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INDICATIONS OF OXYGENATION AFTER THORACIC OPERATIONS DEPENDING ON THE METHOD OF SELECTION OF DUAL ENDOBRONCHIAL TUBE USED

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Annotation. *Pulmonary complications are a key problem in the postoperative period in patients with diseases of the thoracic cavity. They are characterized as the main factors of longer recovery and hospital mortality. The aim of the study was to compare the indicators of oxygenation of patients and the number of postoperative pulmonary complications after thoracic surgery, depending on the method used to select a dual endobronchial tube. The study was performed on 192 patients with diseases of the thoracic cavity (esophagus, lungs, mediastinum), operated on in the thoracoabdominal department of the Shalimov National Institute of Surgery and Tranplantology. A retrospective comparison group - 96 patients after thoracic surgery, which used the choice of DLT size according to the well-known method of Slinger "according to the patient's height". The study group consisted of 96 patients after thoracic surgery, in which the choice of the size of the dual endobronchial tube was used according to the developed method (according to the formula that evaluates morphometric indicators of height, sex and diameter of the left main bronchus). EZR v 1.54 statistical software was used for statistical calculations. (graphical user interface for statistical software R version 4.0.3, R Foundation for Statistical Computing, Vienna, Austria). Pulmonary complications developed in 33 (34.4%) patients of the control group and in 13 (13.5%) patients of the study group, the difference was statistically significant, p=0.001. One-factor analysis revealed a link between the risk of complications and the indicators method, sex, PaCO2, PaO2. For the study group, the risk of complications is lower (p=0.001), BP=0.30 (95% CI 0.15-0.61) compared with the control group. The risk of complications for men is higher (p=0.048), BP=2.33 (95% CI 1.01-5.37) compared to women. An increase in the risk of complications with an increase in PaCO2 (p<0.001), BP=1.34 (95% CI 1.21-1.49) with an increase in the indicator by 1 unit, respectively. With increasing PaO2, the risk of complications decreases (p<0.001): BP=0.96 (95% CI 0.94-0.98) - with increasing 1 unit. Thus, the application of the proposed method in comparison with the traditional method reduces (p=0.001) the number of postoperative pulmonary complications by 2.5 times (from 34.4% to 13.5%).*
Keywords: *thoracic anesthesiology, single-lung ventilation, pulmonary complications.*

Introduction

Operations on the thoracic cavity lead to severe violations of chest muscle contractions, alveolar ventilation after prolonged single-lung ventilation, which leads to reduced oxygenation, collapse of the alveoli, decreased tidal volume, vital capacity of the lungs in the postoperative period [2, 10, 11].

Determination of respiratory function in the postoperative period is important in terms of prescribing preventive measures to prevent the development of disorders of evacuation of bronchial secretions, which can lead to bronchial obstruction and the development of atelectasis. Which in turn leads to the development of lung infection [5, 6].

Among the preventive measures, first of all, it should be noted the correct selection of the dual lumen endobronchial tube (DLT) for single-lung ventilation during surgery [4, 15]. We have developed a mathematical formula for the selection of DLT based on a comprehensive assessment of the height, sex and diameter of the left main bronchus of patients [12].

The aim of the study - compare the indicators of oxygenation of patients and the number of postoperative pulmonary complications after thoracic surgery, depending on the method used to select a bifurcated endobronchial tube.

Materials and methods

The study was performed on 192 patients with diseases of the thoracic cavity (esophagus, lungs, mediastinum), operated on in the thoracoabdominal department of the Shalimov National Institute of Surgery and Tranplantology. A retrospective comparison group - 96 patients after thoracic surgery, which used the choice of LDT size according to the well-known Slinger method "according to the patient's height" [10, 11]. The study group consisted of 96 patients after thoracic surgery, in which the choice of the size of the bifurcated endobronchial tube was used according to the developed method (according to the formula that evaluates morphometric indicators of growth, sex and diameter of the left main bronchus (DLMB)).

EZR v 1.54 statistical software was used for statistical calculations. (graphical user interface for statistical software R version 4.0.3, R Foundation for Statistical Computing, Vienna, Austria).

Patients in both groups were comparable in age, sex, height, weight, DLMB, ASA scale (Table 1), p>0.05 in all indicators.

The distribution of № LDT patients in the study and control groups did not differ, p=0.752 (Table 2).

The research was performed as part of SRW "Improve methods of surgical treatment and postoperative analgesia

Table 1. General characteristics of patients.

Indicator		Control group, n=96	Research group, n=96	The level of significance of the difference, p
Sex	w	27 (28,1)	29 (30,2)	0,874
	m	69 (71,9)	67 (69,8)	
Height		174,5 (168 - 176)	172 (168 - 176)	0,406
Weight		76 (69,5 - 82,5)	76 (70 - 86)	0,312
DLMB		1,295 (1,2 - 1,34)	1,29 (1,2 - 1,34)	0,738
Age		60 (56 - 65)	58 (56 - 64)	0,265
ASA	2	80 (83,3)	84 (87,5)	0,540
	3	16 (16,7)	12 (12,5)	

Note. Fisher's exact test or χ^2 - exact test is used in the comparison.

Table 2. Distribution of patients on the left dual endobronchial tube.

Indicator		Control group, n=96	Research group, n=96	The level of significance of the difference, p
№ Tube	35	21 (21,9)	21 (21,9)	0,752
	37	18 (18,8)	20 (20,8)	
	39	44 (45,8)	34 (35,4)	
	41	13 (13,5)	21 (21,9)	

Note. Fisher's exact test or χ^2 - exact test is used in the comparison.

of patients with esophageal diseases", State registration № 0117U007505.

Results. Discussion

In the study of PaO2 (oxygen saturation), they were higher ($p<0.05$) in patients in the study group (Fig. 1) compared with the control group from the 4th hour to the 48th hour of postoperative measurement.

There was also an increase in carbon dioxide saturation (PaCO2) in patients of the study and control groups at different time intervals. The value of this indicator was higher in patients of the control group (Fig. 2).

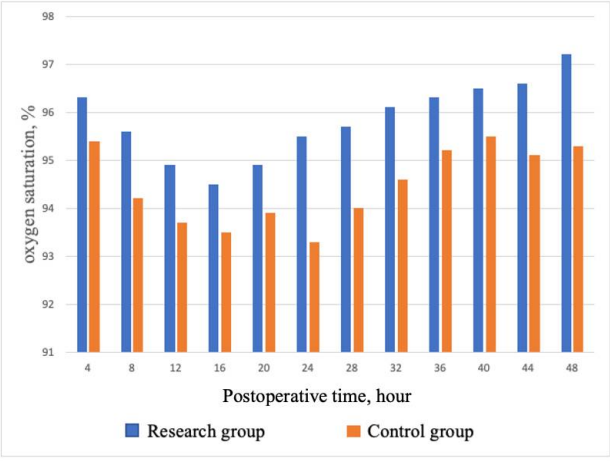

Fig. 1. Indicators of PaO2 in patients of the study and control groups at different time intervals.

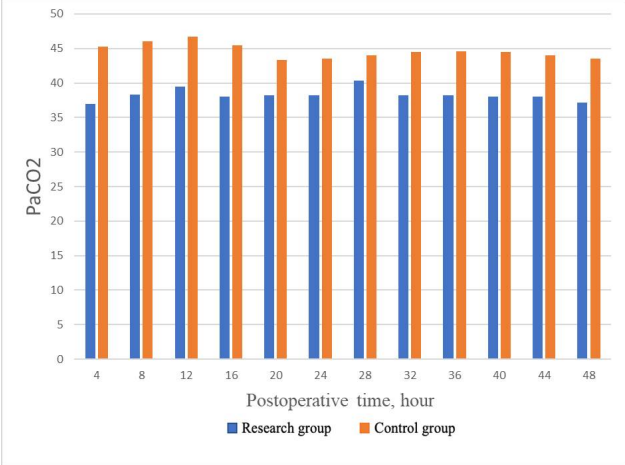

Fig. 2. PaCO2 values in patients of the study and control groups at different time intervals.

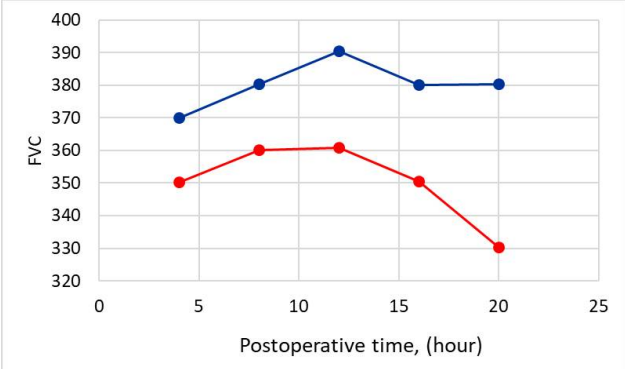

Fig. 3. FVC in patients of the study and control groups at different time intervals.

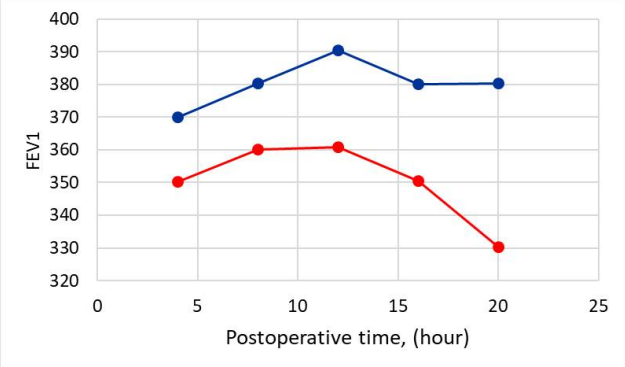

Fig. 4. FEV1 in patients of the study and control groups at different time intervals.

Thus, it was found that improving the method of choice of DLT in thoracic patients improves lung function, which is manifested by higher values of oxygen saturation and reduced PaCO2.

In the study of FVC (vital capacity of the lungs) and FEV1 (forced exhalation in 1 second) in patients of the study and control groups before surgery, the difference was not observed: 94.9±10.7 and 95.8±10.7, (p=0,71); 83.4±10.5 and 82.6±10.7 (p=0.74), respectively. In the postoperative period after 12 hours in both groups there was a decrease

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Table 3. Coefficients of one-factor models of logistic regression for predicting the risk of complications.

Factorial feature		The value of the model coefficient, b±m	The level of significance of the difference between the coefficient of the model from 0, p	Odds ratio indicator (95% BP)
Method	Control	Reference		
	Research	-1,21±0,37	0,001	0,30 (0,15-0,61)
Sex	Women	Reference		
	Men	0,84±0,43	0,048	2,33 (1,01-5,37)
Height		0,050±0,027	0,061	-
Weight		0,018±0,013	0,151	-
DLMB		2,30±1,56	0,140	-
№Tube	35	Reference		
	37	0,12±0,59	0,837	-
	39	0,74±0,48	0,127	-
	41	0,59±0,57	0,301	-
Age		0,004±0,019	0,840	-
ASA	2	Reference		
	3	0,68±0,44	0,120	-
PaCO2		0,29±0,05	<0,001	1,34 (1,21-1,49)
PaO2		-0,041±0,009	<0,001	0,96 (0,94-0,98)
FEV1		-0,004±0,016	0,807	-

in these indicators, but in the study group less pronounced (p<0,05). Starting from 24 hours of the postoperative period, a gradual increase was observed, with almost preoperative values for patients of both groups after 72 hours. However, after 24 and 48 hours in patients of the study group, FVC and FEV1 were better (Fig. 3, 4).

Pulmonary complications developed in 33 (34.4%) patients of the control group and in 13 (13.5%) patients of the study group, the difference was statistically significant, p=0.001.

To confirm the effectiveness of the proposed method, the method of one-factor analysis of logistic regression models was used. As factorial factors that may be associated with the risk of pulmonary complications, the analysis was performed for 11 indicators: method of selection of DLT, sex, height, weight, DLMB, № tube, age, ASA, PaO2, PaCO2, FEV1 (Table 3).

One-factor analysis revealed a link between the risk of complications and the indicators method, sex, PaCO2, PaO2. For the study group, the risk of complications is lower (p=0.001), HS=0.30 (95% CI 0.15-0.61) compared with the control group. The risk of complications for men is higher (p=0.048), HS=2.33 (95% CI 1.01-5.37) compared to women. An increase (p<0.001) in the risk of complications with an increase in PaCO2 (p<0.001), HS=1.34 (95% CI 1.21-1.49) with an increase in the indicator by 1 unit, respectively. With increasing PaO2, the risk of complications decreases (p<0.001): HS=0.96 (95% CI 0.94-0.98) - with increasing 1 unit.

This analysis confirms the study of many authors [1, 3, 7, 8, 9, 13, 14] that with better oxygen saturation in the perioperative period the number of postoperative pulmonary complications decreases and, conversely, with increasing levels of PaCO2 in the blood the number of postoperative pulmonary complications increases proportionally.

Thus, a one-way analysis revealed an association (p=0.001) with the risk of pulmonary complications with the DLT method.

Conclusions and prospects for further development

1. Thus, the application of the proposed method in comparison with the traditional method allows to reduce (p=0.001) the number of postoperative pulmonary complications by 2.5 times (from 34.4% to 13.5%).

2. The technique of choosing a bifurcated endobronchial tube may be recommended for use in thoracic anesthesiology.

The use of the technique of determining the diameter of the dual endobronchial tube is a promising way to prevent ventilation disorders during thoracic surgery and reduce the number of postoperative pulmonary complications.

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ПОКАЗНИКИ ОКСИГЕНАЦІЇ ПІСЛЯ ТОРАКАЛЬНИХ ОПЕРАЦІЙ ЗАЛЕЖНО ВІД ВИКОРИСТАНОГО МЕТОДА ПІДБОРУ ДВОПРОСВІТНОЇ ЕНДОБРОНХІАЛЬНОЇ ТРУБКИ

Усенко О. Ю., Сидюк А. В., Сидюк О. Є., Клімас А. С., Савенко Г. Ю., Тесля О. Т.

Анотація. *Легеневі ускладнення складають ключову проблему в післяопераційному періоді у хворих з приводу захворювань органів грудної порожнини. Вони характеризуються як основні чинники тривалішого видужання та лікарняної смертності. Метою роботи стало порівняти показники оксигенації пацієнтів та кількість післяопераційних легеневих ускладнень після торакальних операцій в залежності від використаного метода підбору двопросвітної ендобронхіальної трубки. Дослідження виконано на 192 хворих, із захворюваннями грудної порожнини (стравоходу, легень, середостіння), оперованих в торако-абдомінальному відділі Національного інституту хірургії та трансплантології ім. О.О. Шалімова. Ретроспективна група порівняння - 96 пацієнтів після торакальних операцій, в яких використаний вибір розміру ДЛТ за загальновідомою методикою Slinger "за зростом хворого". Група дослідження - 96 пацієнтів після торакальних операцій, в яких використаний вибір розміру двопросвітної ендобронхіальної трубки за розробленою методикою (за формулою, яка оцінює морфометричні показники зросту, статі та діаметра лівого головного бронха). Для проведення статистичних розрахунків використовували статистичне програмне забезпечення EZR v. 1.54 (графічний інтерфейс користувача для статистичного програмного забезпечення R версії 4.0.3, R Foundation for Statistical Computing, Відень, Австрія). Легеневі ускладнення розвинулись у 33 (34,4%) пацієнтів контрольної групи та у 13 (13,5%) пацієнтів групи дослідження, відмінність статистично значима, p=0,001. При проведенні однофакторного аналізу виявлено зв'язок ризику розвитку ускладнень із показниками метод, стать, PaCO2, PaO2. Для групи дослідження ризик розвитку ускладнень є нижчим (p=0,001), ВШ=0,30 (95% ВІ 0,15-0,61) у порівнянні з групою контролю. Ризик розвитку ускладнень для чоловіків є вищим (p=0,048), ВШ=2,33 (95% ВІ 1,01-5,37) у порівнянні з жінками. Виявлено зростання (p<0,001) ризику розвитку ускладнень із зростанням показника PaCO2 (p<0,001), ВШ=1,34 (95% ВІ 1,21-1,49) при зростанні показника на 1 одиницю, відповідно. При зростанні ж показника PaO2 ризик розвитку ускладнень знижується (p<0,001): ВШ=0,96 (95% ВІ 0,94-0,98) - при зростанні показника на 1 одиницю. Таким чином, застосування пропонованої методики у порівнянні з традиційною методикою дозволяє знизити (p=0,001) кількість післяопераційних легеневих ускладнень ускладнень у 2,5 рази (з 34,4% до 13,5%).*

Ключові слова: *торакальна анестезіологія, однолегенева вентиляція, легеневі ускладнень.*