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Evaluation of p-possum scoring in predicting the mortality of the patient in emergency surgery in tertiary care center

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Introduction

Scoring systems are designed to rate the severity of an illness at an early stage and used for comparison of different clinical settings to identify different standards of care and to allocate adequate resources. An accurate risk adjusted scoring system, is one which should be patient specific and incorporate the influence of the diagnosis for which he or she is being subjected for surgery.

It should take into consideration whether the procedure is elective or emergency and incorporate all the 2 variable presentations of each patient as well as be an indicator of the efficiency of the procedure itself. Such scoring systems should be used as indicators for quality of health care provided for patients as well as an index to evaluate the outcome of the procedure to compare operative techniques among surgeons.

The Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (POSSUM) and its modification the Portsmouth POSSUM, have been proposed as a method for standardising patient data so that direct comparisons can be made in spite of differing patterns of referral and population[1,2]

The Physiological and Operative Severity Score for the enumeration of Mortality and morbidity (POSSUM) was developed in 1991 for use within general operative practice.[3]

POSSUM evaluates 12 preoperative physio logical varia bles and 6 operative variables using a 4-grade scoring system, with results analyzed using linear or exponential methods. The POSSUM scoring system has been reported to overestimate mortality, particularly in low-risk patients.[4,5]

In order to address this problem across a number of surgical procedures, modifications of the POSSUM scoring system have been proposed, including Ports mouth - POSSUM (p-POSSUM)9and oesophago gastric-POSSUM (o-POSSUM).[6]p-POSSUM includes a revision to both its regression equation constant and weighting to predict in-patient mortality. Numerous researchers have found the predictive ability of p-POSSUM to be more accurate as compared to POSSUM. [7,8]

The efficacy of POSSUM and its modification of the scoring system i.e P-Possum (Portsmouth possum) has

been claimed to be an improvement over its predecessor and has been discussed in detail in this.

Aims and Objectives

This study aims to assess the efficacy of the scoring system by comparing the observed and expected rates of mortality.

To calculate the rates of predicted mortality in the cases taken for emergency laparotomy and calculate efficacy in predicting the mortality rates.

Materials and Method

Source of data

Patients admitted to tertiary care center and underwent emergency laparotomy.

Study period: was from January 2021 to December 2021 (12month).

Sample Size: 100

Type of study: Retrospective Observational

Method of data collection

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 intra-operative findings recorded by the operating surgeon. The data will be collected from the Medical Record Department.

Using the following equations the mortality rates were calculated. Loge [R/1-R] = (0.1692xPS) +(0.155x OS)-9.065

Where R=risk of mortality PS=physiological score and OS=operative score

Any post-operative morbidity or death in the hospital was recorded in accordance with definitions described pre viously. Subsequent statistical analysis was done of the findings.

Inclusion criteria

- Patients undergoing emergency laparotomy by midline incision.
- Age more than 18 years.
- Both male and female except pregnant female
- Patient admitted during January 2021 to December 2021

Exclusion criteria

- Age less than 18 years
- Day care surgery
- Pregnant Female
- Patients with significant immuno suppression (Patients who are HIV or HB sag positive and those on immuno suppressive drugs/ anticancer chemotherapeutic drugs).

Methodology

During hospitalization relevant history was collected and appropriate investigations as deemed necessary were done using standard procedures. The patients were then scored depending on their physiological parameters and the intra-operative findings were noted and a final expected mortality rate was calculated. Physiological and Operative severity score for the enumeration of mortality and morbidity (POSSUM).

The details of the scoring system have been enumerated in the upcoming table. It follows an exponential seque nce.

Physiological parameters. Table 1

	1	2	4	8
Age	<60	61-70	>70	
Cardiac history	No failure	Diuretics, anti-anginal, digoxin,	Peripheral edema, War far	Raised JVP, Cardiomegaly

		Hyper tensive therapy	in therapy, bor der line cardio megaly	
Respiratory history	No Dyspnea	Dyspnea on Exertion	Limiting dyspnea	Dyspnea at rest
Systolic BP	110-130	100-109 131-170	90-99 >171	<89
Pulse	50-80	40-49 81-100	101-120	<39 >121
GCS	15	12-14	9-11	<8
Hemoglobin	13-16	11.5-12.9 16.1-17.0	10.0-11.4 17.1- 18.0	<9.9 >18.1
WBC Count	4000-10000	3100-3999 10100-20000	<3000 >20100	
Urea	<7.5	7.6-10	>10.1-15.0	>15.1
Sodium	>136	131-135	126-130	<125
Potassium	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	Abnormal rhythm >5/min

Table 2: Operative Score:

	1	2	4	8
Operative Severity	Minor	Moderate	Major	Major+
Multiple procedure	1	-	2	>2
Total Blood Loss	<100	101-500	501-999	>1000
Peritoneal Soiling	none	Minor (Serous fluid)	Local pus	Free bowel content, pus, blood
Presence of Malignancy	none	Primary only	Nodal metastasis	Distant metastais
Mode of Surgery	Elective	-	Emergency	Emergency < 2 hrs

All laparotomies are classified as major in severity.

Physiological score ranges from 12-88

Operative score ranges from 6-48

The minimum total score is 18

The maximum total score is 136

The combination of the two scores in the equation predicts the mortality and morbidity for the patient and doesn't matter on the total score alone i.e two patients with the same total score can have different predicted rates of mortality and morbidity if the operative and physiological scores differ.

Statistical Methods

The observed mortality rates were tabulated and the expected mortality rates were calculated using the P-POSSUM equation and were also tabulated correspondingly. Using linear regression analysis the O:E ratio was calculated. Using this value the chi-square test was then applied to obtain the p-value to note any significant difference between the predicted death rate and the actual outcome. A p-value of 0.05 was used as a test of signifi cance.

Results

This was a Retrospective study conducted under the department of General Surgery, from January 2021 to December 2021. The study included 100 cases of emergency laparotomies done over the aforementioned period of 12 months.

Vital parameters were tabulated and the demographic profile, profile of cases admitted on emergency including the kind of surgeries done were documented.

With this information the statistical analysis was per formed obtaining observed and predicted rates of mortality and morbidity. Thereby, obtaining the chi-square value along with p-values to find significance and efficacy of the score.

Table 3: Gender Distribution

Male	72
Female	28
Total	100

Graph 1

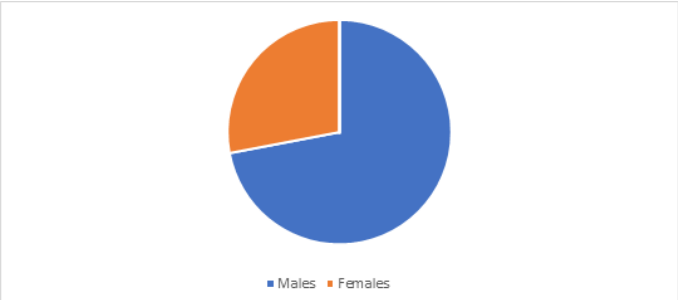


Table 4: Age Distribution

Age	Frequency
<60	79
61-70	9
>70	12

Graph 2:

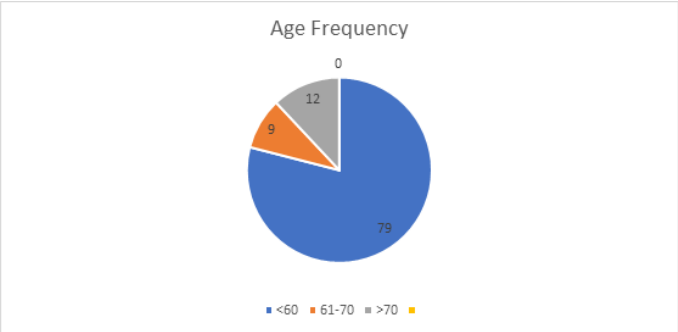


Table 5: Diagnosis

Cause	Frequency and Percentage
Acute emphysematous necrotis ing pancreatitis	1
Acute gangrenous cholecystitis	1
Appendicular mass with intestinal obstruction	1
Ascending Colon Perforation	2
Blunt trauma to abdomen	7
Duodenal perforation	2
Duodenal perforation with active bleeding	1
Gall Bladder Perforation	1
Gastric Perforation	1
Gastric Outlet Obstruction	4
Gastric varices	1
Ileal Perforation	10
Intestinal Obstruction (Small Bowel)	19
Intestinal Obstruction (Colon)	7
Intestinal Volvulus	1
Ischaemic Bowel Disease	8
Jejunal Perforation	2
Malrotation of gut	1
Obstructed Hernia (Inguinal)	1
Obstructed Hernia (Umbilical)	1
Perforated Appendix	6
Prepyloric Perforation	5
Recto-sigmoid perforation	1
Ruptured liver abscess	2
Sealed off Perforation	2
Sigmoid Volvulus	1
Stab Injury	6
Transverse Colon Perforation	2
Strangulated Umbilical Hernia	1
Total	100

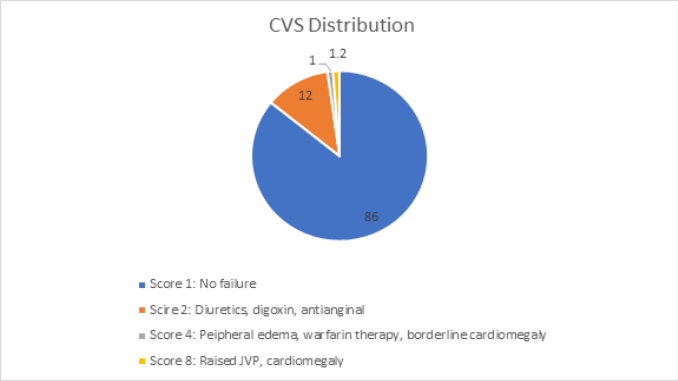
Table 6: Surgeries Done

Surgery	Frequency
Primary Closure of Perforation with Omental Patch	19
Resection and Anastomosis	22

Resection with Ostomy	30
Distal gastrectomy with gastrojejunal anastomosis	2
Partial Gastrectomy	1
Adhesiolysis of band	8
Pancreatic Necrosectomy	1
Bowel wash with Drain placement	2
Drainage of abscess	2
Open Cholecystectomy	2
Appendicectomy	6
Vagotomy with Pyloroplasty	1
Splenectomy	3
Hernia Repair	1
Total	100

CVS Distribution

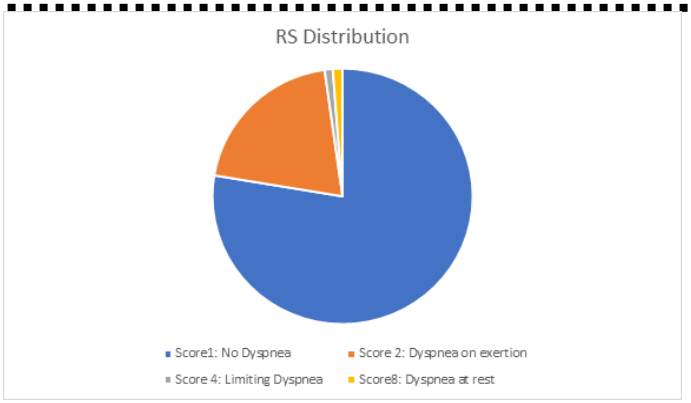
Graph 3



In our study out 100 patients 86 patients having no CVS abnormality (86%),12 patients were on antihyertensive (12%),1 patient on warfarine therapy (1%) and 1 patients found to have cardiomegaly (1%)

RS Distribution:

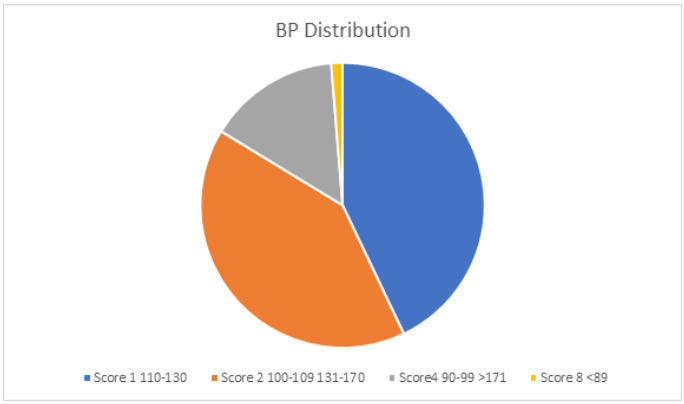
Graph 4



In our study out 100 patients 77 patients have no respiratory complaints (77%), 20 patients have Dyspnea on exertion (20%),1 patients have Limiting dyspnea (1%), 2 patients have Dyspnea at rest (2%).

BP Distribution:

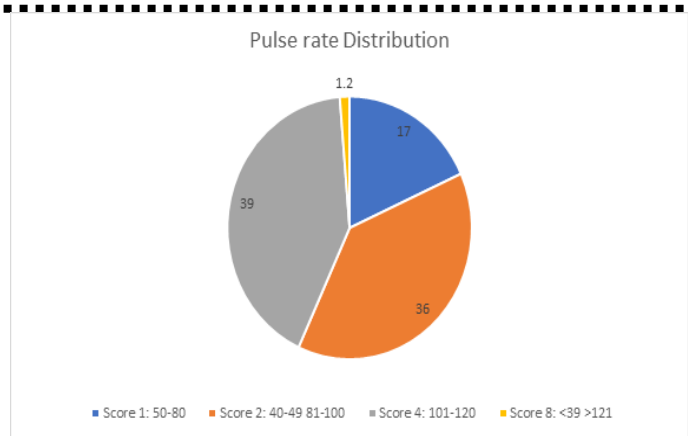
Graph 5



In our study out 100 patients 40 patients have BP between 110-130mmhg (40%), 38 patients have BP between 100-109mmhg and 131-170 mmhg (38%)14 patients have BP between 90-99 mmhg and > 170 (14%) and 8 patients have BP between <89mmhg.

Pulse Rate Distribution:

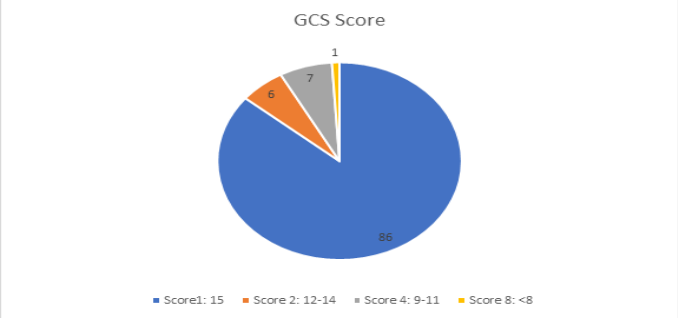
Graph 6



In our study out 100 patients 39 patients have pulse rate between 101-120/min (39%),36 patients have pulse rate between 40-49/min and 81-100/min (36%),17 patients have pulse rate between 50-80/min (17%),8 patients have pulse rate between 121/min.

GCS Distribution

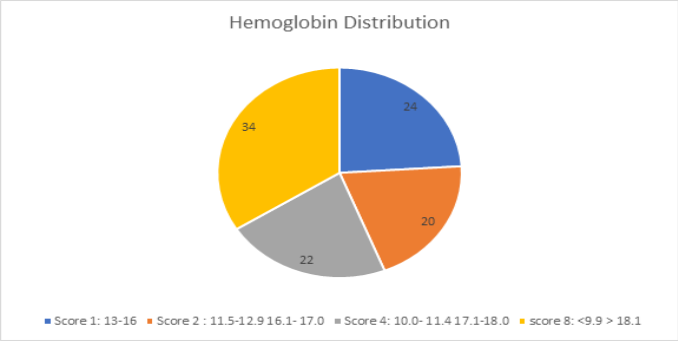
Graph 7



In our study out 100 patients 86 patients have GCS 15 (86%), 7 patients have GCS between 9-11(7%),6 patients have GCS between 12-14(6%) and 1 patients have GCS <8(1%).

Hemoglobin Distribution

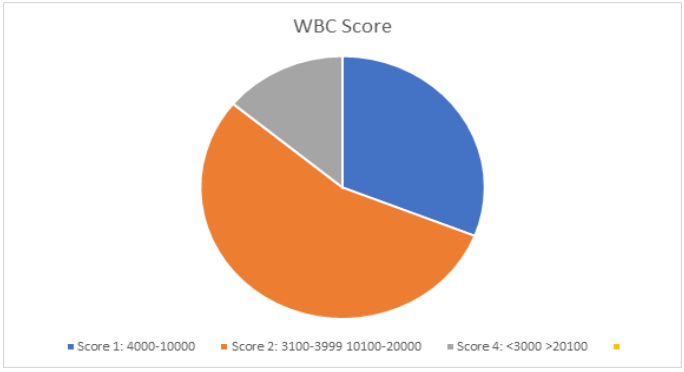
Graph 8



In our study out 100 patients 34 patients have HB count between 18.1gm% (34%), 24 patients have HB count between 13-16gm%(24%), 22 patients have HB count between 10-11.4 and 17.1-18gm%(22%), 20patients have HB count between 11.5-12.9 and 16.1-17gm%(20%).

WBD Distribution:

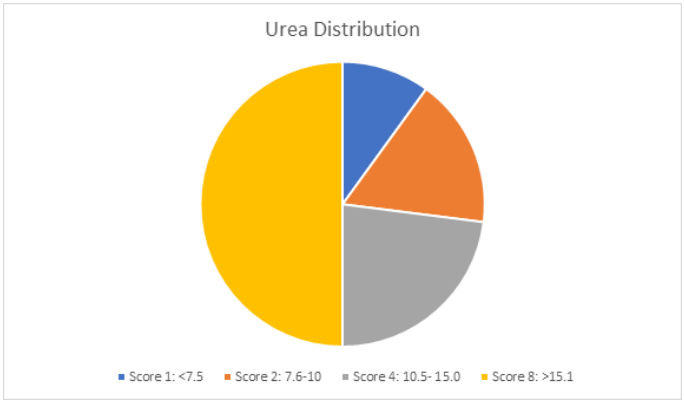
Graph 9



In our study out 100 patients 55 patients have WBC count between 3100-3999 and 10100-20000(55%), 31 patients have WBC count between 40000-10000(31%), 14 patients have WBC count between 20100.

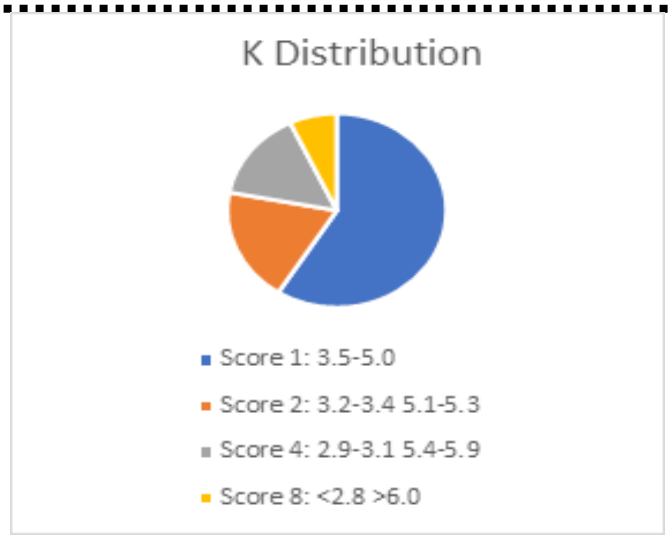
Urea Distribution

Graph 10



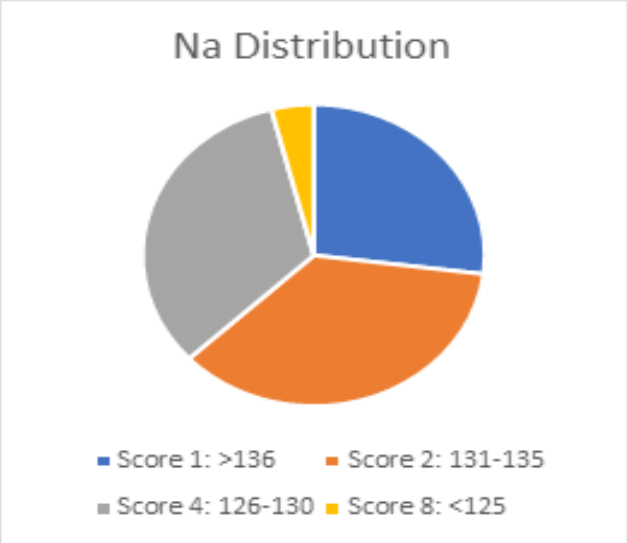
K Distribution

Graph 11



Na distribution

Graph 12



ECG Score

Graph 13

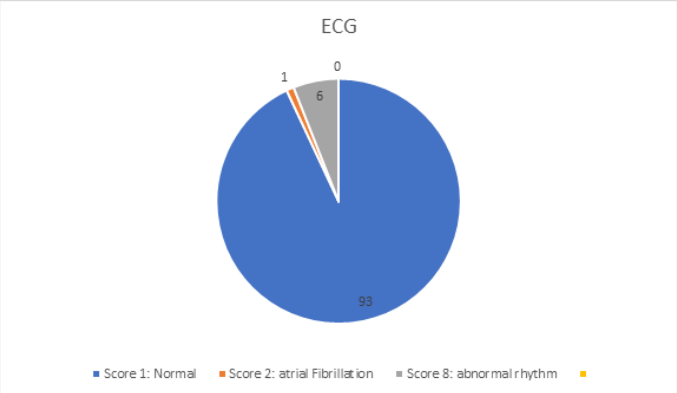


Table 7: Operative Severity Distribution

Operative Severity Score	Description	Frequency and percentage
4	Major	99
8	Major+	1
Total		100

Table 8: Total Blood loss Distribution:

Total Blood Loss Score	Description	Frequency and percentage
1	<100	26
2	101-500	64
4	501-999	6
8	>1000	4
Total		100

Table 9: Peritoneal Soiling Distribution

Peritoneal soiling	Description	Frequency and percentage
1	None	25
2	Minor (Serous fluid)	27
4	Local Pus	12
8	Free Bowel content, pus, blood	46
Total		100

Table 10: Presence of Malignancy Distribution

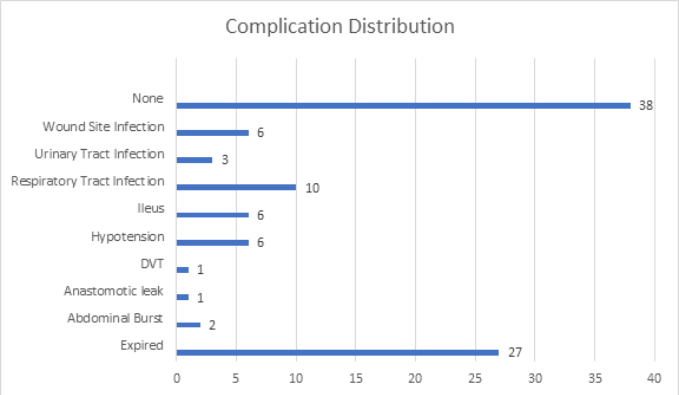
Presence of malignancy score	Description	Frequency and Percentage
1	None	95
2	Primary only	3
4	Nodal metastasis	2
Total		100

Table 11: Mode of Surgery Distribution

Mode of surgery	Description	Frequency and Percentage

4	Emergency	94
8	Emergency <2 hrs	6
Total		100

Complication Distribution



Physiological parameter total score

The physiological parameter total score was 28.6+9 (13-55). The median total score was 27 (IQR1-IQR3 22-33).

Operative total score

The operative total score was 17.2+4.1 (12-30). The median total score was 16.5 (IQR1-IQR3 13-20).

Comparison of POSSUM score with outcomes

Table 12

Groups	Mean POSSUM score	Statistical test applied	P value	Interpretation
Expired (n=27)	54.78+11.42	Unpaired t test	<0.0001	The mean POSSUM score in the expired group was significantly higher than the survived group
Survived (n=73)	42.48+8.51			

Linear regression for prediction of mortality with POSSUM score

Table 13

Variable	Coefficient	95%Confidence Limits	Standard Error	F-test	P-value
POSSUM score	0.021	0.014-0.028	0.004	33.9279	<0.0001
Constant	-0.688	-1.023- -0.353	0.169	16.5784	<0.001

Table 14: Correlation co-efficient =0.32

Source	df	Sum of square	Mean square	F-statistic	P-value
Regression	2	5.0688	5.0688	33.9279	<0.0001
Residuals	98	14.6412	0.1494		
Total	99	19.71			

Co-efficient for POSSUM score is positive. The p value and 95% limits indicate that POSSUM score is a strong predictor of mortality.

Discussion

To provide a comparative audit6 between different patient populations, measures of outcome must include methods to accommodate individual differences in an assortment of patients. 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, there has been a search for accurate risk scoring systems that can be used to compare patient outcomes according to the different units of different hospitals. Risk scoring systems should quantify a patient's risk of death or mor bidity based on the severity of the illness derived from data available at an early stage of the hospital stay. To overcome, this shortcoming, POSSUM and later its

modification P-POSSUM was proposed. But P POSSUM must be correlated to the general condition of the local population for it to be effective.8,14

In the emergency setting, the value of the POSSUM or P-POSSUM scoring system would be all the more important, where the comparison of observed to expected morbidity and mortality rates would be expected to yield significant results and, determination of the possible 58 causes for the adverse outcome in patients who succumb following the surgical procedure, would be more beneficial. In our study, we assessed the value of the P-POSSUM scoring system in 100 cases of emergency laparotomy by comparing the observed and expected mortality rates. 27 patients expired (crude mortality rate = 27%), a total of 35 patients suffered some com plications postoperatively (Morbidity rate = 35%). The observed number of cases suffering some form of mortality were 27 which was equal to the total number of predicted outcomes via the P-POSSUM scoring system. Therefore, there was found to be no statistically signifi cant difference between the observed and expected values for mortality. Hence the P-POSSUM is capable of accurately predicting the morbidity and mortality following emergency surgeries.

Limitations

Our study has as limitations the selected sample. Since it is a high complexity reference hospital, it deals with patients with more complex clinical conditions and, con sequently, they are expected to have a greater potential for complications and associated deaths.

P-POSSUM proved to be an accurate tool for this high-risk population and it is not possible to safely extrapolate its use to low-risk patients.

Data collection by more than one service surgeon was another limiting factor in the study, as it allows subjective data used in the calculation of the score, such as estimated blood loss, to be interpreted differently, leading to variations in the final score result.

Summary

A total of 100 patients taken for emergency laparotomies were studied, who were admitted to the surgery emergency ward from the period of January 2021 to December 2021.

The study group included the following cases. The most common being Intestinal obstruction (small bowel) (19%), followed by ileal perforation (10%) and ischemic bowel disease (8%), intestinal obstruction(colon) (7%), blunt trauma to abdomen (7%), perforated appendix (6%), stab injury (6%). The others included pre-pyloric perforation, gastric perforation, duodenal perforation, colon perforation, obstructed hernia and other cases of lesser frequency.

Resection with ostomy placement was the most commonly done surgery accounting for 30 cases (30%) followed by Resection and anastomosis in 22 cases (22%) and Primary Closure of perforation with omental patch 19 cases (19%). The other procedures included Adhesiolysis of band (8 cases,8%) and Appendicectomy (6 cases, 6%), Splenectomy (3cases 3%) and others (12 cases). They were scored using the P-POSSUM scoring system.

Physiological scores were assessed at the time of admission and the operative score was determined based on the intra-operative findings and complications, if any were noted. The observed mortality rates were compared with the predicted scores determined by the P-POSSUM formula.

27 patients expired in this study (Mortality rate =27%). The PPOSSUM score was found to be an accurate predictor of mortality. The most common morbidity experienced was Respiratory tract infection followed by Wound site infection, Hypotension, Ileus.

There was no statistically significant difference between the observed and the predicted values in the mortality rates, which has proved it to be an accurate tool for assessing mortality rates.

Conclusion

A total of 100 cases of emergency laparotomy were studied, which resulted in 27 deaths. On applying the P-POSSUM score we found that the expected number of deaths in the study group were equal to that of the observed value.

No significant difference was noted between the ob served as well as predicted mortality rates. Therefore the present study suggests that the P-POSSUM scoring system is an accurate scoring system for predicting post-operative mortality among cases taken for emergency laparotomy.

The common complications of Respiratory tract infection Wound site infection, Hypotension and Ileus should be minimized by appropriate use of antibiotics, minimal intra-operative handling and prevention of spillage of toxic contents during surgery. Post-operative measures such as early mobilization and adequate physiotherapy are essential for reducing complications like lower respiratory tract infection and deep vein thrombosis.

The P-POSSUM scores is not specific for a specific surgical procedure, with no discrimination of potential variables specific to certain surgical contexts, POSSUM and P-POSSUM scores have proven useful across different surgical specialties. Like other scores their use in clinical practice requires time and they do not allow for an accurate preoperative risk estimation because they are dependent on operative variables that can only be obtained during and after surgery. So they just permit to do a prediction based on the presumptive values of operative values.

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