A step towards early detection of Pulmonary Hypertension on non-contrast chest CT scans using artificial intelligence

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RATIONALE

Currently the diagnosis of pulmonary hypertension is based on a measurement of pulmonary pressures by right heart catheterization. The identification of new tools in PH is currently needed to help clinicians in diagnosis and follow-up of these patients. In this study, we compared HRCT scans evaluation using artificial intelligence based vascular quantification with invasive hemodynamic assessment.

Aim : To assess feasibility of applying AI-based pulmonary vascular quantification in pulmonary hypertension

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 HRCTs. The analysis identified all pulmonary arteries and veins followed by a precise dimension quantification of each vascular branch. The focus of this analysis was to correlate large pulmonary arteries (>2mm in diameter) to HD values using Pearson correlation analysis.

PATIENTS CHARACTERISTICS

	All patients (n=29)	Without PH (n=8)	PAH (n=9)	PH group 2 (n=4)	PH group 3 (n=8)
Demography :					
Male/Female	18 / 11	5 / 3	6 / 3	3 / 1	4 / 4
Mean age (years)	67	69	70	63	63
Hemodynamics :					
mPAP (mmHg, mean ± SD)	29,2 (± 11,9)	15,4 (± 2,8)	39 (± 10)	37,7 (± 9,1)	27,7 (± 5,3)
PVR (WU, mean ± SD)	4,29 (± 3,3)	1,78 (± 0,8)	7,23 (± 4,1)	2,49 (± 1,5)	4,40 (± 1,8)
Imaging markers :					
Arterial vol. % norm. by total vascular vol. (mean ± SD)	40,94 (± 6,5)	37,05 (± 3,3)	46,54 (± 7,4)	37,97 (± 4,5)	40,03 (± 4,6)
Arterial vol. % norm. by height (mean ± SD)	300,97 (± 177)	196,92 (± 52,9)	435,29 (± 235,1)	321,36 (± 113,7)	243,74 (± 119,5)

RESULTS

Pearson correlation coefficient identified a **significant correlation between large arterial volume percentage normalized by total vascular volume with both mPAP** (r=0.57, p<0.01) **and PVR** (r=0.57, p<0.01) (figure 1). The **normalization approach by height showed a correlation between mPAP and pulmonary arterial volume** (r=0.55, p<0.01) but not with PVR (r=0.30, p=0.11).

CONCLUSION

Large arterial volume quantified using AI-based HRCT analysis was correlated with both mPAP and PVR. These results suggest that AI-based quantification tools could help clinicians in the early detection of P(A)H in patients at risk of suffering from this condition. This non-invasive approach has to be further validated on a larger clinical dataset but may have the potential to help in the diagnosis process.

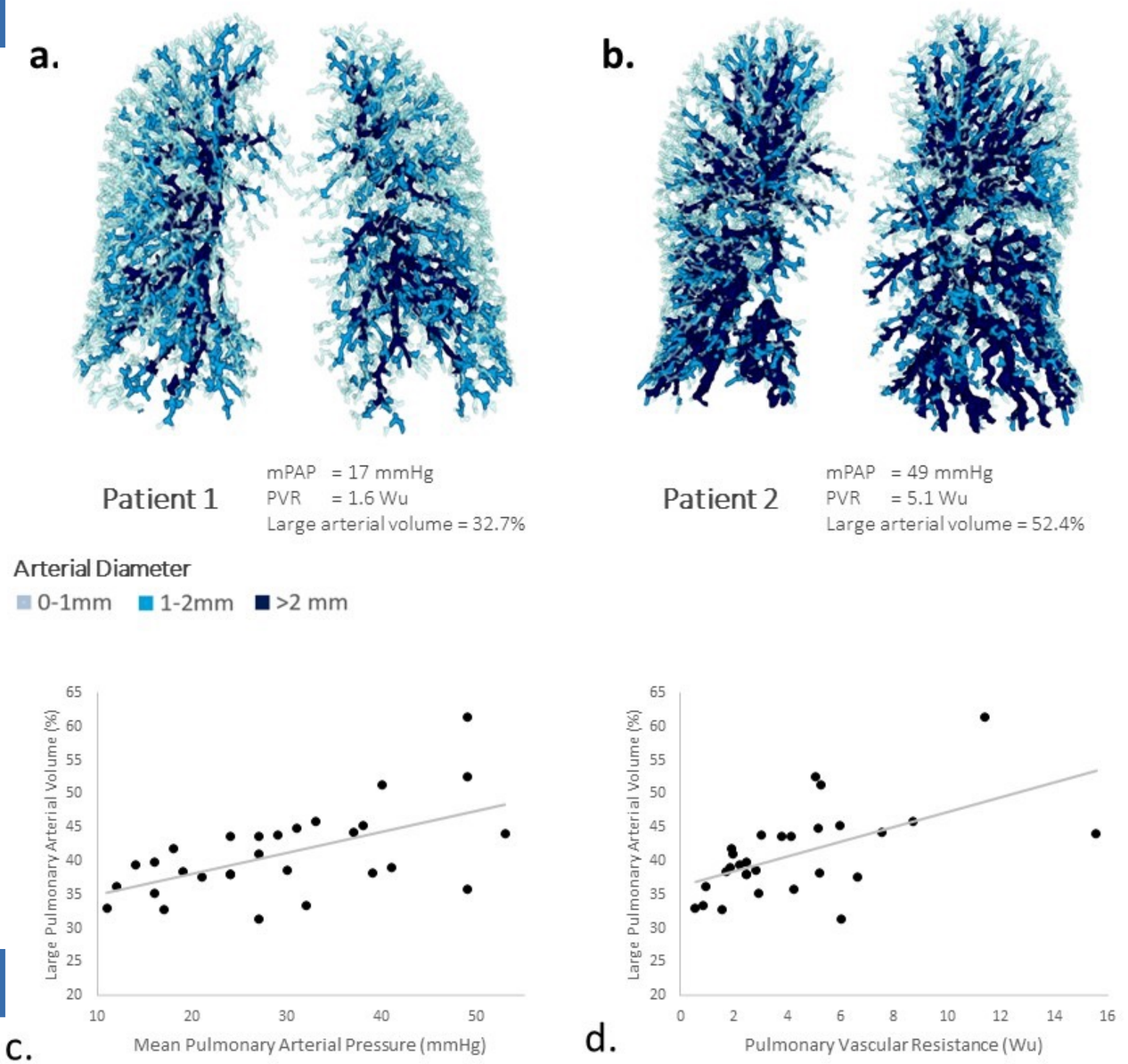

***Fig 1**. Results of the AI-based vascular quantification platform LungQ (Thirona, Nijmegen, the Netherlands). **a.** and **b.** two examples of visualized quantified pulmonary arteries from a patient with low RHC values (**a.**) and a patient with high RHC values (**b.**). The focus of this analysis was on the arteries with a diameter >2mm. **c.** and **d.** Scatter plots of the percentage of vascular volume in the large pulmonary arteries versus the mean pulmonary arterial pressure (**c.**) and the pulmonary vascular resistance (**d.**).*

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