ORIGINAL RESEARCH PAPER

Surgery

EFFICACY OF PREDICTING THE MORTALITY AND MORBIDITY IN EMERGENCY LAPAROTOMY CASES USING POSSUM AND P-POSSUM SCORING SYSTEM

KEY WORDS: POSSUM; surgical scoring; mortality

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ABSTRACT

Introduction: The Physiological and Operative Severity Score for the enumeration of Mortality and morbidity (POSSUM) and its modification the Portsmouth POSSUM (P-POSSUM), have been proposed as a method for standardizing patient data so that direct comparisons can be made despite differing patterns of referral and population. In this prospective study, the validity of P-POSSUM was tested in patients undergoing emergency laparotomy and the risk factors for low outcome were noted.

Materials and Method: Some 100 cases who underwent emergency laparotomy under surgical units at Silchar Medical College and Hospital, Silchar. Data collected were based on hospital based prospective observational study. The study period was from JUNE 2017 TO MAY 2018 for a period of one year. All patients admitted in surgery department of Silchar Medical College and Hospital during the study period and meeting the inclusion and exclusion criteria will be included in this study.

Result: A total of 100 patients who met the inclusion criteria were included in this study. From the interpretation of results using the Hosmer and Lemeshow Test, the POSSUM score was found to be an accurate predictor of morbidity ($x^2 = 3.694$, d.f=8) with a p- value of 0.884). As the p-value is >0.05 the POSSUM sore can be assumed to be an accurate measure of morbidity. From the interpretation of results using the Hosmer and Lemeshow Test, the P-POSSUM score was found to be an accurate predictor of mortality ($x^2 = 3.100$, d.f=8) with a pvalue of 0.928). As the p-value is >0.05 the P-POSSUM sore can be assumed to be an accurate measure of mortality

Conclusion: Portsmouth POSSUM scoring system serves as a good predictor of postoperative outcome in emergency laparotomy procedures.

INTRODUCTION

In the culture of increased scrutiny, surgeons must be able to clearly and accurately demonstrate how they perform, through comparative audit of their surgicaloutcomes1. Even if the patient reaches the hospital in time and is operated, the post-operative period is still unpredictable.

Perforation peritonitis is one of the most encountered surgical emergencies in which patient presents with acute abdomen. It is the most common surgical emergency in India2. Secondary peritonitis is the consequence of contamination of the peritoneal cavity due to contents of organ within the peritoneal cavity. Majority of these episodes are due to lesions in stomach, duodenum, small intestines, appendix and colon3. Mortality due to hollow viscous perforation ranges from 10% to 40 % 4.

Crude morbidity and mortality rates are limited indicators of quality of care, and can be misleading when the results of emergency surgery are compared between different units and hospitals. Scoring systems that group patients based on the severity of illness before treatment can allow a meaningful analysis of morbidity and mortality rates. Mortality is an important and objective measure of outcome.

The ideal scoring system for surgical audit purposes should assess mortality and morbidity and should allow audit retrieval of the surgical success. It should be quick and easy to use and should be applicable to all general surgical procedures in both the emergency and elective setting. It should be of use in all types of hospital and should provide educational information. Finally it should be possible to integrate the scoring system into pre-existing audit programmes with the minimum of disruption5.

The Physiological Operative Severity Score for the enUmeration of Mortality and morbidity {POSSUM} is in widely used to predict morbidity and mortality in a variety of surgical settings, and provides a tool for risk adjustment and comparison. All 12physiological and 6 operative variables required for POSSUM scoring can be recorded easily and reproduced satisfactorily by resident staff with minimal difficulty. Any comparative system that over predicts mortality and morbidity has the effect of making poor results look better. The Portsmouth predictor modification {P-POSSUM}proposed by Whiteley et al 6,7 counters the over prediction of mortality in low risk patients by POSSUM. The variables used are the same but a different formula is used to predict the risk of death. Differences in predictive values of two scoring systems are related to the method of analysis. Wijesinghe et al 8 directly compared the exponential and linear methods of analysis; use of linear analysis for POSSUM or exponential analysis for P-POSSUM yielded spurious results by over predicting mortality. Comparing the outcome for such patients using data from developed countries or centres with selection bias may be misleading.

MATERIALS AND METHODS

Some 100 cases who underwent emergency laparotomy under surgical units at Silchar Medical College and Hospital, Silchar. Data collected were based on hospital based prospective observational study. The study period was from JUNE 2017 TO MAY 2018 for a period of one year. All patients admitted in surgery department of Silchar Medical College and Hospital during the study period and meeting the inclusion and exclusion criteria will be included in this study.

Inclusion Criteria –

All cases requiring emergency laparotomy will be included in this study.

Exclusion Criteria-

Patients less than 12 yrs of age will be not taken up in the study.

Data analysis -

Data will be analyzed using descriptive statistics and chi-square test. Suitable statistics software will be utilized for analysis and will be presented in the form of tables, figures,

graphs and diagrams whenever necessary.

The risk of morbidity and death is calculated using POSSUM and P-POSSUM equations.

POSSUM equations:

1) Log R1 / 1 – R1 = -7.04 + (0.13 x physiological score) + (0.16 x operative severity score)
2) Log R2 / 1 - R2 = -5.91 + (0.16 x physiological score) + (0.19 x operative severity score)

R1 = Risk of mortality R2 = Risk of morbidity

P-POSSUM equation for mortality:

Log R / 1 – R = -9.065 + (0.1692 x physiological score) + (0.1550 xoperative severity score)

R = Risk of mortality

Physiological score and operative severity score is calculated by recording following points in annexure 1.

Postoperative complications (morbidity and death) in the hospital are recorded in accordance with definitions described previously. A total of 100 cases are included in the study.

Morbidity: definitions

Wound haemorrhage: local haematoma requiring evacuation.

Deep haemorrhage: postoperative bleeding requiring re-exploration.

Chest infection: production of purulent sputum with positive bacteriological cultures, with or without chest radiography changes or pyrexia, or consolidation seen on chest radiograph.

Wound infection: wound cellulitis or the discharge of purulent exudates

Urinary infection: the presence of > 105 bacteria / ml with the presence of white cells in the urine, in previously clear urine.

Deep infection: the presence of an intra-abdominal collection confirmed clinically or radiologically.

Septicemia: positive blood culture

Pyrexia of unknown origin: any temperature above 37° C for more than 24hoccurring after the original pyrexia following surgery (if present) had settled, forwhich no obvious cause could be found.

Wound dehiscence: superficial or deep wound breakdown.

Deep venous thrombosis and pulmonary embolus: when suspected, confirmed radiologically by venography or ventilation/ perfusion scanning or diagnosed at postmortem.

Cardiac failure: symptoms or signs of left ventricular or congestive cardiac failure(alteration from preoperative measures)

Impaired renal function: arbitrarily defined as an increase in blood urea of > 5mmol / l from preoperative levels.

Hypotension: a fall in systolic blood pressure below 90 mmHg for more than 2 H as determined by sphygmoman ometry or arterial pressure transducer measurement

Respiratory failure: respiratory difficulty requiring emergency ventilation.

Anastamotic leak: discharge of bowel content via the drain, wound or abnormal orifice.

The data were entered into Microsoft Excel {Microsoft Corporation, Redmond, Washington, USA} for analysis. The risk of morbidity and death was calculated using POSSUM and P-POSSUM equations, which are as follow

RESULTS

Out of 100 patients included in the study, 21 individuals (21%) were females and 79 individuals (79%) were males. Out of these ,nine individuals died (two females and 7 males).(p >0.05 ;statistically not significant)

INDICATIONS FOR SURGERY

Out of the 100 cases taken for laparotomy in our study, duodenal perforation was the most common indication with a total of 28 cases (28%). This was followed by intestinal obstruction in 23cases (23%).

TABLE 1: INDICATIONS

SNO	INDICATIONS	NO OF PATIENTS
1	DUODENAL PERFORATION	28
2	APPENDICULAR PERFORATION	17
3	ILEAL PERFORATION	10
4	GASTRIC PERFORATION	7
5	JEJUNAL PERFORATION	2
6	INTESTINAL OBSTRUCTION	23
7	OBSTRUCTED HERNIA	2
8	BLUNT INJURY	6
9	PENETRATING INJURY	5

Out of 100 patients taken for laparotomy, Omental patch closure (35 patients) was the most commonly performed operation followed by appendectomy (17) followed by ileal/jejunal (primary) repair

COMPLICATIONS

There were 100 patients operated in our study. Among these , 34 patients are free from any complications ,66 patients had complications .Of these ,Wound infection was the most common complications(38 patients) suffered followed by chest infection(21 patients)

TABLE 2:TYPES OF SURGERY

SNO	TYPES OF SURGERY	NO OF PATIENTS
1	OMENTAL PATCH REPAIR	35
2	APPENDECTOMY	17
3	RESECTION & ANASTONOSIS	8
4	MESENTERIC REPAIR	2
5	JEJUNAL/ILEAL REPAIR	14
6	ILEOSTOMY	1
7	SPLENECTOMY	5
8	REDUCTION OF INTUSSUSCEPTION	4
9	COLOSTOMY	4
10	RELEASE OF BAND	1
11	RESECTION WITH OSTEOMY	7
12	ADHESIOLYSIS	1
13	EXP. LAP WITH RENT CLOSURE	1

TABLE 4: LIST OF COMPLICATIONS

A. URINARY TRACT INFECTION	7
B. DEEP INFECTION	11
C. DEEP HEMATOMA	1
D. WOUND INFECTION	38
E. CHEST INFECTION	21
G. SEPTICEMIA	12

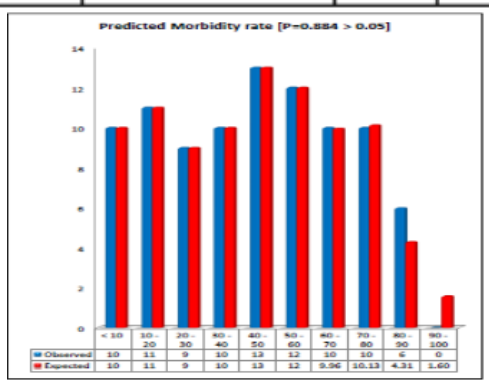
H. PYREXIA OF UNKNOWN ORIGIN	2
I. WOUND DEHISCENCE	6
K. IMPAIRED RENAL FUNCTION	3
M. ANASTOMOTIC LEAK	1
N. RESPIRATORY FAILURE	2
O. HYPOTENSION	3

PREDICTED MORBIDITY RATE USING POSSUM

		OUTCOME = ALIVE		OUTCOME = DEAD		
		OBSERVED	EXPECTED	OBSERVED	EXPECTED	TOTAL
STEP 1	< 10	10	10.000	0	.000	10
	10 – 20	11	11.000	0	.000	11
	20 – 30	9	9.000	0	.000	9
	30 – 40	10	10.000	0	.000	10
	40 – 50	13	13.000	0	.000	13
	50 – 60	12	12.000	0	.000	12
	60 – 70	10	9.956	0	.044	10
	70 – 80	10	10.133	1	.867	11
	80 -90	6	4.308	2	3.692	8
	90 -100	0	1.603	6	4.397	6

HOSMER AND LEMESHOW TEST

STEP	chi-square	df	sig.
1	3.694	8	.884



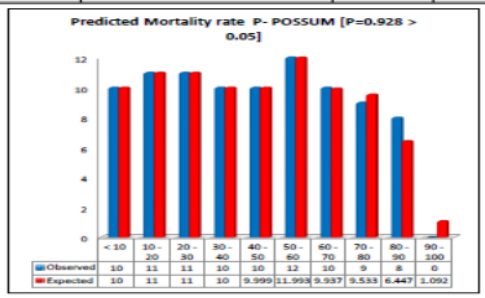
From the interpretation of results using the Hosmer and Lemeshow Test, the POSSUM score was found to be an accurate predictor of morbidity (x2 =3.694, d.f=8) with a p-value of 0.884). As the p-value is >0.05 the POSSUM sore can be assumed to be an accurate measure of morbidity

PREDICTED MORTALITY RATE USING P POSSUM

		OUTCOME = ALIVE		OUTCOME = DEAD		
		OBSERVED	EXPECTED	OBSERVED	EXPECTED	TOTAL
STEP 1	1	10	10.000	0	.000	10
	2	11	11.000	0	.000	11
	3	11	11.000	0	.000	11
	4	10	10.000	0	.000	10
	5	10	9.999	0	.001	10
	6	12	11.993	0	.007	12
	7	10	9.937	0	.063	10
	8	9	9.533	1	.467	10
	9	8	6.447	2	3.553	10
	10	0	1.092	6	4.908	6

HOSMER AND LEMESHOW TEST

STEP	chi-square	df	sig.
1	3.100	8	.928



From the interpretation of results using the Hosmer and Lemeshow Test, the P-POSSUM score was found to be an accurate predictor of mortality (x2 =3.100, d.f=8) with a pvalue of 0.928). As the p-value is >0.05 the P-POSSUM sore can be assumed to be an accurate measure of mortality

DISCUSSION

The aim of any surgical procedure is to cause the reduction in morbidity and mortality. Operative mortality is an important and objective measurement of the final outcome. Monitoring the outcome is an increasingly important part of the governance of surgical activity. Thus there has been a search for accurate risk scoring systems that can be used to compare patient outcomes according to the different units of the different hospital

This prospective, observational and descriptive study was conducted among 100 patients who had underwent midline laparotomy for emergency causes in Department of General Surgery, Silchar Medical College and Hospital. The study was carried out with a view to determine the validity of POSSUM and P-POSSUM scoring in predicting the morbidity and mortality of patients undergoing midline laparotomy. The standards of our institution compared to the generally accepted level of morbidity and mortality was also analyzed.

In our study, a total of 100 patients who met the inclusion criteria were included in this study. Out of which, 79 (79%) patients were male and 21 (21%) patients were female. Age of the patients were ranged from 15-75years. Among them 96(96%) were of <= 60years, two (2 %%) of 61-70 years and 2 (2%) were of >70 years.

In our institution, peritonitis due to hollow viscous perforation has become the leading cause of emergency laparotomies. In our study, we performed emergency laparotomy in 100 patients. Most of the surgeries were performed on the patient with hollow viscous perforations (64 cases 64%), among these, 28 patients were operated for duodenal ulcer perforation, Similar finding was found in a study done by Jha MK et al (31%) Duodenal perforation was the most common indication for surgery & H.Sreeharsha et al (37%).

In our study, Sixty six patients developed significant complications. Of these Wound infection (38 %) was found to be the most common complication, followed by the chest infection (21 %).Similar results were obtained by Mohil et. al. (35 % and 20 % respectively). Jha MK et al (48.3% and 26.7%)respectively. Budhraja et al, also found wound infection as commonest complication. Large number of individuals with gross peritoneal contamination after hollow viscous perforation leading to local contamination of the incision site may attribute to wound infections.

In the present study, mortality was noted in 9 out of 100 cases (9%) which is in close resemblance to the average mortality in various studies Vishwani et al (6.75%), Afridi SP et al and

Dorairajan et al (9.2%),Jha mk et al (12%) Tekkis et al overall mortality rate of 11.1%),H.Sreeharsha et al (15%)

In this study , the POSSUM & P-POSSUM score were found to be an accurate predictor of mortality ,there was found to be no statistically significant difference between the observed and expected values for morbidity (x2 =3.694, d.f=8, p-value 0.884) as well as mortality (x2 =3.100, d.f=8, p-value of 0.928). Hence the P-POSSUM is capable of accurately predicting the morbidity and mortality following emergency surgeries. Similar findings were noted in a study done by Mohil RS et al 9(O: E = 0.66, x2 = 5.33, 9 df, p =0.619) and May S et al (O/E ratio was 0.63 with p value of 0.479), Kumar P et al (O: E ratio of 0.73, 2 =2.4, 9 df, p=0.82).13-15Jha MK et al x2 = 1.523, 4 df , p = 0.823).tekkis et al (x2 test =3.34, 4 d.f., p = 0.51), H.Sreeharsha et al (2=1.72, p=0.974),Tyagi et al (x 2 = 00.258, 4 df, *P* = 0.992).

In our study on analysing the risk factors we found positive rate of increment with all the risk factors studied but it was found 12 out of 18 risk factors to be statisticallysignificant with respect to cardiovascular system (p=0.0005), respiratory system (p=0.028) , blood pressure(p=0.0005), pulse rate(p=0.001) glasgow coma scale(p=0.0005), haemoglobin(p=0.0005), white cell count(p=0.0005), blood urea (p=0.0005), serum sodium (p=0.0005) , serum potassium(p=0.0001),multiple procedures (p=0.0005), total blood loss(p=0.0005)

Similar findings were noted in a study done by Jha MK et al hemoglobin (p =0.001),WBC (p = 0.002), urea (p = 0.001), sodium (p =0.019), potassium (p = 0.030). Tyagi et al , on analysis of individual risk factors nine of the 18 risk factors were found to have significant association with mortality namely cardio respiratory status (*P* = 0.00), Pulse rate (*P* = 0.01), Glasgow Coma Scale (*P* = 0.03), hemoglobin (*P* = 0.05), electrocardiograph changes (*P* = 0.00), blood urea (*P* = 0.00), serum sodium (*P* = 0.03), serum potassium (*P* = 0.02), blood loss (*P* = 0.02), while *P* value for other nine risk factors was >0.05.

CONCLUSION

In today's era, where the patient's safety and proper management of patient is of utmost importance, it becomes only necessary to assess the expected outcome of the procedure performed. Recognizing patients who are at high risk to develop complications and who have high risk of mortality would prompt us to take necessary and timely action and aid us in the better management of the patient

An ideal scoring system should be applicable to a wide range of general surgical procedures, both elective and emergency and should allow the prediction of both morbidity and mortality with reasonable sensitivity and specificity. In the past numerous scoring systems like ASA and APACHE II have been used to predict both morbidity and mortality in surgical patients. These existing scoring systems are either too simple or too complex and do not meet the expectation as being readily applicable to all patients. POSSUM has been proved to be one of the best scoring systems that could predict the morbidity and mortality risk with reasonable accuracy. POSSUM scoring is an accurate predictor of mortality and morbidity following emergency laparotomy and is a valid means of assessing adequacy of care provided to the patient. POSSUM can be used for surgical audit to assess and improve the quality of surgical care and helps in better outcome to the patient.

Hence POSSUM scoring system has an undeniable advantage in our set up for better patient counselling, improving the surgical outcomes in both emergency and elective wards and for better management of limited resources and manpower

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