EVALUATION OF POSSUM SCORING SYSTEM IN SURGICAL DECISION MAKING AND AUDITS

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ABSTRACT

Objectives: To test the validity of POSSUM scoring system as a surgical decision-making and audit tool by determining the association between actual deaths and POSSUM Score predictions in a sample population of patients undergoing abdominal surgical procedures.

Study Design: Descriptive study.

Place And Duration of Study: Combined Military Hospital, Rawalpindi, Pakistan from October 2007 to November 2008.

Patients and Methods: POSSUM score was calculated prospectively for all patients admitted to Surgical Ward I, CMH Rawalpindi, and scheduled to undergo laparotomy. Patients with previous history of surgery and day- surgery cases were excluded. Patients were stratified into three risk groups based on POSSUM Score, and 30 patients were picked randomly for the purpose of this study. The difference between observed deaths and the three risk groups was analysed for statistical significance by means of chi square test.

A total of 90 patients were included in the study. All were males and above 12 years of age, with mean age 34. A significant association was observed between POSSUM Score and actual deaths ($P<0.001$). Actual deaths increased with the rise in POSSUM Score.

Conclusion: POSSUM was found to be a reliable scoring system which gives us an idea about mortality rate in general surgery patients with different physiological states. It shows great promise as an objective accessory to the process of making decisions about surgery in "high risk" patients. Also, it could be a valuable tool for use in surgical audits, providing a more accurate comparison between performances of various surgeons/ surgical teams.

Keywords: Surgical audit, POSSUM, mortality

INTRODUCTION

Audit forms an important and essential part of surgical practice. However, the concept of Surgical Audit and Mortality & Morbidity Conferences is still in its infancy in the Army Medical Corps. Assessing the performance of surgeons and surgical units holds an even more crucial importance for the Pakistan Army because it is very quality conscious, maintains strict systems of accountability, trains a large number of surgeons each year and is responsible for running a vast number of surgical hospitals ranging from the Field Surgical Units to the well equipped Combined Military Hospitals across the country.

Since military hospitals in the country deal with a very varied group of patients (young, fit and healthy soldiers vs. retired, aging pensioners) and have very different facilities available to them (basic radiology and laboratory tests at field hospitals vs. state of the art facilities at tertiary referral centres), crude morbidity and mortality rates are too vague, inaccurate and misleading when comparing results between them[1]. The use of scoring systems is the easiest and most commonly used way to objectify auditing procedures and overcome this obvious shortfall[2]. Various medical specialities have developed different scoring systems to cater to their specific requirements. The American Society of Anaesthesiologists Score (ASA) has gained popularity with anaesthetists, but is over simplified and subjective. The Acute Physiological and Chronic Health Evaluation (APACHE) is used in the "critical care" setup but is complex and requires extensive and meticulous data collection and calculations, and does not take operative variables into account. POSSUM, introduced by Copeland in 1991, is the surgeons' answer to the problem. The

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details of the scoring system are listed in table 1.

The 12 physiological variables form part of a routine pre operative workup. The data is easily collected and reproduced by the ward staff/ registrars, and available in patients' records for retrospective studies. The 6 operative variables are recorded easily and make up for APACHE's shortcoming. These variables are combined using the POSSUM multiple logistic regression equation to give a percentage risk of mortality as follows:

In log(R/1-R) = - 5.91 + (0.16 x physiological score) + (0.19 x operative severity score)

This can easily be done using internet based POSSUM Score calculators where simply filling in the required data gives POSSUM Score at a click. Some of the new surgical e-logbooks in vogue also come with an inbuilt POSSUM calculator to assist the surgeon in assessing his own performance.

While it has not seen much application in UK, POSSUM has been used widely the world over. The system was originally intended for use in surgical audit[3], and a number of modifications have been developed. Whiteley reworked the calculation in 1996, and further tailoring by Prytherch (1998) produced P-POSSUM, which applies a different formula to the same variables and claims a closer fit to observed values. The method of analysis (linear or exponential) also makes a difference in the results of the two equations. Further modifications have been made to the formulae to produce group-specific equations, tailored more precisely to patients of a particular category (CR-POSSUM – colorectal, V-POSSUM–vascular, etc.).

The purpose of this study was to test the validity pf POSSUM scoring system in our patients.

PATIENTS AND METHODS

Data was collected prospectively from indoor patients undergoing laparotomy between Oct 2007 and Mar 2008. All patients admitted to Surgical Ward I, CMH Rawalpindi, and scheduled to undergo laparotomy were included. Patients with previous history of surgery were excluded. Those undergoing day-case surgery were also excluded, as many of these come from rural areas and follow-up is difficult. Data was collected on a standard Performa and physiological score calculate at the time of admission. Operative score was added in by the operating surgeon after surgery. POSSUM score was calculated prospectively for. POSSUM Score was calculated for each patient by feeding the variables into a free online POSSUM Calculator at the following website: www.vasgbi.com/riskpossum.htm

Based on POSSUM Scoring, patients were categorised into three risk groups. Patients with POSSUM Scores 0-25 were grouped as "low-risk". Those with scores 26-50 were termed "medium risk", and those with scores 51 and above were considered high risk. 30 patients were picked out randomly from each risk group for the purposes of this study. These patients were followed for up to 30 days post operatively for mortality (termed "observed mortality"). The data was entered into Microsoft Excel® (Microsoft Corporation, Redmond, Washington, USA) for analysis. Each risk group was assigned a mean POSSUM Score value for simplicity sake.

The data was analysed by using SPSS version 15. Descriptive statistics were used to describe the data. Chi-square test was applied to check the association between observed deaths and deaths as predicted by POSSUM score of each of the three risk groups.

RESULTS

A total of 90 patients who underwent abdominal surgeries (76 elective and`14 emergency) during the study period were included in the study. All patients were male and above 12 years of age (mean age 34 years). Details of types of operations are shown in table 2.

A final table of POSSUM scores for the selected study group was compiled as detailed above. Since the number of patients in each of the 3 risk groups was 30, a mean POSSUM score was calculated for each group (sum of individual POSSUM scores in each group/ 30)

for ease of comparison and calculation. This mean score was a direct indicator of the percentage mortality of the respective group, as predicted by POSSUM. Multiplying this percentage figure by 30 gave us the number of patients which could be expected to die in each group according to the POSSUM formula. Upon actual follow-up of patients for one month, there were 17 (18.8%) deaths observed in total. The three risk groups, with their mean POSSUM Scores and the number of deaths actually observed for each group are as shown in table 3.

A significant association was observed between the three risk groups and actual deaths ($P < 0.001$), with the actual observed number of deaths rising group-wise with the rise in POSSUM Scores. However, while the general trends in POSSUM deaths and observed deaths were comparable, comparison of mortality numbers within each group showed that POSSUM significantly over-predicts mortality than is actually observed.

Table 1: POSSUM Score Variables

	Variables	Ranges
PHYSIOLOGIAL FACTORS	Age	≤61 61-70 ≥70
	Cardiac Signs	No failure Diuretic, digixin, antianginal, antihypertensive therapy Periph oedema, warfarin, borderline cardiomegaly Raised JVP, cardiomegaly
	Respiratory	Dyspnoea on exertion Limiting dyspnoea (one flight), limited COAD Dyspnoea at rest, fibrosis or consolidation
	Systolic BP	≤89 90-99 100-109 110-130 131-170 ≥171
	Pulse	≤40 40-49 50-80 81-100 101-120 ≥120
	GCS	15 12-14 9-11 ≤8
	Hemoglobin	≤9.9 10-11.4 11.5-12.9 13-16 16.1-17 17.1-18 ≥18.1
	TLC	≤3 3.1-4 4.1-10 10.1-20 ≥20.1
	Urea	≤7.5 7.6-10 10.1-15 ≥15.1
	Sodium	≤136 131-135 126-130 125
	Potassium	≤2.8 2.9-3.1 3.2-3.4 3.5-5 5.1-5.3 5.4-5.9 ≥6
	ECG	Normal Atrial fibrillation (rate 60-90/ min) Any other abnorm rhythm, ectopics 5/min, Q, ST/T changes
OPERATIVE	Op severity	Minor Moderate Major Major+
	Multiple procedures	1 2 >2
	Blood loss	≤100 101-500 501-999 ≥1000
	Peritoneal soiling	None Minor(serous) Local pus Frank bowel content/ pus/ blood
	Malignancy	None Primary only Nodal mets Distant mets
	Mode	Elective Emergency-(resusc possible)2-24hrs Emergency – operation within 2 hrs

Table-2: Types of Surgery in the Study Group (n=90)

Type of surgery	No. Of patients
Gastrointestinal	56
Hepatobiliary	19
Urological	3
Herniae	12

DISCUSSION

Audit is an essential part of surgical practice[4]. It is a tool for self assessment and monitoring, and a complement to research and education. As a means of recording data, assessing and accounting for mistakes, and delineating areas of weakness, audit is perhaps the best way of objectively improving surgical practice and comparing one's work with peers/ colleagues from other surgical units[5-8].

Table 3: POSSUM: Comparison of predicted and observed mortality (n=90).

Risk Group	No. of Patients	POSSUM Score Range	Mean POSSUM Score (%)	No. of Deaths	Death Rate (%age)
Low (gp 1)	30	**0 – 25**	13	2	6.7
Medium (gp 2)	30	**26 – 50**	38	4	13.3
High (gp 3)	30	**≥51**	75.5	11	36.7

Of course, as discussed earlier, the standard of pre and post operative care available in a hospital, the ability of the surgeon and a number of patient-related physiological factors and the nature of the disease itself are all variables that determine outcome. Perhaps these factors are of much greater significance in developing countries, where medical practice and facilities are not standardised, patients are generally financially challenged, have compromised nutritional status and less-than-optimal physiological factors, and present to hospitals in advanced stages of disease.

As seen in our results and as experienced by other workers[10] as well, POSSUM tends to over-predict mortality significantly which undermines its utility when applied to individual surgical cases. This is a flaw of the exponential analysis method used in the original system as developed by Copeland et al[9]. It has attracted much criticism from international researchers as not being a standard statistical technique, and because of difficulties in application to individual patients[12-14].

The role of POSSUM score, however, is to give us a detached and objective risk estimate while taking into account patient and operative variables. This information can then be put to a number of uses at various stages of the surgical process.

First and foremost, a predictable outcome has a direct role in the decision of whether to operate at all or not, counselling of the patient, and consent. Ahluwalia et al[12] show the use of POSSUM in surgical decision making and prioritisation of patients with hip fracures for surgery.

Postoperatively, serial POSSUM scores can be of help in assessing the recovery of a patient. POSSUM equation has been modified according to specifics of various pathologies in order to make it more specific to various sub-specialities. Work by V. Valenti et al[13] and R. Vaher et al[14] show very favourable comparisons between POSSUM, P-POSSUM, CR-POSSUM (colo-rectal POSSUM), ASA and Duke's staging system in predicting postoperative morbidity and mortality in colorectal cancer patients.

As an audit tool, POSSUM has a clear advantage over simply comparing mortality rates in that it provides a simple and easy method for risk adjusted evaluations[15]. The mortality rates of a tertiary care surgical unit performing clean, elective general surgeries will be expected to vary from one performing complex thoracic surgeries, or from a field surgical hospital where there is a low overall patient turnover but a large bulk of the patient load is emergency laparotomies and trauma surgeries. This difference is intrinsic to the very physiology of the target patient population, the severity of disease and complexity of surgical procedures, and it would be unfair to attribute it exclusively to the surgeon's skill. Strict auditing without risk adjustment will discourage surgeons from taking on complex surgeries or accepting responsibility for patients presenting in a poor physiological state because they will not wish to spoil their audit figures.

Finally, a review of which surgeon performs how many surgeries from which POSSUM stratum may provide a better assessment of individual performance.

The POSSUM scoring system has been validated as a suitable monitoring tool in a number of general surgical settings over the past few years. The study of POSSUM in hepatobiliary surgery conducted by Ilyas [16] shows a very high (95%) congruence between observed and predicted values for both morbidity and mortality.

This study establishes that POSSUM Score functions adequately in the military surgical setup, especially as a monitoring and audit accessory, with results that are comparable to the results of various other foreign studies[10-14].

CONCLUSION

It is concluded from this study that POSSUM is a reliable scoring system. It gives us an idea of the sort of mortality rate to be expected in patients with different physiological states who are undergoing surgery. While an over-prediction of mortality is to be expected when applied to individual cases, this shortcoming does not hamper its use as an accessory to clinical audit, assessing personal and departmental performance, as a helpful tool in prioritising patients for surgery and monitoring disease progression.

Future studies on POSSUM using larger sample groups will provide greater statistical validity. It will also be very interesting to note how the POSSUM equation behaves when applied to a more varied group of patients, including trauma victims and the critically ill.

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