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Is POSSUM predictive of morbidity and mortality in laryngectomy patients?

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Abstract

Objectives: To test the validity of the comparative audit tool of POSSUM (Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) against a cohort of 92 consecutive laryngectomies at a major tertiary referral centre for head and neck cancer. The major outcome measurements were 30-day mortality rates, formation of a pharyngo-cutaneous fistula, and length of hospital stay.
Methods: By means of a prospective and retrospective case note analysis.
Results: No significant difference between the mean POSSUM morbidity scores of those patients who did, or did not develop a fistula, was found ($p = 0.535$, 95% C.I. −4.36 to 8.33). No significant correlation was observed between POSSUM predicted morbidity and bed occupancy [$r = 0.137$ (95% C.I. −0.070 to 0.334)]. The Portsmouth POSSUM equation for mortality however did accurately predict the mortality rate (observed to expected ratio of 1.05).
Conclusion: The authors propose that whilst there are many similar factors linked to mortality between cohorts of general surgical and head and neck patients, there are several highly specific risk factors in open surgery of the upper aero-digestive tract in the head and neck which are linked with wound breakdown and morbidity which are omitted from the POSSUM scoring system. The authors warn against the use of this comparative audit tool in its current state for such surgical procedures and recommend the creation of a specific POSSUM for head and neck cancer surgery.

Keywords: POSSUM audit; Head and neck surgery; Laryngectomy; Mortality

1. Introduction

The outcome of any surgical procedure, whether successful or not, is not necessarily solely related to the abilities of the individual surgeon, but is a result of a multitude of interrelated and interacting variables relating to host, pathology and operator. Comparison of raw mortality and morbidity rates between units do not reflect these variables and thus the value of comparison of such data in isolation is questionable.

Unfortunately, in the light of the professional misconduct case at Bristol [1] such focus on comparisons, especially on outcomes in oncological surgery, is becoming commonplace. Units serving areas of greater wealth and higher social class will automatically be presented with a better educated patient group who, as a consequence, are less likely to partake of detrimental lifestyle habits and therefore be, amongst other things, better nourished; just one important factor of many which may have profound influence on both morbidity and mortality following surgery. More concerning may be the subliminal, or in some cases explicit, institutional pressure experienced by individual surgeons to select only low-risk cases in order to achieve a low mortality rate.

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With this in mind, during the 1980s, following multivariate discriminant analysis of numerous peri-operative variables, a scoring system was developed to predict 30-day mortality and morbidity rates (The POSSUM audit system; Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) [2,3]. This was an attempt to create a tool of assessment of surgical quality that was risk adjusted for the patient's acute and chronic physiological status as well as for the nature of the operation.

This system was principally designed for a population of general surgical patients and there have been numerous subsequent papers validating it in this patient population [4,5]. It was observed that POSSUM tended to overestimate peri-operative mortality [3,6]; two-fold in high risk patients and up to seven-fold in low risk patients, with the smallest risk of death being 1.08% in the lowest risk group. Following further logistic regressional analysis of 1485 of their own patients Pytherch et al. readjusted the POSSUM formula for perioperative mortality creating the modified P-POSSUM (Portsmouth POSSUM) [7] resulting in a lowering of the minimal predicted risk of mortality to 0.2%.

Application of both of these scoring systems has been applied to other non-abdominal cavity surgical sites including the head and neck region [8–11].

The authors present their evaluation of both POSSUM and P-POSSUM in a cohort of consecutive patients undergoing laryngectomy for squamous cell carcinoma of the head and neck (SCCHN) at University Hospital Aintree; a major tertiary referral centre for head and neck cancer in the North West of England. The specific aim of this study was to assess the ability of POSSUM or P-POSSUM to predict the development of post-operative pharyngo-cutaneous fistula formation, length of hospital stay and 30-day mortality in our patient cohort.

2. Methods

The data relating to patients undergoing surgery in our unit is entered into the Liverpool Head and Neck database. For the purpose of this study, consecutive patients undergoing total laryngectomy between October 2003 and October 2007 were included. The procedures were performed under the care of one of the four ORL-HN surgeons in the Department. All variables enabling calculation of POSSUM and P-POSSUM values for all patients were included in the analysis. Individual POSSUM scores were generated by means of a Web based POSSUM calculator [12]. The development of a post laryngectomy pharyngo-cutaneous fistula, length of hospital stay and 30-day mortality rates was recorded for all patients. Statistical analysis was performed using Graphpad Instat™ statistical package version 2.04a.

Table 1
Total number of laryngectomies with primary closure performed at University Hospital Aintree between October 2003 and October 2007 ($n = 99$).

Time period	Number of laryngectomies
October 2003–2005	44
October 2005–2006	34
October 2006–2007	21

3. Results

From October 2003 to October 2007 a total of 99 patients underwent total laryngectomy, for which 92 complete data sets and 93 POSSUM data sets are available (Table 1).

In all cases primary repair of the pharynx was performed. The pharynx was closed in the same way in all cases; 3 layered closure of mucosa, sub-mucosa and finally inferior constrictors. This method of closure has subsequently been changed within the department since we believe that closure of the inferior constrictors is contributory to fistula formation. Evidence exists of raised neopharyngeal pressures in patients in whom inferior constrictors have been closed [13] leading to the theory of an increased risk of salivary extrusion in the early post-operative period due to neopharyngeal contraction. In keeping with Wang et al. [14] who noticed a 6.7% reduction in fistula rates after discontinuing inferior constrictor closure, we at Aintree have adopted a similar technique which reduced our own fistula rate by 13%.

However, since fistula formation was one of the primary measured outcomes, only patients closed in 3 layers have been included for analysis. All patients in which a flap assisted pharyngeal closure was performed were also excluded. As can be seen in Table 1 the incidence of total laryngectomy performed per annum has reduced markedly reflecting the increasing number of partial laryngeal and transoral laser procedures being performed in our unit over the latter part of the study period.

82% of the patients were men and 18% women. Seventy one percent (71%) patients were having surgery for de novo tumours whilst 29 (29%) patients were receiving surgical salvage following failure of previous radiotherapy. There were 4 post-operative deaths in the first 30 days (4%). The overall fistula rate was 34%. We consider this unacceptably high and is the subject of on-going changes in practice within the department in order to lower the incidence. The rate has reduced to 26% in the subsequent 2 years and continues to drop. The techniques employed to reduce the rate will be presented in a future publication. Of the 99 cases performed, data necessary to calculate POSSUM scores was available for 93.

3.1. POSSUM as a predictor of pharyngocutaneous fistula

The mean POSSUM morbidity score for the 61 patients who did not develop a fistula was 54.8% (range 32–89, 95%