Positive Predictive Value Of Possum Scoring In Outcome Prediction In Laparotomies

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Abstract: Background: Early prognostic evaluation of laparotomies patients is desirable to select the high-risk patients for a more aggressive treatment. The continuous monitoring and audit of clinical practice is an essential part of making improvements in medical science and enhancing patient care. P-POSSUM remain the most commonly used scoring system in laparotomies for prediction of mortality and morbidity. Material & Methods: 50 Patients undergoing emergency or elective laparotomy were scored according to their physiological pre-op, post-op & intra-operative parameters and findings. And thus, final expected mortality rate and morbidity rate was calculated according to P-POSSUM scoring system. Positive predictable value (PPV) and sensitivity were calculated. Results: In this study, True Positives are 27, False Positives are 12, False Negative is 0 & True Negatives are 11. Sensitivity of the P-POSSUM scoring system is 100%. Positive predictive value is 69.23%. Conclusion: P-POSSUM remain the most commonly used scoring system in laparotomies. POSSUM is subjective scoring system but in actual study morbidity is near or less than expected. It may due to vigorous post-operative management for decreasing morbidity score. It's a useful tool for clinicians to predict prognosis as well as anticipate development of morbidities. [Surati K Natl J Integr Res Med, 2020; 11(6):28-32]

Key Words: laprotomy , APACHE I and APACHE II , SOFA , MODS, P-POSSUM Score

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Introduction: Emergency laparotomy is most common emergency surgery and describes an exploratory procedure for which the clinical presentation, underlying pathology and its severity, anatomical site of surgery, and peri-operative management vary considerably. The fact that over 400 different surgical procedures have been recorded during an emergency laparotomy, reflect the diverse nature of this surgical cohort[1]. The varied surgical pathology and the emergent nature of the procedure limit the time to optimize these patients[1]. Although there is scarcity of outcome data after emergency laparotomy, it is generally recognized to be poor[1]. Even after innumerable advances in surgical skills, antimicrobial agents and supportive care, the mortality of peritonitis remains high, and is presently reported to be between 14.9-19.5%[1, 2].

Early prognostic evaluation of these patients is desirable to select the high-risk patients for a more aggressive treatment. The continuous monitoring and audit of clinical practice is an essential part of making improvements in medical science and enhancing patient care. It is also essential to ensure that patients are well informed of risks and to improve quality of care in hospitals. Knowing which patient is at risk of developing complications or dying contributes to the quality of surgical care and cost reduction. Doctors are legally bound to inform their patients of the potential risks involved with a particular treatment. It is therefore essential to identify and make appropriate decision on those patients who are at high-risk of developing serious complications or die. Categorizing patients into different risk groups would also help prognosticate the outcome, select patients for intensive care and determine operative risk, thereby helping to choose the nature of the operative procedure, e.g. damage control vs. definitive procedure.

Possum & It's Variants[3,4]: Copeland et al. first described POSSUM (Physiological and Operative severity for the enumeration of mortality and morbidity) in 1991 as a scoring system for surgical audit. They used logistic regression analysis to predict both morbidity and mortality.

However, it was found to over predict death, especially amongst the low risk patients. This led to the modification of the logistic regression and development of the Portsmouth POSSUM (P-POSSUM). POSSUM used the same physiological and operative scoring methods initially described by Copeland et al. and its predicted mortality matched with the observed mortality. It uses 12 physiological and 6 operative parameters which were divided into 4 grades with exponentially increasing score (1, 2, 4, and 8) to calculate the

risk of mortality. The minimum score is 12 and maximum score is 88, with higher scores predicting higher mortality. POSSUM has subsequently been modified for application in various types of surgeries. O-POSSUM for orthopedic surgeries, V-POSSUM for vascular surgeries and Cr-POSSUM for colorectal surgeries.

P-POSSUM still remains the scoring system of choice for general surgeries and also for emergency laparotomies, especially in the United Kingdom. Numerous studies have validated POSSUM or one of its variants in general surgery, laparotomy or in high risk patients.

When we predict development of morbidity &/or mortality by P-POSSUM, we must know how much out of the predicted patients, actually develop the morbidity &/or mortality. That can be known by knowing the positive predictive value[5,6].

Aims & Objectives: This study was carried out to understand predictive power and sensitivity of POSSUM scoring methods for development of post-op morbidity and/or mortality.

Material & Methods: Source of Data: After receiving the approval from IRB, those patients undergoing laparotomy; admitted under department of general surgery of AMC MET Medical College, Ahmedabad from January 2018 to March 2020; were included for data collection.

Sample Size: 50 Patients.

Method of Collection of Data: During hospitalization, relevant history was collected and appropriate investigations as deemed necessary were done using standard procedures.

The patients were then scored according to their physiological pre-op, post-op & intra-operative parameters and findings. And thus, final expected mortality rate and morbidity rate was calculated using P-POSSUM. And patients were grouped according to the predicted chances of developing morbidity &/or mortality. Positive predictable value and sensitivity of POSSUM score were calculated.

Inclusion Criteria: Those patients who underwent laparotomy during the above mentioned period at the above mentioned source were selected after randomization.

Exclusion Criteria: Age < 18 years. Patient which were lost in follow-up period.

Results: Demographic profile of the patients is tabulated as follows.

Table 1: Demographic Profile

Age Range	Number of Patients
12-20 Years	7 (14%)
20-30 Years	16 (32%)
30-40 Years	12 (24%)
40-50 Years	6(12%)
50-60 Years	4 (8%)
>60 Years	5(10%)

Mode & Indications Of Surgery: Life threatening emergencies like penetrating trauma, hollow visceral perforation and other cause of acute abdomen with hemodynamically unstable patients are included in immediate emergency surgeries. Whereas appendicectomy, intestinal obstruction and perforated GB etc. are consider in emergency surgeries. Planned appendices tomy, cholecystectomy, cystogastrectomy are consider as elective major surgeries.

Chart 1: Mode of Surgery

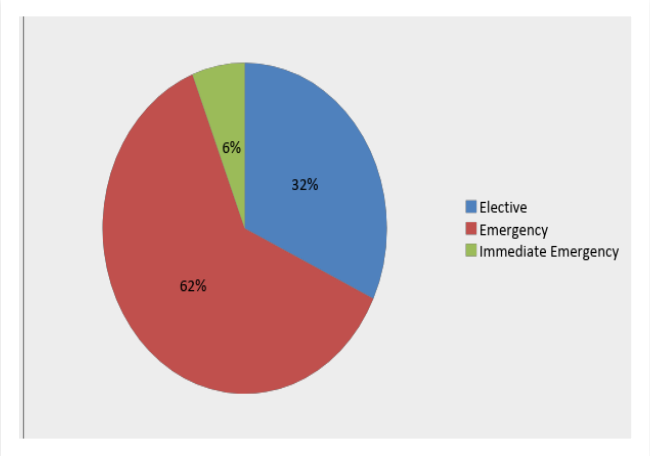

Table 2: Indications of Surgeries

Indications of Surgery	Number of Cases
Perforation of Hollow Viscus	22 (44%)
Penetrating/Blunt Abdominal Trauma	8 (16%)
Acute/Sub acute Intestinal Obstruction	7 (14%)
Obstructed/Strangulated Hernia	4 (8%)
Others	9 (18%)

Prediction Of Morbidity: Around 29 patients out of 50 were faced morbidity. Most common complication encountered was wound infection, followed by sub-acute intestinal obstruction. Other morbidity include Anatomic leak, septicemia, burst abdomen, renal failure etc.

Table 3: Morbidity & Mortality

Complication	Number of Cases
Wound Infection	12 (41%)
Sub-acute Intestinal Obstruction	5 (17%)
Septicemia	4 (14%)
Anastomosis Leak	3 (10%)
Burst Abdomen	3 (10%)
Death	2 (7%)

MORBIDITY AND MORTALITY: According to p-possum scoring system physiological and operative score were calculated and chances development of morbidity and mortality percentage were calculated and compared with actual result of the study.

Chart 2: Comparison Between Predicted & Original Morbidity

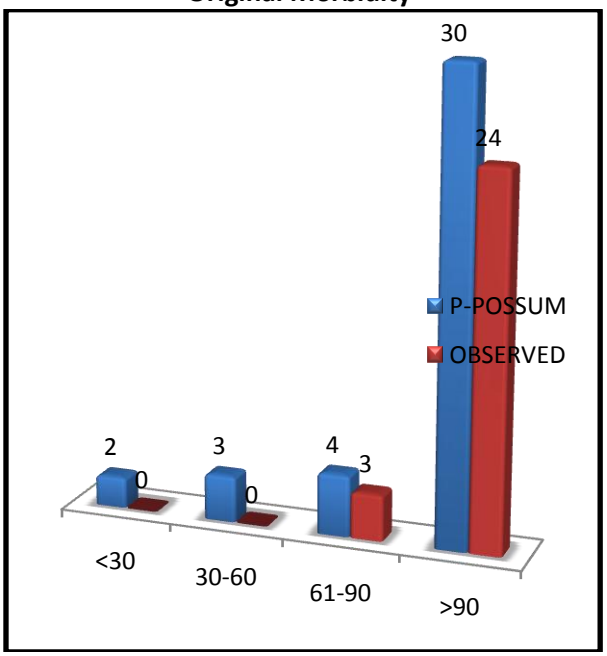

Table 4: Comparison Between Predicted &Observed Morbidity

Chance of development of morbidity	No. Of patients predicted to develop morbidity by P-POSSUM Scoring.	No. Of patients eho developed the morbidity post laparotomy.
Very Low(<30%)	2	0
Low(30%-60%)	3	0
Moderate(60%-90%)	4	3
High(>90%)	30	24

Table 5: Comparison Of Predicted & Morbidity.

Severity of Risk	Predicted According To P-Possum Score	Observed Result Of Study
Risk Of Developing Morbidity (>60%)	34	27
Risk Of Mortality (>60%)	5	2

SENSITIVITY AND POSITIVE PREDICTIVE VALUE for morbidity:

Table 6: Predictive Power & Sensitivity of P-POSSUM Scoring.

Possum Prediction	Observed Data		Total
	No. Of Patients Who Developed Morbidity.	No.Of Patients Who Didn't Developed Morbidity.	
No Of Patients Predicted To Develop Morbidity.	27 (A)	12 (B)	39
Not Predicted To Develop Morbidity.	0 (C)	11 (D)	11
Total	27	23	50

In this study, True Positives are 27, False Positives are 12, False Negative is 0 & True Negatives are 11. Sensitivity of the P-POSSUM scoring system is 100%. Positive predictive value is 69.23%. However, if the positive predictive value was calculated considering only predicted moderate to high chances

of development of morbidity as per table 5, the positive predictive value of P-POSSUM score is higher around 80%.

Discussion: Positive Predictive value reflects the probabilities of subject with positive screening test actually have the diseases. In present study positive predictive value of POSSUM was approximately around 70 percentages which indicate 70 percent would actually develop morbidity have among total positive cases. The test with higher PPV has good outcome for diagnosis and treatment as clinicians have better objective way to anticipate the development of morbidity. So, man a times complications can be avoided.

It may be due to vigorous post-operative management for decreasing morbidity score. POSSUM is nearly too accurate in predicting mortality rate in above study. However, when it came to predict development of morbidity in patients having moderate to severe chances, the P-POSSUM Scoring system has higher positive predictive value. So, where the chances of development of morbidity were higher, the P-POSSUM scoring had higher impact on predicting the development of morbidity. This is also helpful in explaining the prognosis to the patients & their relatives.

Despite advancement in surgical technique and critical care facilities, high-risk surgical procedures are associated with substantial mortality[6]. As per WHO global estimates, approximately 1–5 million postoperative deaths occur per year, and postoperative morbidity is expected to be 5–10 times this rate.[7] Risk scoring measurement can help in standardization and evolution of more effective treatment regimens.

An ideal system, there should balance between ease of use and accuracy. Numerous scoring systems are available such as**,** Simplified acute physiology score (SAPS), multiple organ dysfunction score (MODS), sepsis-related organ failure assessment (SOFA) score, sepsis score, multiple organ failure (MOF) score Acute Physiology and Chronic Health Evaluation (APACHE-I & APACHE-II) etc. But each has its own pros and cons.

POSSUM, in essence, is a surgeons scoring system as it includes parameters accounting for operative severity. In this study, significant differences was noted in P-POSSUM scores predicting patients with healthy recovery as well as predicting patients, who developed post-operative complications and even death, validating P-POSSUM score in our setup as reliable risk scoring system. The efficacy of P-POSSUM scoring system is well-proven across various surgical set-ups too as shown by different studies.

Ying et al. suggested some drawbacks of POSSUM like different definitions of postoperative complications result in different settings, issue of missing data, difficulty in establishing the classification of electrocardiography abnormalities and the exact operative blood loss. Furthermore, liver dysfunction, blood glucose, nutritional status etc., which are often detrimental in outcome of surgery are not included in parameters of P-POSSUM scoring[8].

Conclusion: Till recent times, ease of calculation, especially at the bedside, used to be extremely essential criteria for any scoring system. However, the advents of smart phones and mobile applications have made the use of even intricate scoring systems like the P-POSSUM.

P-POSSUM remain the most commonly used scoring system in laparotomies. Although P-POSSUM has been most frequently used for audit purposes in this cohort, it is associated with certain limitations. Operative variables such as estimated blood loss or peritoneal contamination may have significant inter-observer bias. A similar surgery by two different surgeons, one causing or estimating higher blood-loss than the other, will cause a change in the observed to expected (O/E) risk ratio. Besides, the delay in getting histopathology reports can also delay the risk assessment.

However, unlike P-POSSUM, it does not consider etiology or degree of peritoneal contamination and is purely based on the acute physiologic and chronic health status of the patient. While it does eliminate risk assessment based on subjective evaluation of certain risks in the P-POSSUM scoring system (example, peritoneal soiling or estimated blood loss), it does not consider the surgical procedure or the operative findings. However, it does factor-in emergency surgeries while calculating the risk.

Overall, due to its higher sensitivity and positive predictive value, P-POSSUM can be used as a tool to anticipate the development of morbidity. This is also helpful to clinicians in explaining the prognosis to the patients & their relatives.

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Conflict of interest: None

Funding: None

Cite this Article as: Surati K, Modi R, Suthar H, Modi J, Modi H, Shah A, Khakhariya V, Patel J, Patel M. Assessing The Risk : Positive Predictive Value Of Possum Scoring In Outcome Prediction In Laparotomies. Natl J Integr Res Med 2020; Vol.11(6):28-32