Thoracscore: Predicting risk of in-hospital mortality for patients undergoing pulmonary resection

Thoracscore: Procena rizika intrahospitalnog mortaliteta bolesnika nakon resekcije pluća

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Abstract

Background/Aim. Thoracic surgery is in need of a widely recognized and dependable risk model which could prospectively make objective conclusions and retrospectively allow comparison of outcomes. Thoracscore is the first model with multiple variables developed for predicting in-hospital mortality following pulmonary resections. It is integrated in the British Thoracic Society and National Institute of Health and Clinical Excellence guidelines. However, additional evaluation of Thoracscore is considerably advised in order to demonstrate its validity and potentially make it a dependable tool for thoracic surgeons across the world. Our study assesses the accuracy of Thoracscore scoring system in estimating in-hospital mortality in patients undergoing pulmonary resections. Methods. Between September 2013 and October 2014 data were retrospectively collected on 196 patients operated on at the Thoracic Surgery Clinic, Institute of Pulmonary Diseases of Vojvodina. The procedures performed were: pneumonectomies, lobectomies and modified lobectomies (including bilobectomy and sleeve-lobectomy), Wedge resections and atypical resections. The Thoracscore was calculated based on these nine variables: age, sex, American Society of Anaesthesiologists’ (ASA) class, performance status classification, dyspnea score, priority of surgery, procedure class, diagnosis group and co-morbidities score. Results. Study included one hundred and ninety-six patients, average age of 62 ± 9 years, and 61% were males. Predicted mean in-hospital mortality was 3.6 ± 3.2% 95% confidence interval (CI) 3.16–4.06, and mean actual in-hospital mortality was 6/196 (3.1%) (95% CI 1.78–4.42). Patients who were > 65 years old contributed to 3/6 (50%) of in-hospital mortality, and 4/6 (67%) were males. Four of 6 (67%) patients underwent pneumonectomy due to malignant pathology. Thoracscore was divided into 4 risk groups: low (0–3), moderate (3.1–5), high (5.1–8) and very high (> 8). The correlation between observed and expected mortality was 0.99, by category of risk. Old age, male gender and malignancy showed to be strong indicators of in-hospital mortality. Conclusion. At our department Thoracscore presented with good performance and as a practical tool for predicting in-hospital mortality among patients undergoing lung resections. However, any risk scoring system needs further validation before implementation and outcomes must be compared to those of other programs.

Key words: thoracic surgical procedures; lung diseases; hospital mortality; risk factors; prognosis; treatment outcome.


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Introduction

Over the past twenty years, scoring systems have become a useful method for patient assessment, especially because the patients who require pulmonary resection have become more complex, with more comorbidities. The risk of mortality is one of the crucial elements when trying to decide if surgery is the best option for the patient. Usefulness of an objective risk stratification model was acknowledged by cardiac surgeons more than two decades ago. Today, they substantially rely on several models of risk assessment for patients facing cardiac surgery. However, as of now, broadly accepted risk model for thoracic surgery has yet to be established. Thus far, only two risk scoring systems have been evaluated, but neither become a standard. Thoracoscore is the first model with multiple variables developed for predicting inhospital mortality following pulmonary resections. This model was acquired from data of 15,183 patients who underwent thoracic surgery in 59 French hospitals. It was integrated in the British Thoracic Society and National Institute of Health and Clinical Excellence guidelines.

Thoracoscore was verified internally and externally by some groups: pneumonectomy, lobectomy and modified lobectomies (including bilobectomy and sleeve-lobectomy), 9 Wedge resections and 28 atypical resections. The Thoracoscore was calculated using these nine variables: age, sex, American Society of Anaesthesiologists (ASA) class, performance status classification, dyspnea score, priority of surgery, procedure class, diagnosis group and comorbidities score. Data were collected from the patients’ charts and were entered into the hospital information system by thoracic surgeons. Thoracoscore was calculated for all patients undergoing elective, urgent or emergency pulmonary resections at the Institute for Pulmonary Diseases of Vojvodina. The procedures performed were: 50 pneumonectomies, 109 lobectomies and modified lobectomies (including bilobectomy and sleeve-lobectomy), 9 Wedge resections and 28 atypical resections. The Thoracoscore was calculated using these nine variables: age, sex, American Society of Anaesthesiologists (ASA) class, performance status classification, dyspnea score, priority of surgery, procedure class, diagnosis group and comorbidities score. Data were collected from the patients’ charts and were entered into the hospital information system by thoracic surgeons. Thoracoscore was calculated for all patients undergoing elective, urgent or emergency pulmonary resections at the Institute for Pulmonary Diseases of Vojvodina.

Data analysis and statistical methods

Variables were noted as percentages and continuous variables as mean value ± 1 standard deviation. Descriptive statistics were used for all applicable variables. Mortality rate for all patients undergoing lung resection was calculated using Thoracoscore, and presented as the ratio of observed deaths to expected deaths. The formula used for calculating mortality in the original work of Falcoz et al. was as follows: Odds = exp[-7.3737 + (0.7679 if code of age is 1 or 1.0073 if code of age is 2) + (0.4505 × sex score) + (0.6057 × ASA score) + (0.4505 × sex score)] / (1 + exp[-7.3737 + (0.7679 if code of age is 1 or 1.0073 if code of age is 2) + (0.4505 × sex score) + (0.6057 × ASA score) + (0.4505 × sex score)]). Procedures were stratified into 4 groups: pneumonectomy, lobectomy and modified lobectomy (including bilobectomy and sleeve-lobectomy), Wedge resection and atypical resection. The groups presented as follows: Group 1 – low risk group (< 3%); Group 2 – moderate risk (3.1–5%); Group 3: high risk group (5.1–8%); Group 4: very high risk group (> 8%). Because the original model underestimated mortality in the moderate risk group and overestimated mortality in the high risk group, our risk groups have been modified to have different values from those in the original study by Falcoz et al. In-hospital mortality for each group was observed, predicted and assessed. Calculation of the area under the receiver operating characteristic (ROC) curve was used to interpret Thoracoscore’s
validity. The area under the ROC was calculated as C statistic. The discriminative power of the model was excellent if the area under the ROC was > 0.80, very good if > 0.75 and good if > 0.70. All data were evaluated using Statistics Package for the Social Sciences (SPSS) version 2.0 (SPSS, Inc, Chicago, IL, USA).

Results

The study included 196 patients, average age of 62 ± 9 years where 61% were males. (Table 1). Mean predicted probability of in-hospital mortality was 3.6 ± 3.2%, 95% confidence interval (CI) 3.16–4.06%, while mean actual in-hospital mortality was 3.1% (6/196) (95% CI 1.78–4.42%). Patients who were > 65 years old contributed to 3/6 (50%) of in-hospital mortality, and 4/6 (67%) of patients who died in hospital were males. Four of 6 (67%) patients underwent pneumonectomy due to malignant pathology. Each of the 4 incremental risk groups was analyzed for predictive and observed mortality (Table 2). The correlation between observed and expected mortality was 0.99, by a category of risk. Thoracoscore showed outstanding discriminatory ability with C statistic (0.78, 95% CI).

Discussion

Out of 9 variables in the Thoracoscore model, age,
malignancy, pneumonectomy, ASA class, performance status and dyspnea score had greatest effect on in-hospital mortality risk. Our results correspond with the results presented by Falcoz et al. 1, in their initial study. Alike independent variables for in-hospital mortality after lung resection which were recognized by Berrisford et al. 7 and Harpole et al. 8, Ferguson and Durkin 9 noted performance status as a predictor for postoperative complications. Additionally, Prause et al. 10 and Chamogeorgakis et al. 11,12 noted the ASA score as a strong indicator of perioperative mortality overall. One of the largest pneumonectomy series from the Mayo Clinic showed that pneumonectomy conveys an important risk for in-hospital mortality, contributing to 11% of deaths 11. On the contrary, Bradley et al. 12 and Sharkey et al. 13 disclosed setbacks of Thoracoscore, highlighting its inability to predict postoperative mortality, and suggested the need for an improved scoring system in the area of thoracic surgery.

It should be mentioned that Thoracoscore model analyzes only in-hospital mortality, eliminating other risks, such as the risk of death regarded to surgery. Also, Thoracoscore consists of only 9 variables, not taking into account other factors that could possibly be as important.

Our study has a few limitations as well. First, long-term survival is not monitored, since this is the first time a scoring system for thoracic surgery was used and validated in Serbia. Second, our study is derived from a single-center database, and patient profiles greatly vary from the population in other countries. Taking into account everything listed, additional evaluation of Thoracoscore is considerably advised.

**Conclusion**

At our department Thoracoscore presented good performance and came across as a practical tool for predicting in-hospital mortality among patients undergoing lung resections. Older age, male gender and malignant pathology showed to be the strongest indicators of in-hospital mortality in our study. This scoring system is easy to use and, if further validated, could find its practical value in thoracic surgery units.

**REFERENCES**


Received on February 28, 2016.
Revised on June 14, 2016.
Accepted on August 22, 2016.
Online First November, 2016.