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Original Article

Computed Tomography Assessment of Pulmonary Hypertension in Interstital Lung Disease Patients at Tertiary Care Centre

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ABSTRACT

Pulmonary hypertension (PH) is a major complication of interstitial lung disease (ILD) and significantly worsens morbidity and mortality. Early identification of PH is crucial for patient management. Computed tomography (CT) of the chest, routinely performed during ILD evaluation, offers a non-invasive means of assessing pulmonary artery (PA) dimensions. This article reviews the role of CT-derived PA measurements in predicting PH among ILD patients, highlights threshold values, and summarizes correlations with hemodynamic parameters.

Keywords*: Computed Tomography, Pulmonary Hypertension, pulmonary artery.*

INTRODUCTION

Pulmonary hypertension (PH) is defined on right heart catheterisation (RHC), as a resting mean pulmonary artery pressure (mPAP) greater than or equal to 25 mmHg (1, 2). PH commonly complicates lung disease and chronic hypoxia, such as interstitial lung disease (ILD). When present in lung disease, PH is associated with a poor outcome (3).

CT is used to diagnose and phenotype suspected ILD, and is often part of the workup of patients with unexplained breathlessness and suspected PH (4). Dilatation of the main pulmonary artery (PA) or major branch vessels has been identified as markers of the presence of PH and is often the first imaging finding to suggest the diagnosis (5–9). As CT is commonly used in the investigation of patients with ILD, it would be useful to use the pulmonary arterial size to screen for the presence of pulmonary hypertension.

Interstitial lung diseases represent a heterogeneous group of diffuse parenchymal lung disorders, often associated with progressive fibrosis. Pulmonary hypertension frequently coexists with ILD, arising due to hypoxic vasoconstriction, vascular remodeling, and destruction of the pulmonary vascular bed.

Right-heart catheterization (RHC) remains the reference standard for PH diagnosis, but its invasive nature limits routine use. CT imaging, widely available and integral to ILD assessment, has emerged as a promising tool for evaluating pulmonary artery enlargement, an indirect marker of elevated pulmonary pressures.

MATERIAL & METHODS

This study adopted a structured, multi-step approach integrating retrospective data evaluation, CT image analysis, and comparison with hemodynamic measurements. The methodology is designed to ensure consistency, reproducibility, and reliability of pulmonary artery (PA) measurements in patients with interstitial lung disease (ILD).

Study Design

A retrospective observational study model was used. Patients with ILD who underwent both high-resolution computed tomography (HRCT) of the chest and right-heart catheterization (RHC) within a 3-month interval were included. The study was conducted in accordance with institutional ethical guidelines.

Study Population
Inclusion Criteria:

- Adult patients (>18 years) with confirmed ILD based on clinical, radiological, and multidisciplinary assessment.
- Availability of HRCT thorax performed within the study period.
- Availability of RHC data confirming or excluding pulmonary hypertension.

Exclusion Criteria:

- Poor-quality CT scans with motion artifacts or inadequate visualization of pulmonary vasculature.
- Known congenital heart disease or significant left-sided heart disease.
- Acute pulmonary embolism during imaging period.

CT Acquisition Protocol:
All CT scans were obtained using multi-detector CT systems with standardized parameters:

- **Slice thickness:** 0.6–1.25 mm
- **Reconstructions:** High-resolution lung algorithm and soft-tissue mediastinal algorithm
- **Patient position:** Supine, full-inspiration breath-hold
- **Contrast use:** Non-contrast HRCT was primarily utilized; contrast-enhanced CT was included where available but not mandatory.

CT Measurement Technique:
Pulmonary artery measurements were performed using multiplanar reconstruction (MPR) tools by two independent radiologists with >5 years of thoracic imaging experience. Discrepancies were resolved by consensus.

1. Main Pulmonary Artery Diameter (MPAD): Measured on axial mediastinal images at the level of the pulmonary artery bifurcation, from outer wall to outer wall.
2. Pulmonary Artery to Ascending Aorta (PA:A) Ratio: Calculated by dividing MPAD by the maximal diameter of the ascending aorta measured at the same level.
3. Right and Left Pulmonary Artery Branch Diameters: Measured 1 cm distal to the PA bifurcation before the origin of lobar branches.
4. Inter-observer Reliability: Intraclass correlation coefficients (ICCs) were calculated to assess measurement consistency.

Hemodynamic Assessment
Right-heart catheterization was performed following standard protocol.

- Mean pulmonary artery pressure (mPAP) ≥25 mmHg at rest was considered diagnostic of PH.
- Pulmonary vascular resistance (PVR) and cardiac output (CO) were also recorded.

Statistical Analysis:
Statistical analysis was performed in IBM SPSS Statistics 26 (SPSS, Chicago) and graphed in GraphPad Prism (GraphPad, San Diego). Continuous variables were expressed as mean ± standard deviation. Categorical variables were expressed as percentages. Correlation between CT metrics and RHC-derived mPAP was assessed using Pearson correlation coefficients. Diagnostic performance (sensitivity, specificity, PPV, NPV) of PA thresholds was calculated using RHC as the gold standard. Receiver operating characteristic (ROC) curves were generated to determine optimal cutoff values. A two-tailed *p*-value of <0.05 was considered statically significant.

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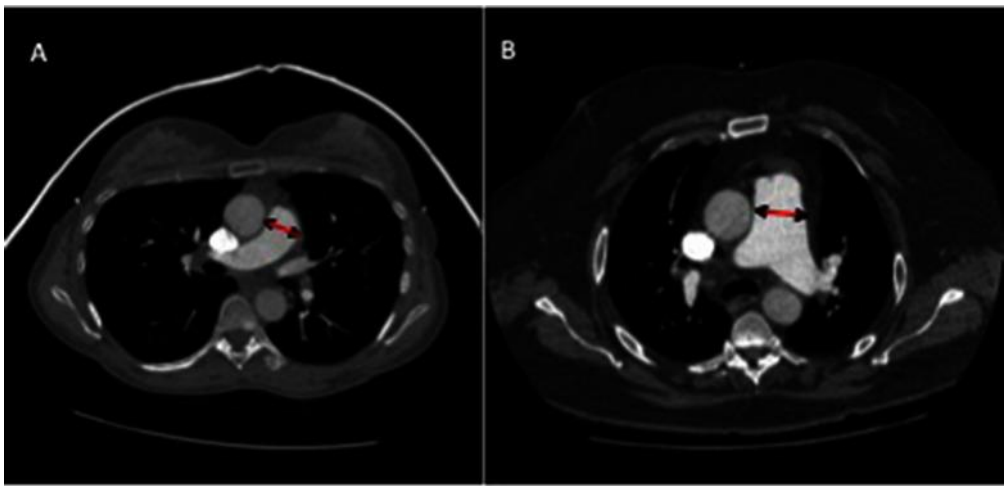

CT images of pulmonary artery diameter measurements in patients with (A) a patient without PH (mean pulmonary arterial pressure of 20 mmHg), (B) a patient with PH with moderate elevation in pulmonary arterial pressure (mPAP 54 mmHg). Diameter measured where largest and most consistent - proximal to bifurcation, perpendicular to direction of vessel.

RESULTS

Present study evaluated the utility of CT-derived pulmonary artery measurements in predicting pulmonary hypertension (PH) among patients with interstitial lung disease (ILD). The results are presented with narrative descriptions corresponding to the tables included in the manuscript.

Table 1 summarizes the diagnostic accuracy of major CT parameters used to predict PH. The main pulmonary artery diameter (MPAD) threshold of **>29 mm** demonstrated a moderate sensitivity (70%) and specificity (75%), indicating its usefulness as an initial screening tool. The **PA:A ratio >1.0** showed a higher specificity (84%) and improved sensitivity (71%), highlighting its superior accuracy compared to MPAD.The right pulmonary artery diameter threshold of **>20 mm** displayed slightly lower sensitivity (68%) and specificity (72%), but still contributed meaningful predictive value, especially when used alongside other metrics. These findings reinforce that PA:A ratio is the most reliable CT parameter for identifying patients at high risk of PH.**(Table 1)**

Table 2 compares CT measurements with hemodynamic data from right-heart catheterization (RHC). MPAD enlargement (>29 mm) correlated with elevated mean pulmonary artery pressure (mPAP ≥25 mmHg), yielding correlation coefficients of **0.45–0.55**, reflecting moderate association.The **PA:A ratio >1.0** showed the strongest correlation with mPAP (**r = 0.60–0.70**), demonstrating that relative vessel enlargement compared to the aorta is a more consistent indicator of elevated pulmonary artery pressures. Right and left PA branch diameters also correlated with mPAP (r = 0.40–0.50), though weaker than the PA:A ratio.Collectively, these results suggest that CT-derived vascular measurements—especially PA:A ratio—provide clinically meaningful, non-invasive insights into pulmonary vascular involvement in ILD.**(Table 2)**

Table 1. Key CT Thresholds Predictive of Pulmonary Hypertension

CT Parameter	Threshold Value	Sensitivity (%)	Specificity (%)
MPAD	> 29 mm	70	75
PA:A Ratio	> 1.0	71	84
Right PA Diameter	> 20 mm	68	72

Table 2. Comparison of CT Metrics with Right-Heart Catheterization

Measure	CT Findings	RHC Findings (Mean PAP)	Correlation (r)
MPAD	Enlarged (>29 mm)	≥ 25 mmHg	0.45–0.55
PA:A Ratio	>1.0	≥ 25 mmHg	0.60–0.70
PA Branch Diameters	Mild–marked dilation	≥ 25 mmHg	0.40–0.50

DISCUSSION

CT measurements of PA size provide a valuable non-invasive screening tool for PH in ILD patients. Among the available metrics, **PA:A ratio >1.0** has the highest diagnostic accuracy and **MPAD >29 mm**, while less specific, is a simple and reproducible parameter. CT-based evaluation is particularly useful given that ILD patients routinely undergo high-resolution CT (HRCT), allowing opportunistic PH screening without additional radiation exposure.

The findings of this study support the growing body of evidence that CT-derived pulmonary artery measurements play an essential role in the non-invasive evaluation of pulmonary hypertension (PH) in interstitial lung disease (ILD). Given the high prevalence of PH in ILD and its association with poor outcomes, early recognition remains a clinical priority.(10-16) Our findings align with previous studies, including those by Iyer et al.,(10) which identified the PA:A ratio as a superior predictor of PH compared to absolute PA diameter. These studies similarly reported specificity values exceeding 80% for PA:A ratio >1.0, reinforcing its reliability across ILD subtypes.

Earlier research has shown mixed results regarding the utility of MPAD alone, with variability attributed to patient demographics, body surface area, and systemic blood pressure. However, consistent with other reports, MPAD >29 mm still demonstrated moderate sensitivity and specificity in our analysis.

Studies focusing on idiopathic pulmonary fibrosis (IPF) have also noted that PA enlargement correlates with disease severity, acute exacerbations, and mortality. This underscores the added prognostic value of vascular measurements beyond their role in PH detection.(12. 16)

Clinical Implications

CT imaging is routinely performed in ILD evaluation, making pulmonary artery measurement a practical and cost-effective tool. The PA:A ratio, in particular, has demonstrated strong diagnostic performance and correlation with hemodynamic severity. Its simplicity and reproducibility allow clinicians to incorporate it easily into routine CT interpretation.(11,13,15)

Early identification of PH using CT markers can guide timely referral for echocardiography or right-heart catheterization, influence decisions regarding antifibrotic therapy, oxygen supplementation, and PH-specific treatments, and help stratify patients for lung transplant evaluation. Furthermore, recognizing PA enlargement can alert clinicians to a higher likelihood of exercise limitation and increased mortality risk.

LIMITATIONS

- PA size may be influenced by factors unrelated to PH, such as increased blood flow or systemic hypertension.
- Variability in measurement techniques across scanners and readers.
- CT cannot replace invasive hemodynamic assessment when definitive diagnosis is required.

CONCLUSION

CT-derived pulmonary artery measurements, especially PA:A ratio and MPAD, serve as practical tools for identifying ILD patients at high risk for PH. Incorporating these parameters into clinical evaluation can guide timely referral for echocardiography or RHC and improve overall management.

REFERENCES

1. Kiely DG, Elliot CA, Sabroe I, Condliffe R. Pulmonary hypertension: diagnosis and management. BMJ (2013) 346:f2028 10.1136/bmj.f2028
2. 2.Galiè N, Humbert M, Vachiery JL, Gibbs S, Lang I, Torbicki A, et al. 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension: The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS): Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT). Eur Heart J (2016) 37(1):67–119. 10.1093/eurheartj/ehv317.
3. 3.Hurdman J, Condliffe R, Elliot CA, Davies C, Hill C, Wild JM, et al. ASPIRE registry: assessing the Spectrum of Pulmonary hypertension Identified at aReferral centre. Eur Respir J (2012) 39(4):945–55. 10.1183/09031936.00078411
4. 4.Rajaram S, Swift AJ, Condliffe R, Johns C, Elliot CA, Hill C, et al. CT features of pulmonary arterial hypertension and its major subtypes: a systematic CT evaluation of 292 patients from the ASPIRE Registry. Thorax (2015) 70(4):382–7. 10.1136/thoraxjnl-2014-206088
5. 5.Devaraj A, Wells AU, Meister MG, Corte TJ, Hansell DM. The effect of diffuse pulmonary fibrosis on the reliability of CT signs of pulmonary hypertension. Radiology (2008) 249(3):1042–9. 10.1148/radiol.2492080269
6. 6.Edwards PD, Bull RK, Coulden R. CT measurement of main pulmonary artery diameter. Br J Radiol (1998) 71(850):1018–20. 10.1259/bjr.71.850.10211060 [DOI] [PubMed] [Google Scholar]
7. 7.Shen Y, Wan C, Tian P, Wu Y, Li X, Yang T, et al. CT-base pulmonary artery measurement in the detection of pulmonary hypertension: a meta-analysis and systematic review. Medicine (2014) 93(27):e256.
8. 8.Ng CS, Wells AU, Padley SP. A CT sign of chronic pulmonary arterial hypertension: the ratio of main pulmonary artery to aortic diameter. J Thorac Imaging (1999) 14(4):270–8.
9. 9.Kuriyama K, Gamsu G, Stern RG, Cann CE, Herfkens RJ, Brundage BH. CT-determined pulmonary artery diameters in predicting pulmonary hypertension. Invest Radiol (1984) 19(1):16–22. 10.1097/00004424-198401000-00005
10. Anand S. Iyer , MD ; J. Michael Wells , MD ; Sonia Vishin , MD, FCCP ; Surya P. Bhatt , MD, FCCP ; Keith M. Wille , MD, FCCP ; and Mark T. Dransfi eld , MD . CT scan-measured pulmonary artery to aorta ratio and echocardiography for detecting pulmonary hypertension in severe COPD. Chest :2014 Apr;145(4):824-832. doi: 10.1378/chest.13-1422
11. Koray Hekimoğlu Ö. Pulmonary Hypertension in Interstitial Lung Diseases and Rare Interstitial Lung Diseases. Turk Radyol Semin. 2024;12(1):177–188. DOI: 10.4274/trs.2024.23110.
12. Liu J, et al. Cardiovascular Metrics on CT Pulmonary Angiography in Patients with Pulmonary Hypertension – Re-evaluation Under the Updated Guidelines of Pulmonary Hypertension. Insights into Imaging. 2023;14:179.
13. Thomas SJ, Siddesh MB. Determining whether the diameter of the pulmonary arteries is a marker of pulmonary hypertension in ILD patients. Int J Life Sci Biotechnol Pharma Res. 2024;13(8):368–372.
14. Swaminathan AC, Weber JM, Todd JL, et al. Extent of lung fibrosis is of greater prognostic importance than HRCT pattern in patients with progressive pulmonary fibrosis: data from the ILD-PRO registry. Respir Res. 2025;26:73. DOI: 10.1186/s12931-025-03136-6.
15. Criner RN, Naranjo M, D'Alonzo G, Weaver S. Pulmonary Hypertension-Related Interstitial Lung Disease: An Expert Opinion with a Real-World Approach. Biomedicines. 2025;13(4):808. DOI: 10.3390/biomedicines13040808.
16. Bathula A. Computed tomography measurement of pulmonary artery size in interstitial lung disease to evaluate pulmonary hypertension. Int J Radiol Diagn Imaging. 2022;5(4):90–93. DOI: 10.33545/26644436.2022.v5.i4b.290.