Application of Modified POSSUM Scoring System in Patients Undergoing Thoracoscopic Surgery

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Abstract: Objective: To investigate the predictive value of a physiology and surgical severity-based score (POSSUM score) modified according to the characteristics of thoracic surgery for complications and mortality in patients undergoing thoracoscopic surgery. Method: To investigate the value of the modified POSSUM scoring system in predicting the complication and mortality rate of patients undergoing thoracoscopic surgery. The clinical data of 104 patients who underwent thoracic surgery in the Thoracic Surgery Department of Guangzhou Red Cross Hospital between May 2018 and May 2020 were retrospectively analyzed. The modified POSSUM score was used for preoperative patients to predict the number of postoperative complications and deaths, and compared with the actual number of complications and deaths. Result: The number of postoperative complications predicted by the improved POSSUM scoring system was 36, and the actual number of complications was 42. The difference was not statistically significant (P>0.05); The predicted number of postoperative deaths was 8, and the actual number of deaths was 1. The difference was statistically significant (P < 0.05).
Conclusion: The modified POSSUM scoring system can be used to predict complications after thoracoscopic surgery but may overpredict postoperative mortality.

Introduction

In recent years, the Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (POSSUM) has been widely used. The system was first proposed by Copeland et al. [1] in 1991 and consists of probabilistic formulas for predicting complications and operative mortality. It contains 12 physiological indicators and 6 surgical severity indicators, and it is defined on four scales of 1, 2, 4, and 8. It calculates Physiologic Score and Operative Severity Score respectively to predict surgical mortality and morbidity of complications. 12 physiological indicators are age, cardiac signs, respiratory signs, systolic blood pressure, pulse rate, Glasgow coma score, hemoglobin, blood leukocytes, blood urea, serum sodium, potassium, electrocardiogram; The 6 surgical severity indexes were the type of surgery, the number of surgery, the contamination of the abdominal cavity, the total blood loss, the degree of malignancy, and the mode of surgery. They are mainly used for the assessment of the risk of specialized operations such as hepatobiliary, gastrointestinal, and pancreas in general surgery. Studies at home and abroad have shown that the POSSUM score is also suitable for predicting the risk of thoracic surgery [2-3], which indicates that the POSSUM scoring system can also accurately predict postoperative complications in pulmonary patients. With the popularization of thoracic surgery, thoracic surgery has become the mainstream, which puts forward higher requirements for targeted treatment and nursing after surgery, so it is particularly important to predict and reduce postoperative complications. The predictive formula for the incidence of surgical complications was $\ln(R/1-R) = -5.91 + (0.16 \times \text{physiology score}) + (0.19 \times \text{surgical severity score})$, and R was the predicted value. Prediction of complication rate $= -5.91 + (0.16 \times 12 \text{ physiology scores}) + (0.19 \times 6 \text{ surgical severity scores})$. The mortality prediction formula was $\ln(R/1-R) = -7.04 + (0.13 \times \text{physiological score}) + (0.16 \times \text{surgical severity score})$.

1. Materials and methods

1.1 General information

Patients who were hospitalized in thoracic surgery for thoracoscopic surgery from May 2018 to May 2020 were selected. Surgical methods: exploratory thoracoscopy, lung wedge resection, lobectomy, pneumonectomy; A total of 104 cases, 70 males and 34 females; Age: 16 to 80 years old.

1.2 Methods

1.2.1 Scoring method

The POSSUM scoring system was modified according to the characteristics of thoracic surgery, and the abdominal cavity contamination in the surgical invasiveness index was changed to thoracic cavity contamination. The specific scoring standard is: no pollution, 1 point; Clear pleural effusion, 2 points; Purulent pleural effusion, 4 points; 8 points for contamination of esophageal or stomach contents. The surgical method was changed to a classification score more suitable for lung surgery: simple thoracoscopic exploration, 1 point; Lung wedge resection 2 points; Lobectomy, 4 points; Pneumonectomy, 8 points; According to the modified POSSUM scoring system, the physiological indexes and surgical invasiveness indexes of each patient within 24 hours before surgery were collected and scored. The probability of postoperative complications (R1) was calculated according to the COPELAND equation. Postoperative complications were defined as all complications that occurred during hospitalization after surgery, that is, diseases or symptoms that did not occur before surgery but occurred after surgery were classified as postoperative complications. The definition of complications and standard reference [4].

1.2.2 Statistical analysis SPSS 17.0 statistical software was used for statistical processing

The POSSUM scores of the uncomplicated group and the complication group were expressed as mean ± standard deviation (X ± s), and t-test was used for comparison between the two groups; The predicted and actual complication rates and mortality were expressed as percentages, and the comparison between the two groups was performed using the χ^2 test.

2. Results

2.1 Postoperative complications and death

Postoperative complications occurred in 42 patients (41.9%). Among them, 1 case of heart failure, 6 cases of fever, 3 cases of pneumothorax, 1 case of pulmonary edema, 3 cases of atelectasis, and 1 case of respiratory failure. There were 5 cases of pulmonary infection, 2 cases of phlebitis, 2 cases of infusion reaction, 5 cases of subcutaneous emphysema, 5 cases of wound infection, and 8 cases of arrhythmia. One patient died of pulmonary infection complicated with respiratory failure after operation.

2.2 POSSUM scoring system

The physiology score and surgical severity score of the patients with postoperative complications were 16.62±3.91 and 13.93±4.22, respectively, which were higher than those of the uncomplicated group, 15.15±2.66 and 11.58±4.05, with statistically significant differences.

2.3 Comparison of the modified scoring system prediction system with actual morbidity and mortality

The 104 cases in this group were evaluated by the modified POSSUM scoring system. The number of postoperative complications predicted by the Copeland equation was 36 cases, and the actual incidence was 42 cases. There was no statistically significant difference between the two ($\chi^2 = 0.738$, P = 0.390), as shown in Table 2. In this group of 104 patients, the number of deaths predicted by the Copeland equation after the modified POSSUM score was 8 cases. The actual number of deaths was 1, and there was a statistically significant difference between the two ($\chi^2 = 5.691$, P = 0.017), as shown in Table 3.

Table 1 Comparison of the two groups of POSSUM scoring systems

Groups	Number of cases	Physiological Score	Surgical severity score
Complication group	42	16.62±3.91	13.93±4.22
Uncomplicated group	62	15.15±2.66	11.58±4.05
t value		2.29	2.85
P value		0.24	0.005

Table 2 Comparison of predicted and actual complications

R1(%)	Number of cases	Average of R1	Predictive value	Actual value	Actual-forecast ratio
＜10	13	0.09	2	4	2
≥10＜20	30	0.14	5	7	1.4
≥20＜30	18	0.25	5	6	1.2
≥30＜40	15	0.35	6	7	1.16
≥40＜50	10	0.46	5	5	1
≥50＜60	6	0.54	4	4	1
≥60＜70	5	0.66	4	4	1
≥70＜80	3	0.75	3	3	1
≥80	2	0.83	2	2	1
Total	104	-	36	42	-

The results in Table 1 show that there was no statistical difference between the predicted value and the actual value of postoperative complications between the two groups, indicating that the POSSUM scoring system can also more accurately predict postoperative complications in patients with lung surgery.

Table 3 Comparison of predicted and actual deaths

R2(%)	Number of cases	Average of R2	Predictive value	Actual value	Actual-forecast ratio
＜10	84	0.04	4	0	0
≥10＜20	15	0.14	2	0	0.5
≥20＜30	5	0.25	2	1	0.5
≥30	0	0	0	0	0
Total	104		8	1	-

3. Discussion

Thoracoscopic surgery is a common operation in thoracic surgery. With the popularization of thoracoscopy and the advancement of equipment development, complications have been reduced compared with before, but postoperative

complications are still common, mostly cardiopulmonary complications [5]. This study showed that there was no statistically significant difference between the predicted value of postoperative complications and the actual value, which indicated that the POSSUM scoring system could also more accurately predict postoperative complications in patients with thoracoscopic surgery. Several studies have shown that the POSSUM scoring system over-predicts the postoperative mortality of patients [6-7]. This study agrees with seeing that even modified POSSUM overpredicts operative mortality.

This study found that the physiological POSSUM scoring system of thoracoscopic surgery is mainly concentrated between 10% and 30%, which may be related to the selection of thoracoscopic surgery population. Routine thoracotomy for critically ill patients. In addition, it may be caused by the small trauma of thoracoscopic surgery, the high degree of surgical precision, the less blood loss, and the relatively low surgical severity score.

The POSSUM scoring system provides medical staff with a scientific basis for objectively evaluating the perioperative physiological status and prognosis of patients. By early warning of complication rates and providing forward-looking information, it is helpful to formulate patient care plans, targeted and more comprehensive individualized care programs, and improve the quality of care. It can enable patients and their families to better understand the risks of surgery and reduce the occurrence of medical disputes. Strictly complete the treatment plan on time, check vital signs, cardiopulmonary function, etc. in time to minimize complications.

In conclusion, the modified POSSUM scoring system can be used to predict postoperative complications in patients undergoing thoracoscopic surgery. However, there is a possibility of over-prediction in predicting the number of postoperative deaths. The next step is to add pulmonary adhesions, pulmonary function tests, and refine the POSSUM score according to the preoperative TNM staging; The establishment of a postoperative prediction system with its own characteristics of thoracic surgery will have more application prospects.

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