International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

A Comparative Study of P-Possum Vs Apache II Scoring System in Predicting Postoperative Mortality and Morbidity in Gastrointestinal Surgeries

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Abstract: ***Surgical morbidity and mortality can be avoided or minimized by diligent preoperative evaluation, clinical condition optimization, effective control of anaesthetics and surgery, and adequate postoperative support. There are many available morbidity and mortality predictors (ASA, APACHE, SAPS II). The POSSUM Score uses both a pre-operative assessment of the severity of pre-existing concomitant medical conditions and information collected during the peri-operative period, i.e., the severity of surgical insults, intra-operative blood loss, etc., to predict the post-operative course of patients. The applicability of the POSSUM Score for specific medical conditions has been tested by a variety of tests, and a number of varieties have also arisen, i.e., the P-Possum-Score or the V-POSSUM-Score. The development of APACHE II scoring system for use in intensive care units specifically, in patients it is evident who were undergoing different surgeries, it can predict peri-operative events. This study was undertaken to compare p-possum and APACHE II scoring system for identifying gastrointestinal surgeries outcomes in our setup and, if the outcome is low, what are the different causes for it to be analysed among the group with this high-risk. In our study we found that 11 0ut of 33 (33.3%) patient of age less than 60 years, 4 out of 12 (33.3%) patients of age between 61-70 years and 4 out of 5 (80 %) patients of age more than 70 years expired. Among older adults, the risk of complications and early death after commonly performed abdominal procedures is greater and statistically significant which is similar to previously done studies.***

Keywords: P-POSSUM score, APACHE II, GI surgery

1. Introduction

Surgical morbidity and mortality can be avoided or minimized by diligent preoperative evaluation, clinical condition optimization, effective control of anaesthesia and surgery, and adequate postoperative support. [1] There are many available morbidity and mortality predictors (ASA, APACHE, SAPS II). [2, 3] The ASA-Classification Ranking, for instance, is most commonly used in surgical and anaesthesia settings to determine the seriousness of pre-existing diseases. The ASA-score, however, is less relevant for evaluating whether a patient will experience severe complications as a result of the severity of the surgery performed. [4, 5]

Among these systems POSSUM, created by Copeland and collaborators.[2] The POSSUM Score uses both a pre-operative assessment of the severity of pre-existing concomitant medical conditions and information collected during the peri-operative period, i.e., the severity of surgical insults, intra-operative blood loss, etc., to predict the post-operative course of patients. The applicability of the POSSUM Score for specific medical conditions has been tested by a variety of tests, and a number of varieties have also arisen, i.e., the P-Possum-Score or the V-POSSUM-Score.[4]The revised scoring system, named "Portsmouth" POSSUM The same variables and grading systems are incorporated in surgical scoring system P-POSSUM, when implemented prospectively, the expected mortality provided is very close to the actual or observed mortality in-hospital. [6] Both operative and physiological parameters are used in P-POSSUM scoring system pre-operatively, intra operatively, has been proposed to address these concerns. [7]

Disease severity is evaluated by qualifying 34 physiological variables in the APACHE scoring system. The number of variables including laboratory and physiological as well in APACHE II scoring system are lowered from 34 to 12, and variables for previous health status & age are added, so recently it replaced the original APACHE method. The development of APACHE II scoring system for use in intensive care units specifically, in patients it is evident who were undergoing different surgeries, it can predict peri-operative events.

This study was undertaken to compare p-possum and APACHE II scoring system for identifying gastrointestinal surgeries outcomes in our setup and, if the outcome is low,

what are the different causes for it to be analysed among the group with this high-risk.

As a risk-based scoring system, for the direct comparison of predicted and observed rates of adverse outcomes, the POSSUM has been recommended, hence calling it as "surgeon-based scoring system."

Aim
The aim is to evaluate the predictive accuracy of p-possum vs APACHE II scoring system in identifying risk factors in patient undergoing GI surgeries.

Objectives
1) To evaluate the validity of Portsmouth POSSUM in comparison with APACHE II scoring system in predicting anticipated morbidity and mortality rate in patient undergoing GI surgeries in Bharati hospital and research centre, Pune.
2) At the end of study, a new scoring system will be developed in patients undergoing GI surgeries for post-operative prediction of morbidity and mortality.

2. Materials and Methods

Study Area: Bharati hospital and research centre

Study Population: This prospective study with 50 patients undergoing gastrointestinal surgeries were included who were admitted in department of general surgery admitted in Bharati Hospital and research centre, Pune from October 2018 to APRIL 2021 will be included in the study after giving informed consent and ethical clearance.

Study Design: Prospective observational study

Period of Study: 24 months

Inclusion Criteria
As per the definition of POSSUM scoring system patients were included who were undergoing any of the following surgical procedures:
1) Any laparotomy
2) Bowel resection
3) Cholecystectomy, Appendectomy
4) GI malignancy

Exclusion Criteria
1) Age less than 18 years
2) Day care surgery

3. Methodology

Patients were informed details about the conduct of the study via detailed patient information sheet and prior to inclusion of patients in the study an informed written consent will be taken. During hospitalization relevant history would be collected and using standard procedures as deemed necessary appropriate investigations will be done. Depending on their physiological parameters the patients will be scored and the record of the intra-operative findings will be kept and a final expected mortality rate will be calculated.

4. Results

Age distribution
Of 50 cases studied, 33 (66.0%) patients of age less than 60 years, 12 (24.0%) patients of age between 61 – 70 years and 5 (10.0%) patients of age above 70 years in the study group.

Sex distribution
Of 50 cases studied, 29 (58.0%) were male and 21 (42.0%) were females in the study group. The male to female sex ratio in the study group was 1.38: 1.00.

Distribution of incidence of mortality
Of 50 cases studied, 31 (62.0%) survived and 19 (38.0%) expired in the study group.

Distribution of mean P- POSSUM Score according to mortality Distribution of mean ± SD of P-POSSUM score in group of cases who survived and group of cases who expired was 35.23 ± 9.85 and 51.32 ±11.28 respectively. Distribution of minimum – maximum range of P- POSSUM score in survived and expired group of cases was 24 – 72 and 31– 77 respectively.

Distribution of mean P-POSSUM score is significantly higher in group of expired cases compared to group of survived cases (P-value<0.001).

Distribution of mean APACHE – II Score according to mortality Distribution of mean ± SD of APACHE-II score in group of cases who survived and group of cases who expired was 6.68 ± 3.67 and 15.42 ± 5.30 respectively. Distribution of minimum – maximum range of APACHE-II score in survived and expired group of cases was 0 – 15 and 8 – 24 respectively.

Distribution of mean APACHE-II score is significantly higher in group of expired cases compared to group of survived cases (P-value<0.001).

Distribution of diagnostic cut-offs of DHI scores for the diagnosis of BPPV:
The receiver operating characteristic (ROC) curve, which is defined as a plot of test sensitivity as the y coordinate versus its 1-specificity or false positive rate (FPR) as the x coordinate, is an effective method of evaluating the quality or performance of diagnostic tests against a specific Gold standard. This technique is used to find the best predictor of incidence of mortality.
From the ROC curve analysis, it is clear that, the distribution of area under the curve (AUC) differs significantly for P-POSSUM score and APACHE- II score for the prediction of mortality from the reference value of 0.500 (P-value<0.001 for both).

The distribution of area under the curve (AUC) for P-POSSUM-Score and APACHE-II Score was 0.883 and 0.924 respectively for the prediction of mortality.

The distribution of area under the curve (AUC) is relatively higher for APACHE-II score compared to P-POSSUM-score for the prediction of incidence of mortality. Thus, APCHE-II score is relatively more useful in predicting the incidence of

mortality compared to POSSUM-score and thereby APACHE-II score seems to be a relatively better classifier than the POSSUM Score. However, there is a little difference between the values of AUCs for both scores P-POSSUM-score and APACHE-II score viz 0.883 and 0.924 respectively, the ability of both the scores to predict the incidence of mortality seems to be approximately similar.

With reference to ROC analysis, the optimal cut-offs of P-POSSUMscore and APACHE-II score were 42.00 and 11.00 respectively.

Distribution of incidence of mortality according to P-POSSUM Score The incidence of mortality in the group of cases with higher P-POSSUM score (≥42) and group of cases with lower P- POSSUM score (<42) was 75.0% and 3.8% respectively.

Distribution of incidence of mortality is significantly higher in group of cases with higher P- POSSUM score (≥42) compared group of cases having lower P-POSSUM score (<42) in the study group (P-value<0.001).

Distribution of incidence of mortality according to APACHE-II Score The incidence of mortality in the group of cases with higher APACHE-II score (≥11) and group of cases with lower APACHE-II score (<11) was 76.2% and 10.3% respectively.

Distribution of incidence of mortality is significantly higher in group of cases with higher APACHE-II score (≥11) compared group of cases having lower APACHE-II score (<11) in the study group (P-value<0.001).

Distribution of diagnostic efficacy indices of P-POSSUM score and APACHE-II Score for the prediction of mortality

Distribution of sensitivity, specificity, PPV, NPV and accuracy for P- POSSUM Score (Cut-off value of 42) as a predictor of incidence of mortality is 94.7%, 80.6%, 75.0%, 96.1% and 86.0% respectively.

Distribution of sensitivity, specificity, PPV, NPV and accuracy for APACHE-II Score (Cut-off value of 11) as a predictor of incidence of mortality is 84.2%, 83.9%, 76.2%, 89.7% and 84.0% respectively.

Based on the analysis of diagnostic efficacy indices of both scores for the prediction of mortality yielded almost similar indices especially accuracy measure of both scores P-POSSUM-score and APACHE-II score viz 86.0% and 84.0% respectively, the ability of both the scores to predict the incidence of mortality seems to be approximately similar.

5. Discussion

Surgical audit has increased in importance over the past few years, both as an educational process and as a means of assessing and improving the quality of surgical care. Recognizing patients who are at risk of developing complication will contribute substantially to the better management of the patients and resource utilization. Preoperative assessment of postoperative outcomes is useful for reducing the morbidity and mortality associated with any surgical procedure. The risk associated with anaesthesiologic and surgical procedures has been decreased due to the development of new drugs and improvements in methods and equipment. The acceptable level of risk has probably not changed, with a significant number of unhealthy and elderly patients undergoing extensive surgical procedures. Thus, choosing a more useful scoring system to predict post-operative morbidity and mortality, especially mortality, is necessary to facilitate the best postoperative care for surgical patients. [8]

In our study we found that 11 0ut of 33 (33.3%) patient of age less than 60 years , 4 out of 12 (33.3%) patients of age between 61-70 years and 4 out of 5 (80 %) patients of age more than 70 years expired. Among older adults, the risk of complications and early death after commonly performed abdominal procedures is greater and statistically significant which is similar to previously done studies. [9]

APACHE-II had the maximum area under the curve. APACHE-II is a relatively better test that has the capability to predict with maximum accuracy the subset of patients that are going to expired from GI surgeries. APACHE-II is relatively more useful in predicting the incidence of mortality compared to p-POSSUM score.

Positive Predictive Value
APACHE-II easily trumps the p-POSSUM score with a positive predictive value of 76.2% while p-POSSUM gives only 75%.

Negative Predicitive Value
APACHE II has negative predictive value of 89.7% and 96.1% for p- POSSUM score.

Analysis of individual scores:

APACHE-II
APACHE-II has higher AUC than p-POSSUM. The cut-off point obtained in the study is 11. APACHE-II is accurately able to predict death despite not taking into account of intra operative findings and the underlying pathology. There is a definite discrepancy between studies elsewhere and this study in probabilities of death for patients with score 11-20.

P-POSSUM
The main advantage of P-POSSUM unfortunately is also its Achilles heel its dependence on intra operative findings. While one may assume that its accuracy of prediction may be enhanced by this characteristic, it also makes it less useful in a preoperative setting. P-POSSUM performed admirably running APACHE-II a close second in discriminatory ability. [10] The cut off obtained in this study is very high compared to cut off values from similar studies. As one approaches the higher scores the probability of death shows an increase that corresponds well with expected mortality.

This is the new scoring system derived from P- POSSUM and APACHE II variables with minimum score of 12 and

maximum score of 48. It is classified into three categories as Minimal risk, Moderate risk, High risk of mortality. [11]

6. Conclusion

APACHE-II is a highly accurate score with good reliability at higher scores and moderate sharpness. The cut off obtained is 11 which is reasonably similar to cut off values obtained elsewhere. The main difficulty in computing this score is the plethora of biochemical and haematological values needed. Among both APACHE II had the highest positive predictive value. P-POSSUM is easily relatable to a surgeon and is nearly as accurate as APACHE-II. The cut off value obtained in this study did not match similar studies. To conclude we can say that while these scores do provide a method of estimating mortality, they are no substitute to clinical management. None of the scores here provide a dynamic assessment of the patient as they are a calculated only once at a particular point of time. APACHE-II seems to be the ideal score.

Based on the analysis of diagnostic efficacy indices of both scores for the prediction of mortality yielded almost similar indices especially accuracy measure of both scores POSSUM-score and APACH-II score viz 86.0% and 84.0% respectively, the ability of both the scores to predict the incidence of mortality seems to be approximately similar. Through my study we have derived a new scoring system which needs further evaluation.

	1	2	3	4
Physiological criteria				
AGE	< 50years	51-60 years	61-70 years	> 70years
heart rate (beats/min)	50-80	81-100 40-49	101-120	>120 <40
GCS	15	12-14	9-11	<8
Hb	13-16	11.5-12.9 16.1-17.0	10.0-11.4 17.1-18.0	<10.0 >18.0
SBP	110-130	131-170 100-109	>170 90-99	<90
pH	7.5-7.59	7.25-7.32	7.6-7.69 7.15-7.24	>7.69 <7.15
Urea (mg/dl)	<21.28	21.28-28.0	28.28-42.01	>42.01
Na+	>135	131-135	126-130	<126
K+	3.5-5.0	3.2-3.4 5.1-5.3	2.9-3.1 5.4-5.9	<2.9 >5.9
Operative criteria:				
Peritoneal soiling	None	Minor (serous fluid)	Local pus	Free bowel content, pus or blood
Presence of malignancy	None	Primary only	Nodal metastasis	Distant metastasis
Mode of surgery	Elective	Admitted for elective procedure but operated in emergency	Emergency resuscitation for >2 hours possible, operation <24 post admission	Emergency (immediate, <2 hours needed)

Total score range: 12 to 48Interpretation: -

- 12to24: Grade – I → Minimal risk of mortality
- 25to36: Grade – II → Moderate risk of mortality
- 36to48: Grade – III→ High risk of mortality

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