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Validation of the Use of Possum Score in Emergency Abdominal Surgery in Government Hospital Setting.

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Abstract
Introduction: *Acute abdomen may be a life-threateningcondition particularly when evaluation of the patient in emergency department with acute abdominal pain is obscured by its myriad presentation, delaying or preventing the correct diagnosis, with subsequent adverse patient outcomes requiring surgery. In such patients requiring surgery, a scoring system can be used to audit and evaluate efficiency in hospital care and prevent subsequent morbidity and mortality. The objective was to study spectrum of abdominal emergencies and validate POSSUM (Physiological and Operative Severity Score for Enumeration of Mortality and Morbidity score) in government hospital setting in patients undergoing subsequent laparotomy and their prognosis.*
Materials and methods:*Prospective study of 400 patients admitted in JA GROUP OF HOSPITAL, Gwalior and underwent laparotomy for abdominal emergencies from January 2016 to December 2017. Parameters for calculating POSSUM score were retrieved. Observed: expected (O: E) ratios for morbidity and mortality calculated using linear and exponential analysis.*
Results:*Out of 400 patients, most no. of patients were between age group 31 – 40 (n = 41) and most were males (n = 160). Small bowel perforation (n=101) followed by gastro-duodenal perforation (n=81) were commonest. Post-operative complications were seen in 89 patients (44.5%) and 16 patients (8%) died post operatively. O: E ratio for morbidity and mortality using linear analysis were 0.69 and 0.37 respectively. Using exponential analysis. O: E ratio for morbidity and mortality for strata 60-100 were 0.82 and 1.06 respectively.*
Conclusion:*POSSUM score is an accurate tool for predicting morbidity and mortality in perforation peritonitis, even though it is over predicting morbidity and mortality in lower risk group.*

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I. Introduction

Certain patients present in the emergency with acute abdomen and require subsequent emergent treatmentwhich may involve surgery.[1] Despite advancements in surgical techniques, anti–microbial therapy and intensive care, management of these emergency procedures continues to be highly demanding, difficult and complex.[2.] These Emergency procedures which require laparotomies are performed commonly throughout the world, but one in six patients die within a month. to reduce this consecutive mortality and morbidity, A lot of research has been carried out to assess the individual risk in predicting mortality and morbidity of the patient to demonstrate reliable association between presentations, co-morbidities and operative procedures out of which most frequently studied general tools were APACHE II, ASA-PS and P-POSSUM. Outcome of all surgical procedure performed mainly depends on the pre and post-operative clinical status of the patient including their inter-current illness, nature and extent of surgical intervention, and co- morbid conditions influencing the patient final outcome. Therefore, it is being felt since long to develop a system, which can predict outcome of the surgery performed. The ability to compare results of surgeries and their outcome has become increasingly important in recent years. Interest is focused on the development of scoring systems that standardize patient data to allow meaningful comparisons.[4]

In 1991, Copeland GP et al. while working in Broad green hospital, Liverpool, UK, devised, Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (POSSUM). The POSSUM system is a two-part scoring system that includes a physiological assessment and a measure of operative severity. It was found to be quick, easy to use, and could be applied for both elective and emergency work and accurately predict outcome. The physiological part of the score includes 12 variables, each divided into 4 grades with an exponentially increasing score (1, 2, 4, and 8). The physiological variables are those apparent at the time of surgery and include clinical symptoms and signs, results of simple biochemical and haematological investigations, and electrocardiographic changes.

This study was aimed at patients presenting with surgical emergencies in predicting mortality and morbidity ratesby use of risk adjustment with POSSUM scoring.

II. Materials and Methods

Consecutive 400 patients, who underwent a Laparotomy in JAH group ofHospital from January 2016 to December 2017, were scored using POSSUM system. For each patient the predicted risk of mortality and morbidity was calculated from POSSUM equation. The study population consisted of patients aged 10 years and above admitted for emergency surgery andpatients who died immediately before surgery and trauma patients were excluded. Patients were assessed for any preoperative and postoperative complications. Multivariate logistic regression analysis was used to determine the relationships between the predicted and observed morbidity and mortality rates. Postoperative complications and mortality within 30days were described.
The morbidity (R1) and mortality (R2) risk were calculated according to the previously validated POSSUM equations as follows:
For morbidity: Log (R2 /(1-R2) =-5.91 + (O.16 X physiological score) +(0.19 X operative severity score). For mortality: Log (R1 /1-R1) = -7.04 + (0.13 X physiological Score) + (0.16 X operative severity score).

All the data analysis was done using IBM SPSS ver. 23 software. Continuous data was presented as mean ±SD. For calculation of significance between continuous variables between two proportions and percentages, Chi-square and Fischer's test was used.

III. Results

Out of the 400 patients 320 patients were males and most belong to the age groups of 21-30 years (96) followed by 31-40 years (76).

Table 3: Distribution of patients according to Age

Age group(yrs.)	No.of patients
10-20	76
21-30	96
31-40	82
41-50	72
51-60	42
61-70	16

Out of 400 patients, 199 patients presented with perforationout of which 101, 81, 11,5 and 1 patients hadileal, peptic, appendicular, Colonic and rectal perforationrespectively, Obstructed hernia in 72 patients and Acute intestinal obstruction in 129 patients.

Table 4: Distribution according to site of perforation

Type of perforation	No.of patients
Appendix/caecal	11
Colonic	5
Peptic	81
Rectal	1
Small bowel	101
Obstructed hernia	72
Acute intestinal obstruction	129

Observed Mortality in present study was 32 (8%). 178 patients (44.5) developed complications. Most common complication observed was wound infection (n=72) followed by pneumonia (n=42), wound dehiscence (n=26), sepsis (n=16) and fecal fistula (n=16).

Table 5: Frequency of Complications

Complications	No. of patients
Fecal fistula	32
Intra peritonealabscess	12
Pneumonia	84
Sepsis	32
Wound dehiscence	52
Wound infection	144

Mean morbidity risk for this study (n=400) calculated by POSSUM morbidity equation was 64.8%. Expected and observed morbidity was 260 and 178 respectively with O: E Ratio 0.69. Total 172 patients were

present in morbidity risk group 81-100% with mean risk 91.25% and expected and observed morbidity was 39.42 and 40 respectively. Total 272 and 76 patients were present in risk group strata 41-60% & 21-40% respectively with O: E Ratio 0.13 and 0.16 respectively.

Table 6: Comparison of expected and observed morbidity using POSSUM morbidity equations (Linear analysis)

Range of Risk %	Number of Patients	Mean Risk %	Expected Morbidity	Observed Morbidity	O: E Ratio	Chi-square value	Comments
0-10	0	0.00 %	0	0	-	-	Not Applicable
10-20	2	16.70 %	0.17	0	-	-	Not Applicable
20-30	10	25.20 %	1.26	0	-	-	Not Applicable
30-40	28	34.36 %	4.81	1	0.21	14.52	Significant
40-50	34	44.85 %	7.62	3	0.39	7.13	Significant
50-60	82	54.46 %	22.33	8	0.36	25.66	Significant
60-70	92	64.68 %	29.75	11	0.37	31.97	Significant
70-80	66	74.17 %	24.48	26	1.06	0.09	Not Significant
80-90	38	84.91 %	16.13	17	1.05	0.04	Not Significant
90-100	48	96.27 %	23.10	23	1.00	0.00	Not Significant
0-100	400	64.83 %	129.66	89	0.69	2.06	Not Significant
Critical chi square value = 3.84 (degree of freedom = 1 and 5% probability)							

Using exponential analysis POSSUM morbidity equation could predict morbidity accurately for strata 60-100%. When chi square test was applied showed value 3.52 and was not significant but showed significant difference for risk strata 40-100 and 50-100 showing that morbidity equation over predicts morbidity in lower risk patients.

Table 7: Comparison of expected and observed morbidity using POSSUM morbidity equations(Exponential analysis)

Range of Risk	Number of Patients	Mean Risk	Expected Morbidity	Observed Morbidity	O: E Ratio	value 𝛘2	Comments
0-30	12	23.78 %	1.43	0	0.00	-	Not Applicable
10-30	12	23.78 %	1.43	0	0.00	-	Not Applicable
20-30	10	25.20 %	1.26	0	0.00	-	Not Applicable
30-100	388	66.10 %	128.23	89	0.69	17.30	Significant
40-100	360	68.57 %	123.43	88	0.71	14.26	Significant
50-100	326	71.04 %	115.80	85	0.73	11.16	Significant
60-100	244	76.61 %	93.46	77	0.82	3.52	Not Significant
70-100	152	83.83 %	63.71	66	1.04	0.08	Not Significant
80-100	86	91.25 %	39.24	40	1.02	0.01	Not Significant
90-100	48	96.27 %	23.10	23	1.00	0.00	Not Significant
Critical chi square value = 3.84 (degree of freedom = 1 and 5% probability)							

Mean mortality risk calculated by POSSUM mortality equation was 21.78, Expected and observed mortality were 43.36 and 16 respectively. Total 76 and 18 patients were present in risk group 20-40% and 40—60% respectively, while observed mortality in these strata are 0 and 2 respectively. Patients present in risk group 60-80% and 80-100% are 22 and 14 respectively and 14 patients each died in both groups.

Table 8: Comparison of expected and observed mortality using POSSUM mortality equations(Linear analysis)

Range of Risk %	Number of Patients	Mean Risk %	Expected Mortality	Observed Mortality	O: E Ratio	χ2-value	Comments
0-10	66	6.90 %	2.28	0	0.00	-	Not Applicable
10-20	204	14.75 %	15.05	0	0.00	-	Not Applicable
20-30	52	24.01 %	6.24	0	0.00	-	Not Applicable
30-40	24	32.94 %	3.95	0	0.00	-	Not Applicable
40-50	12	42.12 %	2.53	1	0.40	2.33	Not Significant
50-60	6	50.97 %	1.53	1	0.65	0.28	Not Significant
60-70	20	64.76 %	6.48	6	0.93	0.04	Not Significant
70-80	2	78.90 %	0.79	1	1.27	0.04	Not Significant
80-90	12	83.85 %	5.03	6	1.19	0.16	Not Significant
90-100	2	91.10 %	0.91	1	1.10	0.01	Not Significant
0-100	400	21.78 %	43.56	16	0.37	4.75	Significant
Critical chi square value = 3.84 (degree of freedom = 1 and 5% probability)							

Using exponential analysis POSSUM mortality equation better predicts mortality, O: E Ratio for strata 60-100% was 1.06. Chi square applied showed no significant difference for risk groups 40=100. 50-100, 60-100, 70-100, 80-100and 90-100.

Table 9: Comparison of expected and observed mortality using POSSUM mortality equations(Exponential analysis)

Range of Risk	Number of Patients	Mean Risk	Expected Mortality	Observed Mortality	O: E Ratio	value χ^2	Comments
0-40	346	15.91 %	27.52	0	0.00	-	Not Applicable
10-40	280	18.03 %	25.24	0	0.00	-	Not Applicable
20-40	76	26.83 %	10.20	0	0.00	-	Not Applicable
30-40	24	32.94 %	3.95	0	0.00	-	Not Applicable
40-100	54	63.94 %	17.26	16	0.93	0.10	Not Significant
50-100	42	70.17 %	14.74	15	1.02	0.00	Not Significant
60-100	36	73.37 %	13.21	14	1.06	0.04	Not Significant
70-100	16	84.14 %	6.73	8	1.19	0.20	Not Significant
80-100	14	84.89 %	5.94	7	1.18	0.16	Not Significant
90-100	2	91.10 %	0.91	1	1.10	0.01	Not Significant
Critical chi square value = 3.84 (degree of freedom = 1 and 5% probability)							

IV. Discussion

The basic point in the health care is to aim at improving patient outcomes in terms of their pre and post-operative morbidity and mortality. By comparing adverse outcome rates, assessment of adequate care provided can be done and through which better basic insight about better health care can be availed.

Study by D.L Kitara et al reported that the patients' presenting with surgical emergencies have age ranged from 14 to 81 with a mean of 40.4 yearswith a M: F ratio of 2:1[7]Ohmann et al reported that maximum number of patients was between 50-69 years of age followed by the patients in the age group of 30-49 years. [8]Present study observed most of the patients belong to the age groups of 21-40 years (44.5%) followed by 10-20 years (19%) with male preponderance (n=320).

In present study, most common complication was wound infection (n=72) followed by pneumonia (n=42), wound dehiscence (n=26), sepsis (n=16) and fecal fistula (n=16). In a study by Batra et al among the 73 patients who developed complications 17 (23.29 %) had fever, 14 (19.18%) had wound infection and 14 (19.18%) had wound gaping.[7] Budhraja et al, also found wound infection as commonest complication followed by wound gaping and fecal fistula (11.6% each). [11.] In present study possum mortality and morbidity score was 21.78% and 64.83% respectively.

D.L Kitara et al studied 76 patients out of which Intestinal obstruction constituted for (45.5%), peritonitis (27.3%), intra-abdominal tumour (18.2%), and surgical jaundice (9.1%) were the causes of mortality. Surgery wards and reported 5.7% mortality. Similar to D.L Kitara, in present study observed mortality was seen in 16 (8%) patients.

Batra et al also reported that an increasing possum score was associated with higher morbidity and mortality, hence it was concluded that possum is an effective scoring system for predicting outcome in patients of perforation peritonitis.[12].

On classifying patients according to risk of mortality, the ratio of Observed: Expected rate of mortality (O/E ratio) in group having 0-10%, 10-20, 20-30 and 30-40 risk of mortality was 0 as there were no deaths in this group whereas in the next group of 40-50%, 50-60%, 60-70%, 70-80%, 80-90% and 90-100% risk of mortality the O/E ratio was 0.40,0.65, 0.93, 1.27, 1.19 and 1.10 respectively. Hence for the whole study the O/E ratio was **0.37**. Similar results were obtained by Batra et al, Possum over predicted mortality and morbidity in low risk groups while it accurately predicted the outcome in high risk groups. [12]

On classifying patients according to risk of morbidity, the ratio of Observed: Expected rate of mortality (O/E ratio) in group having 30-40%, 40-50, 50-60, 60-70, 70-80, 80-90, and 90-100 risk of morbidity was 0.21, 0.39, 0.36, 0.37, 1.06, 1.05 and 1.00 respectively. Hence for the whole study the O/E ratio was 0.69.

Similarly, no significant difference was noted in observed and expected mortality in higher risk groups with O: E ratio 0.71.

V. Conclusion

- Abdominal emergencies were quite commonand each has its own unique presentationwhen the patient visits the hospital. Young age groups and proximal gastrointestinal tract involvement was more common in India in comparison to western world.
- the ability of Possum to identify individual risk objectively, these patients may benefit with better-informed shared decisions, extra care and perioperative management of patients undergoing emergency laparotomy.
- POSSUM also proved to be agood tool for assessing the outcomes of surgery and in turn to assess the quality of surgical care provided in variable settings. It can be used for surgical audit in assessing the outcome in cases undergoing surgeries in abdominal emergencies.

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