Journal of Statistics on Health Decision

EXTENDED ABSTRACT

A17 Predictors of residual pulmonary vascular obstruction in pulmonary embolism patients - cohort study

Vanusa Rocha[1], Vera Afreixo[2], Nuno Leal[3], Tiago Gregório[4]

[1]Faculty of Science and Technology - University of Cape Verde, Cape Verde
[2]CIDMA - Center for Research & Development in Mathematics and Applications, University of Aveiro, Portugal
[3]Internal Medicine Service, Hospital Center of Vila Nova de Gaia and Espinho/EPE, Portugal
[4]Internal Medicine Service, Hospital Center of Vila Nova de Gaia and Espinho/EPE; MEDCIDS; Faculty of Medicine, University of Porto, Portugal

Introduction:

Pulmonary embolism (PE) is a major public health problem. After stroke and coronary artery disease, it is the 3rd cause of cardiovascular mortality. Annual incidences of pulmonary embolism and its related entity deep vein thrombosis are estimated to be 0.5 to 1.0 per 1000 inhabitants but these numbers are probably higher, since PE can be asymptomatic or found only in autopsy [1].

Standard treatment for pulmonary embolism consists of anticoagulant therapy for a minimum of 3-6 months but residual pulmonary vascular obstruction can be found in a significant proportion of patients [2,3].

This persistence of vascular obstruction is relevant as it is associated with a higher risk of recurrence and development of chronic pulmonary hypertension.

The aim of this study was to identify predictors of residual pulmonary vascular obstruction in pulmonary embolism patients after anticoagulant therapy.

Methods:

Patients were eligible if they were adult patients with an image confirmed (CT or Ventilation Perfusion Scan) diagnosis of pulmonary embolism that underwent anticoagulant therapy for a minimum of 3-6 months and had a repeat image at the end of this period.

The outcome of interest was the presence of residual pulmonary vascular obstruction in the second exam. Potential predictors included age, gender, previous thromboembolism, neoplasm, surgery in 6 months, trauma, immobilization, plane travel, hormone therapy/ACO, smoking, overweight, pulmonary infarction, hypotension, PESI score, enlarged right ventricle, elevated cardiac markers (BNP and/or troponin), thrombolysis/thrombectomy and coumarin anticoagulation.

A descriptive analysis was performed using absolute and relative frequencies for qualitative variables, median and interquartile range for quantitative variables. Patients with and without residual pulmonary vascular obstruction were compared using the chi-square test for qualitative variables and the Mann-Whiney test for quantitative variables. The normality of quantitative variables was available by the Shapiro-Wilk test. To determine which of the individual risk factors might have predictive value with regard to the occurrence of residual pulmonary vascular obstruction, the multivariable regression model used was logistic regression by the stepwise automatic selection method based on the AIC. The variables used for automatic selection were selected through univariate analysis using the choice criterion [4]. Performance of multivariable model displayed as area under the receiver operating curve (AUC) and corresponding 95 % confidence interval.

Residual analysis and the diagnosis of influential cases was performed through the graphical analysis. All analyses were performed with R software (version 4.0.3). Statistical hypothesis tests with P value less than .05 were considered significant.

Results:

Overall, 148 patients were included in the analysis, with residual vascular obstruction present in 57. On univariate analysis, patients with residual vascular pulmonary obstruction had a higher rate of pulmonary infarction, right heart dysfunction and elevated cardiac markers. The stepwise multivariate analysis is summarized in Table 1 and identified previous pulmonary embolism, immobilization, pulmonary infarction, and elevated cardiac markers as independent predictors.

Discrimination performance of the model was moderate (AUC =0.74; 95% CI: 0.65-0.82).

Keywords:
Pulmonary embolism, residual pulmonary vascular obstruction, modelling

Corresponding author:
Vanusa Rocha
vanusa.rocha@docente.unicv.edu.cv

Conflict of interest:
The authors declare no conflict of interests

First published: 22JUN2021

Table 1- Multivariable predictors of chronic pulmonary embolism in patients

Characteristics	Odds ratio	95% CI	*p value*
Previous thromboembolism	3.980	1.086 – 16.81	0.0433
Immobilization	0.413	0.167 – 0.964	0.0464
Pulmonary infarction	2.587	1.171 – 5.825	0.0197
Elevated cardiac markers (BNP and/or troponin)	3.674	1.619 – 8.886	0.0026

CI: confidence interval; BNP: B type natriuretic peptide

Discussion:

Chronic pulmonary vascular obstruction is a frequent finding after 3-6 months of anticoagulation for pulmonary embolism. In our sample, it was present in 38.5% of patients. Multivariate analysis demonstrated elevated cardiac markers, pulmonary infarction, previous venous thromboembolism and immobilization as independent predictors. These risk factors potentially identify patients that might benefit of more intensive therapy and/or follow-up, in order to prevent pulmonary embolism recurrence and pulmonary hypertension as complications. However, it should be noted that: (i) AUC for the model only showed modest performance, suggesting that other factors not included in the analysis might have an important role in the development of the outcome and (ii) after performing sensitivity analysis excluding outlier's immobilization was no longer an independent predictor, suggesting that the association between this predictor and the outcome is, at best, not as consistent as with other predictors.

References:

1. Bělohlávek J, Dytrych V, Linhart A. Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism. Exp Clin Cardiol. 2013;18(2):129-38.
2. Pesavento R, Filippi L, Palla A, et al. Impact of residual pulmonary obstruction on the long-term outcome of patients with pulmonary embolism. Eur Respir J 2017;49:1601980. https://doi.org/10.1183/13993003.01980-2016
3. Bonnefoy PB, Margelidon-Cozzolino V, Catella-Chatron J, Ayoub E, Guichard J.B, Murgier M, Bertoletti L. What's next after the clot? Residual pulmonary vascular obstruction after pulmonary embolism: From imaging finding to clinical consequences. Thromb Res 2019;184. https://doi.org/10.1016/j.thromres.2019.09.038
4. Hosmer DW, Lemeshow S. Applied Logistic Regression 2nd- ed. Wiley Inc, 2000, New York. https://doi.org/10.1002/0471722146