# EVALUATION OF P-POSSUM AND O-POSSUM SCORES IN PREDICTION OF 30 DAY MORTALITY RATE IN PATIENTS UNDERGOING RESECTION FOR OESOPHAGEAL CANCER

*A RESEARCH PROJECT HANDED IN AS PART FULFILMENT OF THE REQUIREMENTS OF THE UNIVERSITY OF NAIROBI FOR AWARD OF THE DEGREE OF MASTER OF MEDICINE (MMED) IN GENERAL SURGERY*

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**DECLARATION**

I hereby declare that this study is my original work and has not been presented for dissertation at any other university.

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## DEDICATION

To my lovely wife and children: for their continued support, prayers and understanding during my time at the university.

**ACKNOWLEDGEMENTS**

I would like to offer my gratitude to my supervisor without whose experience and guidance I would not have made it this far.

To Dr Muhinga, cardiothoracic surgeon at Nyeri PGH, my gratitude for your assistance in using Nyeri PGH as a study centre.

The staff at the records departments in KNH and Nyeri PGH: for your professional assistance in acquiring retrospective data.

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**POSSUM** - **P**hysiological and **O**perative **S**everity **S**core for the en**U**meration of **M**ortality and **M**orbidity

**P-POSSUM** - **P**ortsmouth- **P**hysiological and **O**perative **S**everity **S**core for the en**U**meration of **M**ortality and **M**orbidity

**O-POSSUM** - **O**esophagogastric - **P**hysiological and **O**perative **S**everity **S**core for the en**U**meration of Mortality and **M**orbidity

**ROC** - Receiver operating characteristic

**AUC** - Area under curve

**KNH** - Kenyatta National Hospital

**Nyeri PGH** - Nyeri Provincial General Hospital

**Summary**

**Background**

In the last two decades, P-POSSUM has been used for the prediction of post operative mortality rates in general surgery based on certain clinical parameters. The speciality based O-POSSUM uses, by and large, the same parameters with some modification in predicting mortality in upper gastrointestinal surgery. These clinical parameters are available in our referral hospitals where oesophagectomy is likely to be performed. Studies to assess the efficacy of these models in oesophagectomy have been published but literature on this in our setup is lacking. [1, 2, 3]. The aim of this study was to determine the accuracy of P-POSSUM and O-POSSUM in predicting the risk of 30- day mortality amongst patients undergoing resection for oesophageal cancer.

**Objective:** To determine the accuracy of P-POSSUM and O-POSSUM scores in predicting mortality rates in patients undergoing resection for oesophageal cancer at KNH and Nyeri PGH.

**Study design:** A combined prospective and retrospective 7 month study based at KNH, cardiothoracic surgery unit and Nyeri PGH.

**Material and method:** Physiological and operative details of the selected patients were taken based on the parameters set out in the formulae. The predicted mortality was calculated by a preset formula and compared with the actual observed mortality rates.

## 1.0 Introduction

Cancer of the oesophagus is the most common cancer amongst Kenyan males and the third most common in females according to locally available data[4, 5]. Regional and continental studies show similar figures as those in our setup [6, 7]. Resection of the oesophagus is carried out for palliative and curative purposes. Oesophageal resection carries a high mortality rate (mainly due to late presentation) of 10% [8, 9] while in specialized high volume centres mortality is reduced to 3-4% [10, 11, 12.] There has been a reduction in postoperative mortality over the decades [13, 14] and this would further be reduced if those patients at higher risk were identified early and managed more aggressively. The identification of those at higher risk was the basis of using a scoring system.

**P**ortsmouth - **P**hysiological and **O**perative **S**everity **S**core for the en**U**meration of **M**ortality and **M**orbidity (P-POSSUM) and **O**esophagogastric POSSUM(O-POSSUM) are improvements on the original POSSUM scoring system developed by Copeland et al [15] in 1991 to assist in predicting post-operative outcomes in surgical settings and also for surgical audit.

They use the same 12 physiological parameters and 6 operative parameters as in POSSUM and have been used to predict the 30-day mortality in patients undergoing oesophageal resection.

This study aimed at evaluating the validity of these prediction tools in our local setup. Their validity would go a long way in managing these patients in the preoperative and immediate post-operative period. This would translate into increasing the quality of life in palliative cases which represent the majority of the cases.

## 2.0 Literature review

The history of POSSUM dates back to 1991 when Copeland et al designed it for post-operative mortality and morbidity prediction [15]. There have been various modifications which have sought to reduce the original shortcomings, mainly of over-prediction [16], and also some speciality based modifications have been developed [17]. The P-POSSUM model as described by Whiteley et al uses the same 12 physiological and 6 operative parameters as in the original POSSUM but uses linear regression analysis in calculation of mortality risk [18].

Regionally its usefulness has been evaluated in general surgery mainly in laparatomies [19].

The P-POSSUM model has been evaluated in patients undergoing resection for oesophageal cancer [1, 2]. The methods used included the receiver operating characteristic (ROC) curve and the Hosmer- Lemeshow goodness of fit test. The P-POSSUM model had a moderate to good discriminatory power. There were no significant differences between predicted and observed mortality in one of the studies with a lack of fit in the other study. Testing of the model in different populations was recommended.

The O-POSSUM model was developed by Tekkis et al for upper gastrointestinal surgery. It uses 12 physiological and 3 operative variables in addition to actual age of the patient in years [20]. This model was evaluated using the ROC and Hosmer-Lemeshow goodness of fit test [2, 3] which showed fair discriminatory power with a lack of fit in all the studies. The model tended to over-predict mortality in the elderly and young. The shortcomings of the model brought up were the lack of operative data which has a bearing on the patient's survival. The authors recommend including these data especially on blood loss and testing the application in different populations. They also recommend developing a separate model for oesophageal and gastric surgery.

These studies on P-POSSUM and O-POSSUM in oesophagectomy have mainly been based in Western Europe while regionally the models have been studied in general surgical cases (mainly in laparotomy).

## 3.0 Study Justification

Risk prediction models have become important tools in modern day surgery as the surgical culture moves more towards outcome measures. These tools also provide the patient with as much information as possible when giving fully informed consent. Surgical audit of individual units can also be carried out using these tools and this leads to better clinical governance reviews. The models in review have been in use for the last 2 decades. Various studies carried out regionally and internationally have documented their usefulness in general and in some areas of specialized surgery [1, 2,19]. Their use of variables which are in daily use in our setup makes it an attractive option as it would not increase costs to the patient or institutions involved.

When Earlam and Cunha-Melo reviewed oesophageal resections before the 1980's, they found it to have the highest operative mortality of any routinely performed surgery [21]. Respiratory complications (28.5%) and anastomotic leaks (16.4% prevalence in our setup) are amongst some of the complications associated with this high mortality index [22, 23].

Improved perioperative care [24, 25] has seen the mortality rates reduce. The use of these models would assist in identifying those areas of perioperative care that require more attention and thus would contribute to a further mortality decrease.

The ability to accurately predict mortality rates would assist medical personnel to have a more aggressive approach in the immediate post operative period to those who need it more. In our setup, where intensive care is limited due to unavailability of adequate resources, this would translate into the rational allocation of these scarce resources to those who need them most (e.g. ICU beds). In palliative surgery, identification of patients at most risk would assist in the prevention of, or arresting the progression of complications. This would allow for an early discharge and less complications thus resulting in better palliation and greater savings in overall costs. In curative surgery it would help reduce post operative mortality since the surgery is not an emergency thus there would be room for correction of the physiological parameters.

Regional evaluations of these models in resection for oesophageal cancer have not been done, despite the prevalence of the problem, thus the need for this study.

The different socioeconomic status in our setup might affect the applicability of the score as opposed to other countries where P-POSSUM and O-POSSUM have been evaluated. Previous studies on P-POSSUM locally were in general surgery [19] with possible wide user variations (registrars, senior registrars) while this study will be in a specialized surgery setup. Large volume centres have been shown to have lower mortality rates [10, 11, 12] thus the choice of KNH and Nyeri PGH as the study centres.

## 4. Study Objectives

### 4.1 Major objective

To determine the accuracy of P-POSSUM and O-POSSUM scoring systems in the prediction of 30-day post-operative mortality in patients undergoing resection for cancer of the oesophagus.

### 4.2 Specific objectives

1. Prospectively , over a period of 7 months, to determine the number of patients undergoing resection for oesophageal cancer ,
2. Retrospectively ,over a period of 5 years, identify patients who underwent resection of the oesophagus for oesophageal cancer,
3. Identify the preoperative and intraoperative parameters as set out in the P-POSSUM and O-POSSUM scoring tests and predict outcome,
4. Verify whether the predicted outcome tallies with the actual mortality rates.

## 5. 0 Material and Method

### 5. 1 Study design, location and duration

The Kenyatta National Hospital (KNH) is the main referral centre in Kenya and is located at the heart of the capital, Nairobi. Nyeri Provincial Hospital (Nyeri PGH) is a level 5 referral hospital in central province of Kenya with an established cardiothoracic unit and the closest in proximity to the study base. The study was based at these two institutions which routinely carry out oesophagectomies. The target population included all patients diagnosed with cancer of oesophagus and who had undergone resection surgery over a period of 7 months from March 2nd to 13th September 2011 or had undergone resection in the 5 years preceeding February 2011. The sample size was calculated using the formula:

$$n = z^2 \times \frac{p(1-p)}{d^2}$$

where z: score at 95% confidence interval (1.96)

p: estimated mortality rate set as 10% (6)

d: margin of error (0.05%)

thus $n = 1.96^2 \times \frac{0.1 \times 0.9}{} = 138.29$

$0.05^2$

The figure was rounded off to 139.

## 5.2 Inclusion and Exclusion criteria

All patients confirmed to have cancer of the oesophagus and had undergone resection surgery within the time frame stated were deemed to be eligible for the study.

## 5.3. Data collection techniques

Data was collected based on the P-POSSUM and O-POSSUM parameters (appendix 1, 2). This was in the form of questionnaires (appendix 4) .The physiological data was based on the latest laboratory and clinical parameters before surgery for both arms of the study. In the prospective arm of the study the operative data was collected at the end of the operative procedure.

The physiological score was calculated at induction of anaesthesia (both P-POSSUM and O-POSSUM) and operative score at the end of operation for O-POSSUM and on discharge or death of the patient within a 30-day period for P-POSSUM. In the retrospective arm the operative data was collected from the operative notes. The physiological and operative scores were then calculated using the preset formula.

For standardization, all the laboratory work was at KNH and Nyeri PGH laboratories and preoperative and postoperative data collected by the principal investigator and research assistants who were trained on the use of the questionnaires. For the prospective arm, data on blood loss was collected by the anaesthetist based on swabs used ( small RAY-TEC gauze 60ml, large gauze roll 350ml) [26] and the volume of blood in the suction machine.

Patient follow-up was up to postoperative day 30 and patients still on their index admission beyond 30 days had their operative scores for P-POSSUM calculated on day 30. The primary outcome was inpatient mortality defined as death within the same admission as the operation (within a 30 day period) regardless of cause.

## 5.4 Data analysis

Mortality risk was calculated using the following formula:

*Log R/1-R = -9.065 + (0.1692 x physiological score) + (0.1550 x operative severity score).*

*where R = predicted risk of mortality*

Analysis of results was by linear analysis as described by Wijesinghe et al [27] by grouping the patients in deciles of predicted risk (appendix 3). The predicted (expected) deaths were compared with the actual (observed) deaths, the O: E ratio. An O: E ratio above 1 indicated an under prediction while one below 1 indicated an over prediction of mortality.

The discriminatory power of the two models was tested with the receiver operating characteristic (ROC) curve analysis and used the area under curve (AUC). A value of AUC of 1 represented perfect discrimination, of 0.8 and above good discriminatory power, <0.8 and >0.5 represented fair discrimination while that of 0.5 and below of not better than chance.

The Hosmer Lemeshow goodness of fit test [28] was used to assess the differences between the expected and observed mortality rates.

A value of $p< 0.05$ was considered to be a lack of fit. Data obtained was managed using the Statistical Programme for Social Sciences (SPSS) version 17.0.1 statistical software.

## 5.5 Ethical considerations

Approval was sought and obtained from the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee before commencement of data collection. Approval was also sought and obtained from Nyeri PGH authorities for the use of clinical data.

An informed consent was obtained from the patients included in the prospective arm of the study (appendix 4).

## 5.6 Study limitations

Of the physiological parameters, an echocardiogram was not done for all patients. Some patients did not have a total blood count (only haemoglobin levels) thus white blood cell counts were unavailable. Data on blood loss was not included in some patients on the retrospective arm. A baseline score of 1 was recorded for these missing parameters.

## RESULTS

A total of 140 patients undergoing oesophageal resection for cancer of the oesophagus were included in this study. Approximately one-quarter of all patient data (n = 34, 24.3%) were collected prospectively during a seven-month period in 2011. The remaining 106 observations were obtained from a retrospective analysis of surgical records of patients who underwent resection for oesophageal cancer during the five-year period from 2006-2010. The distribution of study observations according to period during which resection was conducted is presented in Table 1.

| Year surgery conducted | Number of patients | Percent (%) |
|---|---|---|
| 2006 | 23 | 16.4 |
| 2007 | 25 | 17.9 |
| 2008 | 9 | 6.4 |
| 2009 | 19 | 13.6 |
| 2010 | 30 | 21.4 |
| 2011 | 34 | 24.3 |
| Total | 140 | 100 |

**Table 1***: Percentage distribution of oesophageal resection according to year of surgery*

## Patient characteristics

The average age of patients was 57.3 years (SD 14.22) and the modal age was 60 years. There was a single teenager in the study and the age of all patients ranged from 15 years of age to 82 years. Figure 1 below shows the percentage distribution of patients according to age. Seventy-two (51.4%) out of the 140 of all patients were aged 60 years and above. Only five patients (3.9%) were age less than 30 years and 10 (7.1%) were aged between 30-39 years.

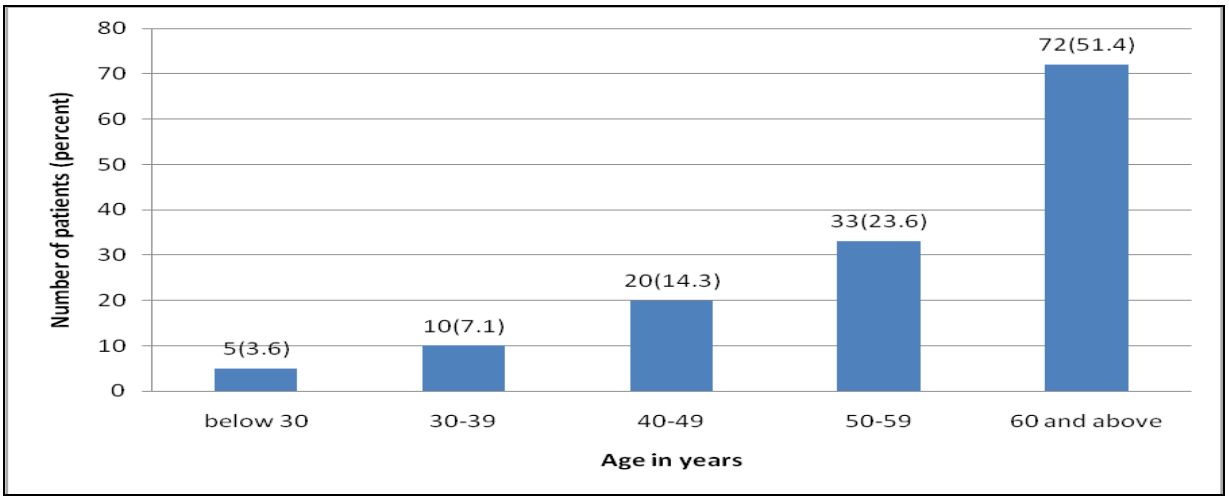


**Figure 1:** ***Percentage distribution of patients undergoing resection for oesophageal cancer according to age***

## Mortality

By the thirtieth post operative day, 52 out of the 140 patients undergoing resection had died giving an overall mortality rate of 37.1%. The distribution of these deaths among patients in the different age groups presented in Table 2 below, shows that no deaths were observed among the patients younger than 30 years. There was a gradual increase in mortality rate with increasing age from 20% among patients 30-39 years to 45.8% for patients aged 60 years and above.

| Age group | Number of patients | Number of deaths | Mortality (%) |
|---|---|---|---|
| Below 30 years | 5 | 0 | 0% |
| 30-39 years | 10 | 2 | 20.0% |
| 40-49 years | 20 | 5 | 25.0% |
| 50-59 years | 33 | 12 | 36.4% |
| 60 and above | 72 | 33 | 45.8% |

**Table 2** ***: Number of deaths among patients of different age groups undergoing oesophageal resection for cancer of the oesophagus.***

## P-POSSUM AND O-POSSUM scores

The mean scores for both P-POSSUM and O-POSSUM are presented in Table 3. The mean physiological score for P-POSSUM was 16.34 compared to a mean of 16.37 for O-POSSUM. The mode for both scores was 16. The mean operative score for P-POSSUM was 15.31 compared to a score of 4.11 for the O-OPPSUM score.

| | P-POSSUM | O-POSSUM |
|---|---|---|
| Physiologic score | 16.34 (3.57) | 16.27 (3.61) |
| Operative score | 15.31 (2.26) | 4.11 (1.38) |

**Table 3***: Average physiological and operative scores for P-POSSUM and O-POSSUM scores*

Patients who died had both significant higher physiological (p = 0.0233) and operative (p = 0.0464) scores for P-POSSUM as shown in Table 4 below. They also had a higher physiological O-POSSUM score (p = 0.0238) but their operative O-POSSUM score (p = 0.1118) did not differ significantly from that of patients who survived.

| | Died | Survived | t-test p value |
|---|---|---|---|
| P-POSSUM score | | | |
| Physiologic | 17.23 | 15.81 | 0.0233 |
| Operative | 15.80 | 15.02 | 0.0464 |
| O-POSSUM score | | | |
| Physiologic | 17.17 | 15.75 | 0.0238 |
| Operative | 3.86 | 4.25 | 0.1118 |

**Table 4*: Mortality and association with P-POSSUM and O-POSSUM scores***

## Linear analysis

The overall number of deaths predicted to occur at day thirty among oesophageal cancer resection patients estimated using both P-POSSUM score and O-POSSUM score agreed well with the 52 observed deaths. Both scores predicted 56 deaths and a standardized mortality rate of 0.93 representing a slight overestimation of mortality.

**P-POSSUM linear analysis**

Overall, P-POSSUM overestimated the risk of death represented by a SMR of 0.93. Table 5 shows the results of linear analysis using P-POSSUM to predict the number of deaths expected among oesophageal cancer resection patients at KNH and Nyeri PGH. Although there was an overall overestimation of mortality, the score slightly underestimated the risk of death following oesophageal resection in the two risk groups of 30-39 % (O: E ratio 1.06) and 40-49 % (O: E ratio 1.08).

| Mortality group (%) | Number of patients | Actual no. of deaths | No of deaths predicted by P-POSSUM | Observed: predicted |
|---|---|---|---|---|
| < 10 | 0 | 0 | 0 | - |
| 10-19 | 3 | 1 | 1 | 1.00 |
| 20-29 | 41 | 8 | 11 | 0.73 |
| 30-39 | 45 | 17 | 16 | 1.06 |
| 40-49 | 28 | 14 | 13 | 1.08 |
| 50-59 | 16 | 9 | 9 | 1.00 |
| 60-69 | 4 | 2 | 3 | 0.67 |
| 70-79 | 2 | 1 | 2 | 0.50 |
| 80-89 | 1 | 0 | 1 | 0.00 |
| >90 | 0 | 0 | 0 | - |
| Total | 140 | 52 | 56 | 0.93 |

***Table 5: Linear analysis of deaths predicted by P-POSSUM***

The Hosmer-Lemeshow test applied to this data indicated a significant fit with the observed deaths (chi = 11.45, df = 8, p = 0.177).

**O-POSSUM linear analysis**

Similar to the P-POSSUM, the O-POSSUM score predicted a total of 56 deaths resulting in an overestimation of mortality (SMR = 0.93). As shown in table 6, the number of deaths among patients 40 to 49 % (O: E 1.17) and 50 to 59 % (O: E 1.13) risk groups were underestimated. The Hosmer-Lemeshow test applied to this data indicated a significant fit with the observed deaths (chi = 5.34, df = 8, p = 0.720).

| Mortality group (%) | Number of patients | Actual no. of deaths | No of deaths predicted by P-POSSUM | Observed: predicted |
|---|---|---|---|---|
| < 10 | 0 | 0 | 0 | - |
| 10-19 | 2 | 0 | 1 | 0.00 |
| 20-29 | 29 | 6 | 8 | 0.75 |
| 30-39 | 64 | 22 | 23 | 0.96 |
| 40-49 | 26 | 14 | 12 | 1.17 |
| 50-59 | 14 | 9 | 8 | 1.13 |
| 60-69 | 4 | 1 | 3 | 0.33 |
| 70-79 | 1 | 0 | 1 | 0.00 |
| 80-89 | 0 | 0 | 0 | - |
| >90 | 0 | 0 | 0 | - |
| Total | 140 | 52 | 56 | 0.93 |

***Table 6: Linear analysis of deaths predicted by O-POSSUM***

## ROC curve analysis

The P-POSSUM score had a greater discriminatory power for mortality compared to O-POSSUM score. Figure 2 compares the discriminatory power of the two scores and shows that both scores were fair at predicting mortality but performed better than would be expected by chance. The area under the P-POSSUM curve was 0.68 (95% CI 0.59 to 0.77) compared to an area of 0.65 (95% CI 0.56 to 0.75) for the O-POSSUM score. The overlapping confidence intervals indicated that the areas under the two curves were not statistically significantly different.

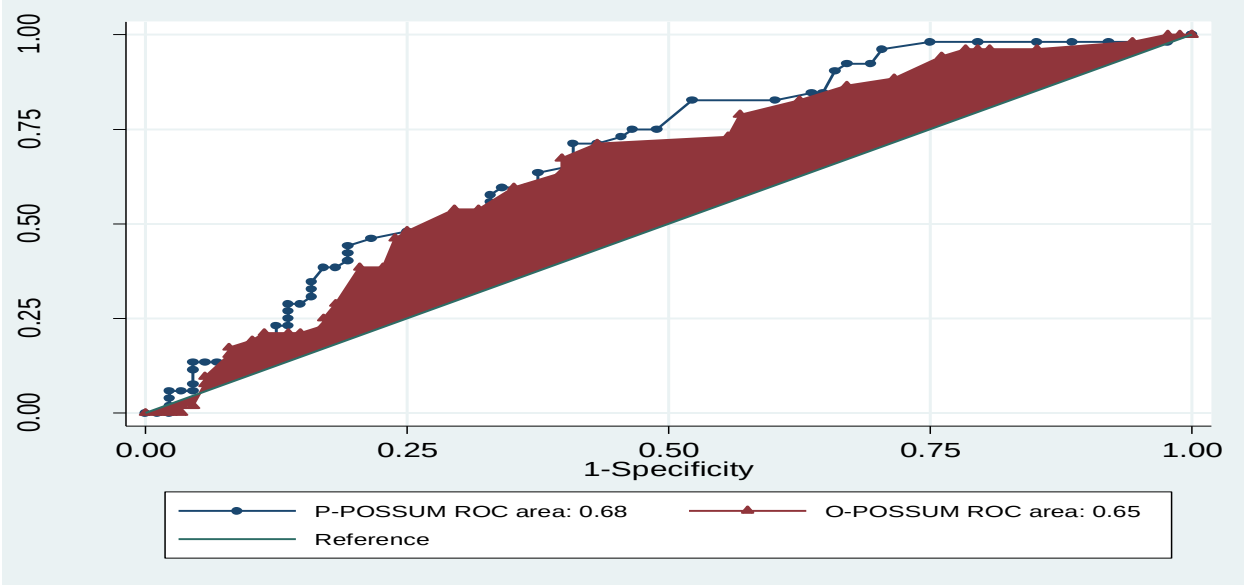


**Figure 2***: Comparison of Receiver-operator characteristic (ROC) curves for mortality predicted by P-POSSUM and O-POSSUM scores*

## DISSCUSSION

The purpose of this study was to assess the P-POSSUM and O-POSSUM scores in predicting mortality in patients undergoing oesophageal resection for cancer of the oesophagus. The results obtained also gave an insight on oesophageal cancer in our region and its management.

The average age of patients was 57.3 years in keeping with regional published figures (5, 6). Mortality rate was 37.1% which compares poorly to international figures of 10-14 %( 8, 9). Possible reasons for these discrepancies might be due to different standards of post operative care, different selection criteria in various centers and low case volumes locally. The highest mortality was in the older age groups (>60yrs) and might be associated with undisclosed chronic conditions. This was also found to be true in the international literature.

Mortality rate was found to have a strong link to preoperative physiological parameters in both scores. Operative scores in P-POSSUM had a greater impact on the mortality rate than O-POSSUM operative scores.

This could be due to more measured parameters in the P-POSSUM operative scores which affect the post operative period. Thus the need to optimize the patient physiologically cannot be overemphasized.

Linear analysis of the two scores showed an overestimation of mortality rate. Similar studies showed no differences in predicted and observed mortality rates in P-POSSUM while O-POSSUM overestimated mortality rates in the elderly. Both scores in this study showed a significant fit with the observed deaths which was similar to other studies for P-POSSUM in contrast to studies on O-POSSUM which showed a lack of fit. ROC analysis showed that both scores had fair discriminatory power that was better than chance which was similar for O-POSSUM in similar studies. However studies done on P-POSSUM showed a moderate to good discriminatory power. Finally, P-POSSUM performed better than O-POSSUM in predicting mortality. This might be due to a wider range of operative parameters used.

## CONCLUSION

Risk prediction tools remain important in surgery both as a guide in surgical decision making and in audit. P-POSSUM performed better in this study and would be useful in surgically resectable oesophageal malignancies.

The parameters used are readily available in our setup and considered routine thus adding no cost to the patient while giving the surgeon an invaluable tool in the selection of patients and in the design of post operative care protocols. This tool, coupled with dedicated high volume cardiothoracic units, would go a long way in reducing post operative mortality in our region.

O-POSSUM has been shown to work well in gastrectomy and a dedicated system for oesophagectomy would possibly suffice due to different associated risk factors of mortality.

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## APPENDICES

## APPENDIX 1

a) Physiological Score (P-POSSUM)

| | ***Score*** | | | |
|---|---|---|---|---|
| | 1 | 2 | 4 | 8 |
| *Age (years)* | *<60* | *61-70* | *>71* | |
| Cardiac signs<br><br>Chest radiography | No failure | Diuretic, digoxin, anti-angina or hypertensive therapy | Peripheral oedema, warfarin therapy,<br><br>borderline cardiomegaly | Raised JVP,<br><br>cardiomegaly |
| Respiratory history<br><br>Chest radiography | No dyspnoea | Dyspnoea on exertion<br><br>Mild COAD | Limiting dyspnoea<br><br>Moderate COAD | Dyspnoea at rest(rate>30/min)<br><br>Fibrosis or consolidation |

| | | | | |
|---|---|---|---|---|
| Blood Pressure (systolic) mmHg | 110-130 | 131-170 or<br>100-109 | >171 or<br>90-99 | <89 |
| Pulse (beats/min) | 50-80 | 81-100<br>40-49 | 101-120 | >121<br><39 |
| Glasgow coma scale | 15 | 14-12 | 11-9 | <8 |
| Hemoglobin (g/dl) | 13-16 | 11.5-12.9<br>16.1-17.0 | 10.0-11.4<br>17.1-18.0 | <9.9<br>>18.1 |
| White cell count (x1012/l) | 4-10 | 10.1-20.0<br>3.1-4.0 | >20.1<br><3.0 | |
| Urea (mmol/l) | <7.5 | 7.6-10.0 | 10.1-15.0 | >15.1 |
| Sodium (mmol/l) | >136 | 131-135 | 126-130 | <125 |
| Potassium (mmol/l) | 3.5-5.0 | 3.2-3.4<br>5.1-5.3 | 2.9-3.1<br>5.4-5.9 | <2.8<br>>6.0 |
| Electrocardiogram | Normal | | Atrial fibrillation (rate 60-90) | Any other abnormal rhythm or >5 ectopics/min |

COAD - chronic obstructive airway disease

b) Operative score (P-POSSUM)

| | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| Operative severity | Minor | Moderate | Major | Complex major operation |
| Number of Procedures | 1 | 2 | >2 | |
| Total blood loss(ml) | <100 | 101-500 | 501-999 | >1000ml |
| Peritoneal soiling | None | Minor (serous fluid) | Local pus | Free bowel content, pus or blood |
| Presence of malignancy | none | Primary malignancy only | Malignancy +nodal metastasis | Distant metastases |
| Mode of surgery | Elective | | Emergency resuscitation of >2h possible <24h after admission | Emergency (immediate surgery <2h needed |

## APPENDIX 2

a) Physiological Score for O-POSSUM

| | ***Score*** | | | |
|---|---|---|---|---|
| | **1** | **2** | **4** | **8** |
| Age range(years) | <60 | 61-70 | >71 | |
| Actual age | <60 | 61-70 | >71 | |
| Cardiac signs | No failure | Diuretic, digoxin, anti-angina or hypertensive therapy | Peripheral edema, warfarin therapy, | Raised JVP, |
| Chest radiography | | | borderline cardiomegaly | cardiomegaly |
| Respiratory history | No dyspnoea | Dyspnoea on Exertion | Limiting dyspnoea | Dyspnoea at rest(rate>30/min) |
| Chest radiography | | Mild COAD | Moderate COAD | Fibrosis or consolidation |
| Blood Pressure (systolic) mmHg | 110-130 | 131-170 or 100-109 | >171 or 90-99 | <89 |
| Pulse (beats/min) | 50-80 | 81-100 40-49 | 101-120 | >121 <39 |

| | | | | |
|---|---|---|---|---|
| Glasgow coma scale | 15 | 14-12 | 11-9 | <8 |
| Hemoglobin (g/dl) | 13-16 | 11.5-12.9<br>16.1-17.0 | 10.0-11.4<br>17.1-18.0 | <9.9<br>>18.1 |
| White cell count (x1012/l) | 4-10 | 10.1-20.0<br>3.1-4.0 | >20.1<br><3.0 | |
| Urea (mmol/l) | <7.5 | 7.6-10.0 | 10.1-15.0 | >15.1 |
| Sodium (mmol/l) | >136 | 131-135 | 126-130 | <125 |
| Potassium (mmol/l) | 3.5-5.0 | 3.2-3.4<br>5.1-5.3 | 2.9-3.1<br>5.4-5.9 | <2.8<br>>6.0 |
| Electrocardiogram | Normal | | Atrial fibrillation (rate 60-90) | Any other abnormal rhythm or >5 ectopics/min |

b) Operative score (O-POSSUM)

| | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| Operative type | oesophagectomy | Total gastrectomy | Partial gastrectomy | Palliative gastrojejunostomy |
| Presence of malignancy | none | Primary malignancy only | Malignancy +nodal metastasis | Distant metastases |
| Mode of surgery | Elective | | | Emergency (immediate surgery <2h needed |

**Appendix 3**

| Mortality group (%) | Number of patients | Mean risk (%) | Predicted deaths (expected) | Actual death (observed) | O:E ratio |
|---|---|---|---|---|---|
| <10 | | | | | |
| 10-29 | | | | | |
| 30-39 | | | | | |
| 40-49 | | | | | |
| 50-59 | | | | | |
| 60-69 | | | | | |
| 70-79 | | | | | |
| 80-89 | | | | | |
| 90-100 | | | | | |
| 0-100 | | | | | |

## APPENDIX 4

## *Physiological Score (P-POSSUM )*

| **VARIABLE** | **SCORE** |
|---|---|
| Age (years) | |
| Cardiac signs/Chest radiography | |
| Respiratory history/Chest radiography | |
| Blood Pressure (systolic) mmHg | |
| Pulse (beats/min) | |
| Glasgow coma scale | |
| Hemoglobin (g/dl) | |
| White cell count (x1012/l) | |
| Urea (mmol/l) | |
| Sodium (mmol/l) | |
| Potassium (mmol/l) | |
| Electrocardiogram | |
| PHYS. SCORE | |

***Serial Number_*** ***IP Number***

**Operative score (P-POSSUM)**

| ***VARIABLE*** | ***SCORE*** |
|---|---|
| Operative severity | |
| Number of Procedures | |
| Total blood loss(ml) | |
| Peritoneal soiling | |
| Presence of malignancy | |
| Mode of surgery | |
| OPERATIVE SCORE | |

**OUTCOME ON DAY 30 -** PREDICTED RISK OF MORTALITY (R)

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***Physiological Score for O-POSSUM***

| ***VARIABLE*** | ***SCORE*** |
|---|---|
| Age range(years) | |
| Actual age | |
| Cardiac signs<br>Chest radiography | |
| Respiratory history<br>Chest radiography | |
| Blood Pressure (systolic) mmHg | |
| Pulse (beats/min) | |
| Glasgow coma scale | |
| Hemoglobin (g/dl) | |
| White cell count (x1012/l) | |
| Urea (mmol/l) | |
| Sodium (mmol/l) | |
| Potassium (mmol/l) | |
| Electrocardiogram | |
| PHYS. SCORE | |

*Serial Number_ IP Number*

Operative score (O-POSSUM)

| ***VARIABLE*** | ***SCORE*** |
|---|---|
| Operative type | |
| Presence of malignancy | |
| Mode of surgery | |
| OPERATIVE SCORE | |

**OUTCOME ON DAY 30 -**

PREDICTED RISK OF MORTALITY (R) - _____

## Appendix 5

**CONSENT BY THE PARTICIPATING PATIENT**

**Serial No…**…….. **Hospital No…**……

**Purpose of the study**

The purpose of this study is to determine the accuracy of the surgical risk scores, P-POSSUM and O-POSSM, in predicting mortality within a 30day period after resection for oesophageal cancer. The information gathered will be used to improve the management of patients with oesophageal cancer who are undergoing resection.

**Risks and benefits**

This study will provide clinicians with an essential tool that will allow them provide better care to those at a higher risk of mortality in resection for oesophageal cancer. There is no harm or risk anticipated in participating in this study. No additional tests outside the usual ones for treatment will be carried out and no extra cost to you will be incurred for participating in the study.

**Voluntary participation**

Participation in this study is out of your own free will. Medical care will not be denied in case you decline to participate in the study. You may terminate participation at any time with no consequences whatsoever.

**Confidentiality**

All information will be treated with confidentiality. Your identity will not be published whatsoever.

I the undersigned have been explained to and understand the above and voluntarily accept to participate in the study.

Signature / Thumb print (Patient/Next of kin):

ID / PASSPORT NUMBER:

Tel 1 (patient)… Tel 2 (Next of Kin)…

DR. ERIC MUTUNGI MUTISO – TEL 0722496207

**KIBALI CHA RUHUSA**

**Nambari ya utafiti:…… Nambari ya Hospitali:……..**

**Sababu ya utafiti**

Sababu ya utafiti huu ni kutibitisha manufaa ya P-POSSUM na O-POSSUM kwa kupunguza vifo kwa wagonjwa wanaofanyiwa upasuaji kwa ajili ya saratani la umio. Utafiti huu utafanyika katika hospitali kuu ya Kenyatta na matokeo yake yatatumiwa kupendekeza njia za kuboresha matibabu kwa wagonjwa wanaofanyiwa upasuaji kwa ajili ya saratani la umio.

**Hatari na manufaa**

Utafiti huu utaimarisha ujuzi wa madaktari kwa matibabu kwa wagonjwa wenye saratani la umio. Hatutarajii hatari zozote kwako unaposhiriki kwenye utafiti huu. Utafiti huu hautakugharimu fedha zaidi.

**Uhusika Kwa hiari**

Kuhusika kwa utafiti huu ni kwa hiari yako mwenyewe na hauwezi kushurutishwa. Utahudumiwa ata kama ukikataa kuhusika kwa huu utafiti. Una uhuru kutamatisha kuhusika wakati wowote bila madhara yoyote ile.

**Usiri**

Habari zozote utakazotoa zitawekwa kwa siri na jina lako halitachapishwa popote.

Ninathibitisha yakuwa nimefahamu yale nimeelezwa na mtafiti na nimekubali kwa hiari yangu mwenyewe kuhusika katika utafiti huu.

Sahihi/Kidole cha Gumba:

(Mhusika/next of kin) Simu 1 (Mhusika):……. Simu 2 (next of kin):…….

.DR. ERIC MUTUNGI MUTISO – TEL 0722496207