or long-term morbidity is not solely dependent on the abilities of a surgeon in isolation but on a multitude of patient factors.

In this study we obtained result from 50 laparotomies, analyzing the final outcome based on the initial score. The results obtained from this study seemed to suggest that though the score is accurate in predicting the mortality of a particular scenario, the same accuracy is not achieved with respect to morbidity .

Mohil et al, conducted a study at Safdarjung hospital which included 120 patients taken for emergency laparotomy.[8] Mortality and morbidity were calculated using the P- POSSUM and POSSUM scores respectively. The study concluded that when the linear method of analysis was used POSSUM over predicted morbidity, and there was a significant difference between the observed and predicted values (observed to expected (O: E) ratio 0.68). POSSUM also significantly over predicted mortality when analyzed by the linear method (O: E ratio 0.39), but the prediction improved when exponential analysis was used (O: E ratio 0.62). The P-POSSUM prediction of death was accurate when linear analysis was used.

Mercer et al conducted a study at the university of Liverpool, where the P-POSSUM score was analyzed for all patients undergoing craniotomies over the span of one year.[9] The study concluded that the P-POSSUM score was an accurate predictor of mortality in both elective and patients needing immediate lifesaving surgery.

Bann et al conducted a study comparing two general surgical consultants using the POSSUM scoring system with a total of 815 patients.[10] They concluded that there were few drawbacks when it came to the POSSUM score which included ambiguity in the timing of pre-operative scoring and doesn't differentiate between a well optimized patient and a poorly optimized one pre-operatively. It also doesn't take into account the competency of the surgeon. The study finally concluded that POSSUM accurately predicts mortality but does little in assessing surgical failings.

In this study, only patients taken for emergency laparotomy were included with the P-POSSUM scoring proving to be an accurate predictor of mortality with a p-value of 0.997. Morbidity using the POSSUM score showed a p-value of 0.043, proving not to be as accurate. This discrepancy could be due to the fact that local factors are not given adequate consideration for individual complications like the extent of wound contamination /diabetic status causing a post-operative wound infection. It doesn't take into account the importance of good post-operative care protocols to prevent complications; like adequate chest physiotherapy and heparin prophylaxis in the prevention of post-operative pneumonia and deep vein thrombosis.

Probably a larger sample size and a wider range of patient population may lead to different outcomes, which is why continuous scrutiny and study is always required. Nonetheless, from a practical standpoint the scoring is simple, fast and doesn't include cumbersome imaging criteria. This study also shows the P-POSSUM scoring system as an effective tool for the prediction of mortality.

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