OXYGEN SATURATION OR RESPIRATORY RATE TO IMPROVE RISK STRATIFICATION IN HEMODYNAMICALLY STABLE PATIENTS WITH ACUTE PULMONARY EMBOLISM

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Background

- In patients with acute pulmonary embolism (PE), risk stratification for short-term death is recommended to drive clinical management.
- A risk stratification strategy combining simplified PESI score, echocardiography and troponin was proposed by the European Society of Cardiology (ESC) in 2014.
- The identification of hemodynamically stable patients at increased risk for death by this strategy needs improvement.

Aim of the study

- To assess whether further stratification by serial cut-off values of oxygen saturation or respiratory rate improves the accuracy of the ESC risk stratification strategy in hemodynamically stable PE patients.

Methods

- Prospective cohorts of hemodynamically stable patients with PE were merged in a collaborative database.
- The accuracy of risk stratification for 30-day mortality by the original and a modified 2014 ESC strategy were assessed.

Results

- Overall, 255 patients (27%) were categorized as low, 510 (54%) as intermediate-low and 181 (19%) as intermediate-high risk according to the original 2014 ESC strategy.
- 30-day mortality was 1.2% in low, 10% in intermediate-low and 11% in intermediate-high risk patients.
- By adding oxygen saturation in air <88%, the discriminatory power of the 2014 ESC model improved for 30-day mortality (c-statistics 0.71; 95% CI 0.65 - 0.77 vs. 0.63, 95% CI 0.56- 0.69) and for PE-related death (c statistics 0.75; 95% CI 0.69 - 0.81 vs. 0.63, 95% CI 0.56- 0.69).

Mortality in intermediate risk patients according to oxygen saturation-based or respiratory rate-based re-classification

ESC risk class	**Death at 30 days** n/N (%; 95% CI)		**PE-related Death** n/N (%; 95% CI)	
	Oxygen saturation		Oxygen saturation	
	≥88%	<88%	≥88%	<88%
Intermediate low	33/413 (8.0; 5.4-10.6)	18/97 (18.5; 10.7-26.2)	20/413 (4.8; 2.7-6.8)	16/97 (16.7; 9.3-24.1)
Intermediate high	7/121 (5.8; 1.7-9.9)	13/60 (21.7; 11.3-32.1)	3/121 (2.5; 0-5.3)	11/60 (18.3; 8.5-28.0)
	Death at 30 days n/N (%; 95% CI)		**PE-related Death** n/N (%; 95% CI)	
	Respiratory rate*		Respiratory rate*	
	<30 bpm	≥30 bpm	<30 bpm	≥30 bpm
Intermediate low	23/214 (10.7; 6.5-14.8)	6/28 (21.4; 6.2-36.5)	17/214 (7.9; 4.3-11.5)	6/28 (21.4; 6.2-36.5)
Intermediate high	2/47 (4.2; 0-9.9)	8/26 (30.8; 12.1-49.4)	0/47 (0)	7/26 (26.9; 9.8-43.9)

Net Reclassification Improvement (NRI) in patients with acute PE at intermediate risk of death according to the 2014 ESC model by adding Oxygen saturation lower than 88% or respiratory rate ≥30 breaths per minute to the model

	Death at 30 days				PE-related death		
	2014 ESC model	2014 ESC strategy + oxygen saturation <88%	2014 ESC strategy + respiratory rate ≥30 bpm		2014 ESC model	2014 ESC strategy + oxygen saturation <88%	2014 ESC strategy + respiratory rate ≥30 bpm
Sensitivity	28.1	46	41		28	54	43
Specificity	74	66	69		73.9	66	69
NRI events	--	0.15	0.10		--	0.26	0.20
NRI non events	--	0.06	0.08		--	0.06	0.09
Overall NRI	--	0.21	0.18		--	0.32	0.29

Conclusions

- This study shows that oxygen saturation in air <88% or respiratory rate of ≥30 breath per minute improves the accuracy of the 2014-ESC risk stratification strategy in identifying hemodynamically stable patients with acute PE at increased risk for death or PE-related death at 30 days.
- The relevance of these findings is mainly related to the ease of evaluation and prompt availability of the evaluated predictors.
- After validation in different study populations, management studies are required to assess whether oxygen saturation may have a role in driving the care of intermediate risk PE patients.