Artificial intelligence-based analysis differentiates PAH from PH using non-contrast chest CT scans

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RATIONALE

Pulmonary arterial hypertension (PAH) should be distinguished from pulmonary hypertension (PH). Despite clear clinical recommendations, classifying patients as PAH or PH remains a challenge. In this study, we evaluated CT scans of patients with proven P(A)H using an artificial intelligence (AI) based pulmonary vascular phenotyping algorithm to differentiate patients with PAH from patients with PH (groups 2 & 3).

Aim: To discriminate PAH and PH using AI-based pulmonary vascular quantification

METHODS

The dataset consisted of patients from a retrospective single-center cohort collected at the University Hospital of Liege (Belgium). The AI-based vascular quantification platform LungQ (Thirona, Nijmegen, the Netherlands) was used to perform a deep characterization of pulmonary arterial and veinous phenotypes on all CTs. The focus of this analysis is the quantification of pulmonary arterial volume of arteries >2mm in diameter, with a precise dimension quantification of each vascular branch using two normalization approaches for inter-patient comparison (by height and by total pulmonary vascular volume).

RESULTS

	PAH (n=9)	PH (n=12)		
Demography :				
Male/Female	6 / 3	7 / 5		
Mean age (years)	70	63		
Hemodynamics :		**Gr 2 (n=4)**	**Gr 3 (n=8)**	
mPAP (mmHg, mean ± SD)	39 (± 10)	37,7 (± 9,1)	27,7 (± 5,3)	
PVR (WU, mean ± SD)	7,23 (± 4,1)	2,49 (± 1,5)	4,40 (± 1,8)	
Imaging markers :				
Arterial vol. % norm. by total vascular vol. (mean ± SD)	46,54 (± 7,4)	39, 3(± 6,7)		*(p < 0,01)*
Arterial vol. % norm. by height (mean ± SD)	435,29 (± 235,1)	269,6 (± 184)		*(p < 0,05)*

CONCLUSION

AI-based vascular quantification analysis was able to identify patients with PAH based on non-contrast enhanced CT scans in a cohort of patients with proven P(A)H. PAH patients had a significantly higher volume in the large (> 2 mm) pulmonary arteries as compared to patients with PH.

PAH

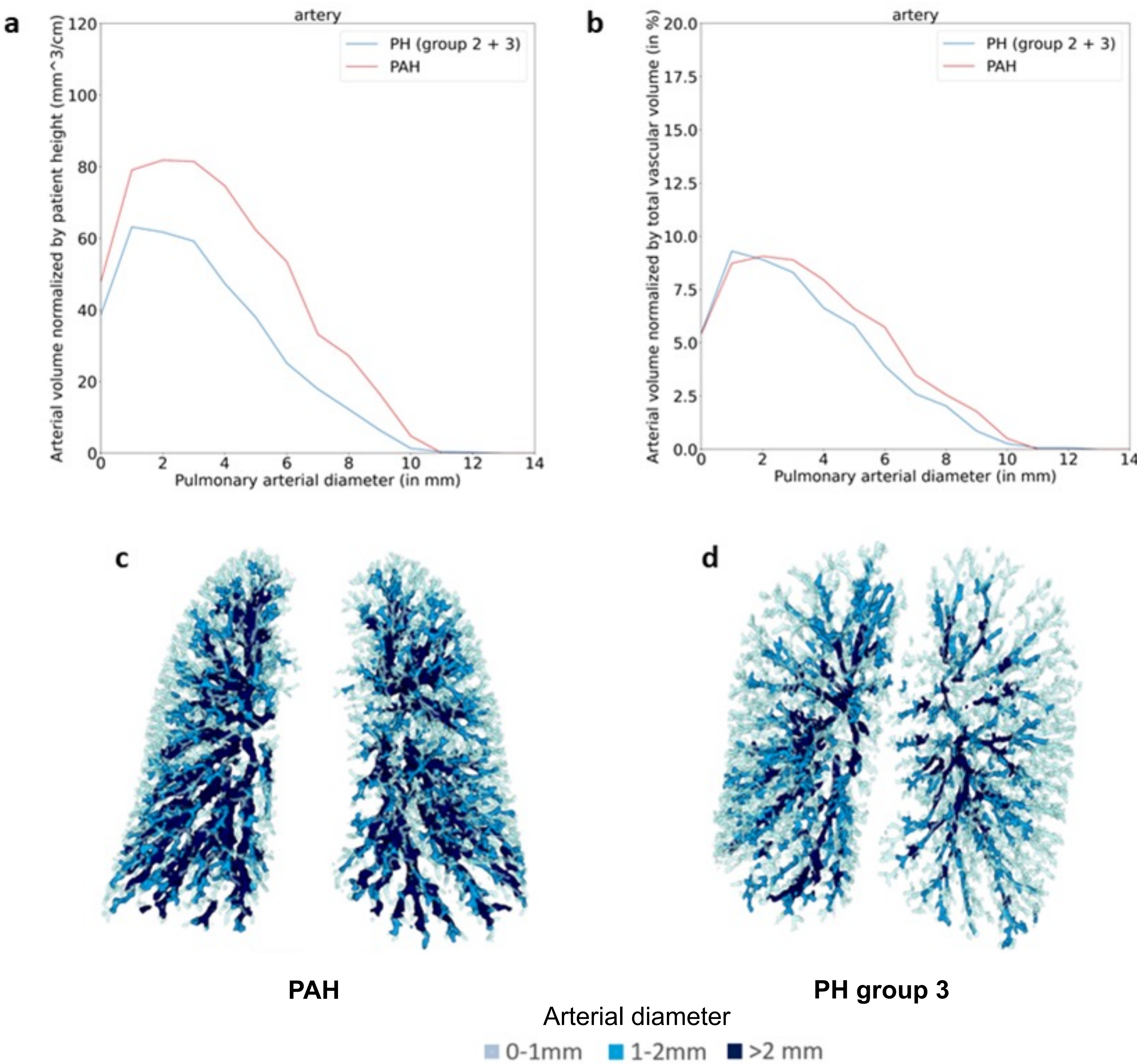PH group 3

Arterial diameter
■ 0-1mm ■ 1-2mm ■ >2 mm

*Fig 1. Results of the AI-based vascular quantification platform LungQ (Thirona, Nijmegen, the Netherlands). **a.** and **b.** show the average arterial volume distribution in relation to the arterial diameter for both the PAH group (in red) and the PH group (in blue). **a.** shows the arterial volume normalized by the patient height, whereas **b.** the arterial volume normalized by the total pulmonary vascular volume. **c.** and **d.** two visual example of the pulmonary arteries from a patient with PAH (**c.**) and a patient with PH group 3 (**d.**). The focus of this analysis was on arteries with a diameter >2mm.*