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Risk Factors for Post - Operative Pneumonia after Bypass - Surgery

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Abstract: ***The objective is to identify risk factors that determine pneumonia development in patients who have undergone cardiac surgery. Prospective study of a single cohort in a postoperative intensive care unit at a tertiary care centre, encompassing all patients undergoing cardiac surgery from March 1, 2017 to December 30, 2020.20postoperative pneumonia cases were enrolled out of 543 patients (3.7%). Significant independent predictors of pneumonia were found COPD and EF. Given the incidence of post discharge pneumonia, efforts also should be directed towards identifying high risk patients and developing and evaluating transitional programs to address this issue.***

Keywords: cardiac surgery, pneumonia, chronic obstructive pulmonary disease

1. Introduction

Postoperative pneumonia (POP) is one most common complication of these and it is defined as hospital - acquired pneumonia or ventilator - associated pneumonia in post - surgical patients (1, 2). Currently, postoperative pneumonia has the highest incidence of hospital - acquired pneumonia in the world, accounting for approximately 50% of all nosocomial pneumonias, with an incidence of 1.5 to 15.8% (3, 4). Postoperative pneumonia can adversely affect the outcomes of surgical patients and may even threaten their lives. Mortality related to postoperative pneumonia among surgical patients has been reported to range from 20 to 50%, and the mortality rate varies by the type of surgery (5).

Postoperative pneumonia is the main infectious complication following cardiac surgery and is associated with significant increases in morbidity, mortality and health care costs (6). The aim of this study was to identify potential risk factors related to the occurrence of postoperative pneumonia in adult patients undergoing cardiac surgery and to develop a predictive system.

2. Material and Methods

This is a prospective study conducted at American Hospital No 3 in Tirana, Albania. A total of 543 patients who underwent selected and isolated OPCAB from March 1, 2017 to December 30, 2020 were selected for this study. The excluded criteria, included history of AF, non - sinus rhythm, congenital heart disease, concomitant surgery, valvular heart disease, cardiac pacemaker implantation. Patients were divided into AF group and non - AF group according to whether they had new - onset AF after OPCAB. AF was denied as any episode of AF noted by continuous ECG/telemetry monitoring, or documented by a physician in the chart, lasting for 30 s or more. The present study includes multiple pre, intra, and post OPCAB variables. The laboratory and ultrasound data are the values of the check before surgery. Perioperative medicine history and in - hospital complications were recorded carefully. Inour study, two researchers collected clinical data, and the data between them had a high consistency. All patients were admitted into ICU after surgery and underwent continuous hardwire monitoring of blood pressure, pulse, electrocardiogram. After the patient leaved the ICU, continuous telemetry monitoring ofblood pressure, pulse, electrocardiogram would be performed until discharge. Patients were checked for blood tests, liver and kidney function immediately and daily after surgery. If the patient did not have any contraindications, nitroglycerin, β - blocker, and antiplatelet drugs were routinely given after the operation. No other prophylactic therapies were taken to prevent postoperative arrhythmia. Other drugs were given according to the patient's condition. If ECG monitoring showed that AF occurred, a 12 - lead ECG and blood gas examination would be performed at the same time. And the patient would be given oral or intravenous amiodarone. All patients were converted into sinus rhythm before discharging. No patients required electrical cardio-version.

Statistical analysis

SPSS 25.0 software was uses for data analysis. Kolmogorov - Smirnov test was used to test the normality of distribution of continuous variables. Means and standard deviations were reported. Student's *t* test was used to compare the means of continuous variables. Chi square test was used to compare the proportion of categorical variables. Multivariate logistic regression was used to determine the independent risk factors of pneumonia. A p value ≤ 0.05 was considered statistically significant.

3. Results and Discussion

Eighty - nine (16.4%) were females and 454 (83.6%) males. Table 1 shows the comparison of the mean values of variables of patients with and without pneumonia. In univariate analysis patients with pneumonia had a higher mean of LA (p=0.04), of euro - score (p=0.04) and extubating time (p=0.05) and a lower mean level of EF (p=0.01), No significant differences were found regarding other continuous variables. Association of categorical variables with pneumonia is shown in table 2. The frequency of pneumonia was significantly higher among patients with

IR (53.9%) (p=0.03), clearance <50 (p<0.01), COPD (p<0.001) and HTP (p<0.01). No significant difference was found for other categorical variables. A multivariate regression model that controls for all possible confounders was used including all significant variables from the univariate analysis (table 3). Significant independent predictors of pneumonia were found COPD and EF. Patients with COPD are more likely to have pneumonia compared to patients without COPD, whereas the increase of EF values is a protective factor for pneumonia.

Postoperative pneumonia has been well recognized as an important cause of morbidity, mortality and increased health care costs (7), which was reaffirmed by the results of this study. The observed incidence of pneumonia in this study was 9.96%, which falls within the previously reported range (8). Gram - negative bacteria predominated in the development of postoperative pneumonia, with *A. baumannii*, *K. pneumoniae* and *P. aeruginosa* being the most common species. Gram - positive organisms such as *S. aureus* and fungi such as *C. albicans* also played important roles, similar to previous findings (9). The overall mortality rate was similar to those reported in other studies (10). However, mortality among patients with pneumonia was much higher than that among patients without pneumonia, which is consistent with published papers (11), emphasizing the need to identify risk factors and high - risk patients.

In this study, significant independent predictors of pneumonia were found COPD and EF. Patients with COPD are more likely to have pneumonia compared to patients without COPD, whereas the increase of EF values is a protective factor for pneumonia.

Several prediction rules for pneumonia after cardiac surgery have been developed in the United States and Europe (12), but no one has been widely recognized so far. More evidence should be provided on risk factors for pneumonia after cardiac surgery, especially in developing countries. As one of the biggest developing countries, it is a pity that there is not yet a high - quality study in this area in China, whose population accounts for about one - fifth of the world's population. This work may contribute significantly as it's the first large - scale study to develop and validate a clinical risk score for postoperative pneumonia after cardiac surgery conducted in China (13).

Independent risk factors for pneumonia after cardiac surgery identified in different studies vary considerably, which may be attributed to differences in the population characteristics and the definition used for clinical diagnosis (14). Several patient characteristics and comorbidities identified as independent risk factors in our analysis have been reported in published literature.

The prediction model may play an important role in risk stratification and identification of high - risk populations. Appropriate preventive measures and specific interventions focusing on high - risk patient subsets may be more efficient. Guidelines for the management of postoperative pneumonia (15, 16) are available, and several measures have been reported to be effective in reducing the occurrence of postoperative pneumonia, such as subglottic secretion drainage (17), oropharyngeal nursing with chlorhexidine (18), respiratory physiotherapy (19), silver - coated endotracheal tubes (20) and selective digestive decontamination (21). Nevertheless, some of these means are laborious, time consuming and expensive, which would certainly lead to a substantial waste of medical staff labor and resources if these techniques are applied to all patients without selection. Instead, adequate prevention and treatment targeting patients in the higher risk category identified by our risk model may be a better clinical strategy. In addition, the score can play a certain guiding role in the communication between doctors and patients, which is an important part of modern medical activities that cannot be underestimated. The most fearful thing for patients and their families is their ignorance of the condition, but a simple and intuitive risk score can help them understand the risk of postoperative pneumonia more easily and reduce their psychological stress.

4. Conclusion

Despite substantial efforts to reduce the incidence of surgery - associated pneumonia, gaps remain in the application of quality improvement strategies. Given the incidence of post discharge pneumonia, efforts also should be directed towards identifying high risk patients and developing and evaluating transitional programs to address this issue.

References

[1] Tamayo E, Alvarez FJ, Martinez - Rafael B, et al. Ventilator - associated pneumonia is an important risk factor for mortality after major cardiac surgery. J Crit Care 2012; 27: 18 - 25.
[2] LaPar DJ, Crosby IK, Rich JB, et al. A contemporary cost analysis of postoperative morbidity after coronary artery bypass grafting with and without concomitant aortic valve replacement to improve patient quality and cost - effective care. Ann ThoracSurg2013; 96: 1621 - 7.
[3] Greco G, Shi W, Michler RE, et al. Costs associated with health care - associated infections in cardiac surgery. J Am Coll Cardiol2015; 65: 15 - 23.
[4] Kollef MH. Ventilator - associated pneumonia. A multivariate analysis. JAMA 1993; 270: 1965 - 70.
[5] Kinlin LM, Kirchner C, Zhang H, et al. Derivation and validation of a clinical prediction rule for nosocomial pneumonia after coronary artery bypass graft surgery. Clin Infect Dis 2010; 50: 493 - 501.
[6] Klompas M. Complications of mechanical ventilation - - the CDC's new surveillance paradigm. N Engl J Med 2013; 368: 1472 - 5.
[7] El Solh AA, Bhora M, Pineda L, et al. Nosocomial pneumonia in elderly patients following cardiac surgery. Respir Med 2006; 100: 729 - 36.
[8] Hortal J, Giannella M, Perez MJ, et al. Incidence and risk factors for ventilator - associated pneumonia after major heart surgery. Intensive Care Med 2009; 35: 1518 - 25.
[9] Bonell A, Azarrafiy R, Huong V, et al. A Systematic Review and Meta - analysis of Ventilator - associated Pneumonia in Adults in Asia: An Analysis of National

Income Level on Incidence and Etiology. Clin Infect Dis 2019; 68: 511 - 8.
[10] Lola I, Levidiotou S, Petrou A, et al. Are there independent predisposing factors for postoperative infections following open heart surgery? J CardiothoracSurg2011; 6: 151.
[11] Xiao P, Song W, Han Z. Characteristics of pulmonary infection after mitral valve repair in patients with metabolic syndrome and its relationship with blood pressure, blood glucose and blood lipid. Exp Ther Med 2018; 16: 5003 - 8.
[12] He S, Chen B, Li W, et al. Ventilator - associated pneumonia after cardiac surgery: a meta - analysis and systematic review. J Thorac Cardiovasc Surg2014; 148: 3148 - 55. e1.
[13] Leal - Noval SR, Marquez - Vacaro JA, Garcia - Curiel A, et al. Nosocomial pneumonia in patients undergoing heart surgery. Crit Care Med 2000; 28: 935 - 40.
[14] Kalil AC, Metersky ML, Klompas M, et al. Management of Adults With Hospital - acquired and Ventilator - associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. Clin Infect Dis 2016; 63: e61 - e111.
[15] Anonymous. Guidelines for the management, of adults with hospital - acquired, ventilator - associated, and healthcare - associated pneumonia. Am J Respir Crit Care Med 2005; 171: 388 - 416.
[16] Torres A, Niederman MS, Chastre J, et al. International ERS/ESICM/ESCMID/ALAT guidelines for the management of hospital - acquired pneumonia and ventilator - associated pneumonia: Guidelines for the management of hospital - acquired pneumonia (HAP) /ventilator - associated pneumonia (VAP) of the European Respiratory Society (ERS), European Society of Intensive Care Medicine (ESICM), European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and AsociacionLatinoamericana del Torax (ALAT). Eur Respir J 2017; 50: 1700582
[17] Fitch ZW, Whitman GJ. Incidence, risk, and prevention of ventilator - associated pneumonia in adult cardiac surgical patients: a systematic review. J Card Surg2014; 29: 196 - 203.
[18] Duchnowski P, Hryniewiecki T, Kusmierczyk M, et al. Performance of the EuroSCORE II and the Society of Thoracic Surgeons score in patients undergoing aortic valve replacement for aortic stenosis. J Thorac Dis 2019; 11: 2076 - 81.
[19] He S, Wu F, Wu X, et al. Ventilator - associated events after cardiac surgery: evidence from 1, 709 patients. J Thorac Dis 2018; 10: 776 - 83.
[20] Kilic A, Ohkuma R, Grimm JC, et al. A novel score to estimate the risk of pneumonia after cardiac surgery. J Thorac Cardiovasc Surg2016; 151: 1415 - 20.
[21] Strobel RJ, Liang Q, Zhang M, et al. A Preoperative Risk Model for Postoperative Pneumonia After Coronary Artery Bypass Grafting. Ann ThoracSurg2016; 102: 1213 - 9.

Table 1: Comparison of the mean values of variables of patients with and without pneumonia

Variables	Pneumonia No		Pneumonia Yes		P
	Mean	SD	Mean	SD	
Mosha	60.5	8.0	60.8	6.7	0.8
LDL	122.8	32.8	132.1	38.3	0.3
HBA1c	6.7	1.3	7.1	1.3	0.2
Hgb	14.2	1.0	13.7	1.3	0.1
LA	35.6	3.1	37.2	3.2	**0.04**
EF	49.8	7.2	44.9	7.7	**0.01**
Euro - score	3.5	4.5	6.4	6.0	**0.04**
Clamping time	76.1	27.0	83.5	37.3	0.4
Time of ECC	105.6	32.7	114.0	46.8	0.4
Extubating time	10.5	2.3	11.7	2.5	**0.05**

Table 2: Association of categorical variables with pneumonia

Variables	Pneumonia No (n=523)		Pneumonia Yes (n=20)		P
	N	%	N	%	
Gender					
Female	87	16.6	2	10.0	0.4
Males	436	83.4	18	90.0	
Hypertension	318	60.8	15	75.0	0.2
Smoker	282	53.9	13	65.0	0.3
DM	298	57.0	13	65.0	0.5
Renal failure	127	24.3	9	45.0	**0.03**
Clearence<50	8	1.5	2	10	**<0.01**
Clearence 50 - 85	119	22.8	7	35.0	0.2
Clearence>85	397	75.9	11	55.0	**0.03**
BMI>31	65	12.4	2	10.0	0.7
BMI 25 - 30	441	84.317	17	85.3	0.9
BMI < 25	11	2.1	1	5.0	0.4
COPD	97	18.5	13	65.0	**<0.001**
Arteriopathy	298	57.0	11	55.0	0.8
Post MI preoperative	410	78.4	18	90.0	0.2
HTP	253	48.4	16	80.0	**<0.01**
Complete revascularization	469	89.7	19	95.0	0.4
Partial revascularization	46	8.8	1	5.0	0.5
Post operative MI	44	8.4	0		0.2

Table 3: Risk factors for Pneumonia. Multivariate logistic regression

Variable	Odds ratio	95% CI	P
EF	0.9123	0.8502 to 0.9788	**0.01**
COPD	7.4626	2.8742 to 19.3759	**<0.0001**