ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING EMERGENCY LAPAROTOMY

1) **DR. SUMITOJ SINGH,** PROFESSOR, DEPARTMENT OF SURGERY, GOVT. MEDICAL COLLEGE, AMRITSAR.
2) **DR. ABHISHEK MOHAN,** SENIOR RESIDENT, DEPARTMENT OF SURGERY, GOVERNMENT MEDICAL COLLEGE, AMRITSAR.
3) **DR. ASHOK KUMAR,** ASSOCIATE PROFESSOR, DEPARTMENT OF SURGERY, GOVT. MEDICAL COLLEGE, AMRITSAR.
4) **DR. AMARBIR SINGH,** ASSOCIATE PROFESSOR, DEPARTMENT OF SURGERY, GOVT. MEDICAL COLLEGE, AMRITSA

CORRESPONDENCE TO: **Dr. Amarbir Singh,** Associate Professor, Department of Surgery, Govt. Medical College, Amritsa

E-MAIL: amarbir_65@rediff.com
TEL: 00919815338884
Address: 44-A, Gali no. 2, Gopal Nagar, Majitha Road, Amritsar 143001

ABSTRACT

Objective: To evaluate the efficacy of the POSSUM scoring system in predicting morbidity and mortality in patients undergoing emergency midline laparotomy in our hospital, a group known to be at high risk of complications and death.

Methods: A total of 100 patients undergoing emergency laparotomy in the general surgery department during the period July 2020 to September 2021 were studied. They were scored using the POSSUM scoring system. Physiological scoring was done at the time of admission and operative scoring was done intraoperatively. Follow-up was done for the first 30 postoperative days and any complications, if present, were noted. The observed morbidity and mortality rates were compared with the POSSUM predicted morbidity and mortality rates.

Results: A total of 43 patients experienced post-op complications. The POSSUM predicted morbidity was 34 patients. An O: E ratio of 1.26 was obtained. There was no statistically significant difference between the observed and predicted morbidity rates [Chi-Square value = 2.745, df = 6, p-value = 0.875]. 15 patients died (mortality rate of 15%). The POSSUM predicted mortality was 12 deaths. O: E ratio of 1.25 was obtained. There was no statistically significant difference between the observed and predicted mortality rates. [Chi-Square value = 4.123, df = 9, p-value = 0.846]

Conclusion: POSSUM scoring can be used to accurately predict morbidity and mortality following emergency laparotomy.

Keywords: Emergency; Laparotomy; Mortality; Risk assessment; Scoring

Introduction

Surgical auditing has long been known not only as a research-generating tool, but also as a crude method to assess a surgical unit's performance. In parts of the developed world today, it

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

is considered mandatory.[1] Quality of care may be assessed by discussion of individual cases or by reviewing a series of patients that underwent a certain surgical procedure. Direct comparison between different surgeons, units, hospitals, and regions is unreasonable owing to differences in patient presentation, the general fitness of the local population, and the nature of the surgery undertaken.[2] The mode and time of presentation especially in the Indian Scenario is subject to significant variation, so it would be unreasonable to compare one patient with another directly.

Scoring systems are given due attention because of the need to accurately evaluate and effectively monitor the proper delivery of healthcare and procedural outcomes. Their applications include comparative audit, in research, to standardize for case mix, and in clinical management as a prognostic indicator.[3] The characteristics of a good risk prediction model would include being simple, reproducible, accurate, objective, and its availability to all patients. In surgery, various risk assessment scoring systems are used, and the Physiological and Operative Severity scoring for the enUmeration of Mortality and Morbidity (POSSUM) risk-adjusted scoring system was developed by Copeland et al. as a method of normalizing data so that direct comparison of the patient outcome may be done despite major differences in case-mix.[4]

Emergency laparotomy is a commonly procedure having a high mortality rate and in the Indian scenario where problems like delayed presentation and limited resources are prevalent, there is a need to validate the POSSUM scoring system in our setup.[5,6]

A review from Whitely et al in 1998 showed that the POSSUM scoring system overpredicted death in their group of patients, particularly in patients with low operative risk. Consequently, the original POSSUM equation was modified leading to the Portsmouth predictor equations for morbidity mortality (P-POSSUM) which used the same variables as the original POSSUM score.[7]

Numerous reports of overprediction of morbidity and mortality in various specialties lead to various modifications of the scoring system in various specific surgeries such as colorectal surgeries, gastrectomy, pancreatic resection, and fracture: neck of femur.[8,9,10,11] In 2002, the original POSSUM equation (using a modified operation classification) was further validated in orthopaedic surgery on a sample of 2326 orthopaedic surgeries over 1 year.[12]

METHODOLOGY

After obtaining approval from the Institutional Ethical Committee, Government Medical College Amritsar, a prospective study of 100 patients undergoing emergency laparotomy, was conducted in the age group : 12-90 years, in Guru Nanak Dev Hospital attached to Government Medical College, Amritsar.

Inclusion criteria – Patient that were of the age group 12 to 90 years that underwent emergency midline laparotomy.

Exclusion criteria:

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

- Patient age <12 yrs. and >90 yrs.
- Patients, who died prior to intubation and on-table deaths.
- Any case of re-exploration
- Any laparotomy where exploration was not via mid-line

POSSUM Score: POSSUM score consists of 12 Physiological variables and 6 Operative severity variables, each of which are divided into 4 grades. [Table1, 2] The sum of the physiological and surgical variables was entered into the following mathematical equations which are used to calculate the risk of morbidity and mortality[2]:

POSSUM Equation for Morbidity:

$Log_e (R_1/1 - R_1) = - 5.91 + (0.16 \times$ physiological score) + (0.19 x operative severity score),

R_1-predicted risk of morbidity.

POSSUM Equation for Mortality:

$Log_e (R_2/1 - R_2) = - 7.04 + (0.13 \times$ physiological score) + (0.16 x operative severity score),

R_2 - predicted risk of mortality.

The patients were followed up for 15 days postoperatively and complications as described in the original score were noted.

STATISTICAL METHODS: The data was collected and was analyzed using appropriate statistical methods. The expected mortality rate was obtained and the O: E ratio was calculated. The Chi-square test was then applied to obtain the p-value to determine whether or not the difference between the predicted death rate and the actual outcome was significant.

TABLE 1: PHYSIOLOGICAL SCORE (12-88) [2]

SCORE	1	2	4	8
AGE (years)	<60	61-70	>71	
Cardiac signs	No failure	Diuretic, Digoxin, anti-angina or hypertensive therapy	Peripheral edema, warfarin therapy, borderline cardiomegaly	Raised JVP, cardiomegaly
Respiratory history	No dyspnea	Dyspnea on exertion	Limiting dyspnea (one on flight)	Dyspnea at rest (rate>30/ min)

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

Chest Radiography		Mild CAOD	Moderate CAOD	Fibrosis or consolidation
Systolic Blood Pressure (mmHg)	110-130	131-170 100-109	>171 90-99	<89
Pulse (beats/min)	50-80	81-100 40-49	101-120	>121 <39
Glasgow coma scale	15	12-14	9-11	<8
Hemoglobin (g/ dl-l)	13-16	11.5-12.9 16.1-17.0	10.0-11.4 17.1-18.0	<9.9 >18.1
White cell count (x10^9/l)	4-10	10.1-20.0 3.1-4.0	>20.1 <3.0	>15.1
Urea (mEq/l)	<7.5	7.6-10.0	10.1-15.0	
Sodium (mEq/l)	>136	131-135	126-130	<125
Potassium (mEq/l)	3.5-5.0	3.2-3.4 5.1-5.3	2.9-3.1 5.4-5.9	<2.8 >6.0
ECG	Normal		Atrial fibrillation (rate 60-90)	Any other abnormal rhythm or >5ectopic beats/min Q-Waves or ST/ T wave changes

TABLE 2: OPERATIVE SCORE (9-44).[2]

SCORE	1	2	4	8
Operative severity	Minor	Moderate	Major	Major+
Multiple Procedures	1		2	>2
Total blood loss (ml)	<100	101-500	501-999	>1000

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

Peritoneal soiling	None	Minor (serous fluid)	Local pus	Free bowel content, pus or blood
Presence of Malignancy	None	Primary only	Nodal metastasis	Distant Metastases
Mode of surgery	Elective		Emergency resuscitation of >2h possible <24h after admission	Emergency (Immediate) surgery <2h needed

RESULTS

We evaluated 100 patients who had emergency midline laparotomy. In our study, 68% of patients were males, with an M: F ratio of 17:8. The patients' age ranged from 13 years to 90 years, with a mean age of 45.53± 16.62 years. Most patients were in the age group 41-60 years (46%). In our study, 3 patients had cardiac risk of which 2 were on diuretic therapy and only 1 had features of congestive cardiac failure. Respiratory risk was more prevalent with 13 patients. This study only included midline emergency laparotomy, so operative severity came out to be major in all of the cases. Furthermore, mode of surgery was also emergency (2-24 hrs) in all cases. Morbidity occurred in 43 out of 100 patients, of which the commonest cause was wound-related complications, followed by pulmonary complications.

TABLE III: Complications

Prevalence of Morbidity	No. of cases	Percentage
Anastomotic Leak	2	2.00%
Atelectasis	3	3.00%
Chest Infection	5	5.00%
Deep Infection	3	3.00%
Deep Vein Thrombosis	2	2.00%
Hypotension	2	2.00%
Urinary Tract Infection	5	5.00%
Wound Dehiscence	5	5.00%

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

Wound Infection	16	16.00%
No complication	57	57.00%
Total	100	100.00%

TABLE IV: Causes of Death

Out of 100 patients, 15 died in the post-op period. The commonest cause of mortality was Sepsis followed by MODS.

Prevalence of Mortality	No. of cases	Percentage
MODS	5	33.34%
Sepsis	6	40.00%
Cardiac Failure	2	13.33%
Respiratory Failure	2	13.33%
Total	15	100.00%

TABLE V INDICATIONS FOR LAPAROTOMY

Indication for Laparotomy	**No. of cases**	**Percentage**
Ileal perforation	25	25.0%
Gastric perforation	18	18.0%
Blunt injury abdomen	7	7.0%
Duodenal perforation	7	7.0%
Ileal stricture	6	6.0%
Sealed Appendicular Perforation	6	6.0%
Acute intestinal obstruction	5	5.0%
Subacute intestinal obstruction	4	4.0%
Caecal gangrene	3	3.0%
Gallstone Ileus	3	3.0%
Obstruction, Ca Ascending colon	2	2.0%

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

Others	14	14.0%

Ileal perforation (25%) was the commonest indication of laparotomy followed by gastric perforation (18%) and blunt trauma abdomen (7%).

TABLE VI

ANALYSIS OF OBSERVED TO EXPECTED MORBIDITY RATIO

Predicted morbidity	No. of patients	Observed Morbidity	Expected Morbidity	O.E. Ratio
<10%	0	0	0	-
10-20%	0	0	0	-
20-30%	1	0	0	-
30-40%	15	6	7	0.85
40-50%	18	9	3	3
50-60%	10	6	4	1.5
60-70%	15	6	5	1
70-80%	12	5	5	1
80-90%	6	2	2	1
90-100%	23	10	8	1.25
Total	100	43	34	1.26

[Chi-Square value = 2.745, df = 6, p-value = 0.875]

TABLE VII

ANALYSIS OF OBSERVED TO EXPECTED MORTALITY RATIO

Predicted morbidity	No. of patients	Observed	Expected	O.E. Ratio
<10%	32	3	0	-
10-20%	27	2	1	2
20-30%	14	1	1	1
30-40%	4	1	0	-
40-50%	6	1	2	0.5
50-60%	7	1	1	1

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

60-70%	3	1	1	1
70-80%	2	1	1	1
80-90%	2	1	2	0.5
90-100%	3	3	3	1
Total	100	15	12	1.25

[Chi-Square value = 4.123, df = 9, p-value = 0.846]

DISCUSSION

In today's era, where the patient's safety and proper management are given great importance, it is crucial to assess the expected outcome of the procedure performed. Recognizing patients who are at high risk of developing complications and those who have a high chance of mortality would prepare us to take the necessary measures thereby allowing us to better manage the patient. In developing countries like India, due to poverty and ignorance and various other factors the presentation of a particular illness is often delayed and variable, leading higher complication rates and high mortality rates.[13]

We evaluated 100 patients who had undergone emergency midline laparotomy in the department of General Surgery, Govt. Medical College, Amritsar. This study was carried out to determine the validity and accuracy of the POSSUM scoring system for the prediction of morbidity and mortality. Since this study only includes emergency cases, correction of all physiological variables, before surgery, was not possible. Furthermore, preoperative diagnosis of malignancy was also not possible or available in all patients. Since all patients underwent midline laparotomies, operative severity was constant and all patients received a score of 4. Since re-exploration cases were not included, the 'multiple procedures' variable was also a constant (all patients received a score of 1).

A total of 43 patients suffered from post-op complications. Wound infections (16%) and chest infections (8%) accounted for majority of the complications. The POSSUM predicted morbidity was calculated to be 34. On using the chi-square test, there was no statistically significant difference between the observed and expected morbidity rates [Chi-Square value = 2.745, df = 6, p-value = 0.875] and O.E. ratio of 1.26 was obtained. Similar results were obtained by Mohil RS et al [14]. (35% and 20% respectively) and Rana DS et al [15] [chest infections (27%) and wound infection (17%)]. High incidence of wound infections could be due to the large number of patients who had peritoneal soiling resulting from hollow viscus perforation resulting in contamination of the incision site. A raised diaphragm, extension of the incision to the upper abdomen, severe peritoneal contamination probably resulted in higher rates of chest infections.

Among the 15 patients that died in the postoperative period, 6 died due to sepsis, 5 due to MODS, and 4 due to cardio-pulmonary complications. On using the POSSUM score, the

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

expected mortality rate was calculated to be 12 deaths. On using the chi-square test, there was no statistically significant difference between the observed and expected mortality rates [Chi-Square value = 4.123, df = 9, p-value = 0.846] and O.E. ratio of 1.25 was obtained. Similar findings were obtained by Sreeharsha et al[16] (O: E=0.71) and Chatterjee AS et al.[13] (O: E = 1.005). Hence, we may conclude that POSSUM scoring system accurately predicted the adverse outcomes following midline emergency laparotomy in our study.

CONCLUSION

We may conclude that even in a resource-limited setup, the POSSUM score may be used to accurately predict the adverse outcomes following emergency laparotomy. POSSUM is one of the best scoring systems for the prediction of morbidity and mortality risk with reasonable accuracy. It has been validated by many authors around the world and has been a successful tool for surgical auditing.

PATIENT'S CONSENT

Informed consent was obtained from all the patients/relatives before the study began.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Watters DA, Green AJ, Van Rij A. Guidelines for surgical audit inAustralia and New Zealand. ANZ journal of surgery. 2006; 76 (1-2):78- 83.

2. Copeland GP, Jones D, Walters M. POSSUM: a scoring system for surgical audit. Br J Surg 1991; 78(3):355-360

3. Saklad M. Grading of patients for surgical procedures. Anesthesiology. 1941;2:281e4.

4. Markus PM, Martell J, Leister I, Horstmann O, Brinker J, Becker H. Predicting postoperative morbidity by clinical assessment. British journal of surgery. 2005 Jan;92(1):101-6.

5. Prytherch DR, Whiteley MS, Higgins B, Weaver PC, Prout WG, Powell SJ. POSSUM and Portsmouth POSSUM for predicting mortality. British Journal of Surgery. 1998 Sep;85(9):1217-20.

6. Brosens RP, Oomen JL, Glas AS, van Bochove A, Cuesta MA, Engel AF. POSSUM predicts decreased overall survival in curative resection for colorectal cancer. Diseases of the colon & rectum. 2006 Jun 1;49(6):825-32. 20

7. Whiteley MS, Prytherch DR, Higgins B, Weaver PC, Prout WG. An evaluation of the POSSUM surgical scoring system. British journal of surgery.

ISSN: 0975-3583,0976-2833 VOL 14, ISSUE 03, 2023

1996 Jun;83(6):812-5.

8. Otsuka Y, Kunisaki C, Ono H, Yamada R, Matsuda G, Nomura M, Akiyama H, Imada T, Shimada H. Modified POSSUM to predict postoperative morbidity following gastrectomy. Hepato-gastroenterology. 2007 Jun;54(76):1142-5.

9. Pratt W, Joseph S, Callery MP, Vollmer Jr CM. POSSUM accurately predicts morbidity for pancreatic resection. Surgery. 2008 Jan 1;143(1):8-19. Ramanathan TS, Moppett IK, Wenn R, Moran CG. POSSUM scoring for patients with fractured neck of femur. British journal of anaesthesia. 2005 Apr 1;94(4):430-3.

10. Mohamed K, Copeland GP, Boot DA, Casserley HC, Shackleford IM, Sherry PG, Stewart GJ. An assessment of the POSSUM system in orthopaedic surgery. The Journal of bone and joint surgery. British volume. 2002 Jul;84(5):735-9.

11. Parihar V, Sharma D, Kohli R, Sharma DB. Risk adjustment for audit of low risk general surgical patients by Jabalpur-POSSUM score. Indian J Surg. 2005; 67: 38-42.

12. Mohamed K, Copeland GP, Boot DA, Casserley HC, Shackleford IM, SherryPG, Stewart GJ. An assessment of the POSSUM system in orthopaedic surgery. The Journal of bone and joint surgery. British volume. 2002 Jul;84(5):735-9.

13. Chatterjee AS, Renganathan DN. POSSUM: A Scoring System for Perforative Peritonitis. J Clin Diag Res. 2015; 9(4): PC05-PC09.
14. Mohil RS, Bhatnagar D, Bahadur L, Rajaneesh, Dev DK Magan M. POSSUM and P-POSSUM for risk-adjusted audit of patients undergoing emergency laparotomy. Br J Surg.2004; 91(4): 500-03.

15. Rana DS, Singh A, Gupta P, Singh V, Bandyopadhyay G. Evaluation of POSSUM Score for Outcome Prediction in Patients Undergoing Emergency Laparotomy. Ann. Int. Med. Den. Res. 2018; 4(4): SG01- SG05.

16. Sreeharsha H, Sp R, Sreekar H, Reddy R. Efficacy of POSSUM score in predicting the outcome in patients undergoing emergency laparotomy. Pol Przegl Chir. 2014 Apr;86(4):159-65. doi: 10.2478/pjs-2014-0029. PMID: 24988229.