ERS CONGRESS | 2026
5-9 September | Barcelona, Spain

High respiratory microplastic burden across paired airway and tissue samples in patients with lung cancer

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Background: Inhalation is an increasingly recognised route of human exposure to airborne microplastics, yet data from paired airway and tissue respiratory compartments remain scarce.

Objective: To quantify microplastic burden and characterise particle features in paired bronchoalveolar lavage (BAL) and lung tissue samples, and to explore associations with clinical diagnosis and selected haematological parameters.

Methods: In this prospective observational study, 50 adults undergoing diagnostic bronchoscopy provided paired BAL and lung tissue samples. Microplastics were isolated under strict contamination control and characterised by stereo-microscopy; 40% underwent micro-Raman spectroscopy.

Results: Across 100 paired samples, 186 microplastics were identified, predominantly fragments (88.2%). Total microplastic burden was higher in patients with lung malignancy than in non-malignant participants ($p=0.025$). Total microplastic counts correlated strongly with BAL counts ($\rho=0.66$, $p<0.001$) but not with tissue counts ($\rho=-0.18$, $p=0.203$), indicating compartmental discordance. In the malignancy subgroup, BAL and tissue microplastic counts demonstrated a significant inverse correlation ($\rho\approx-0.60$, $p=0.001$). Raman-characterised particles showed a non-random distribution by diagnosis, with fluorescence-only particles enriched in epithelial malignancies (χ^2 $p=0.023$).

Conclusion: Paired airway and tissue sampling reveals heterogeneous, compartment-specific distribution of respiratory microplastics, with higher burden in cancer.

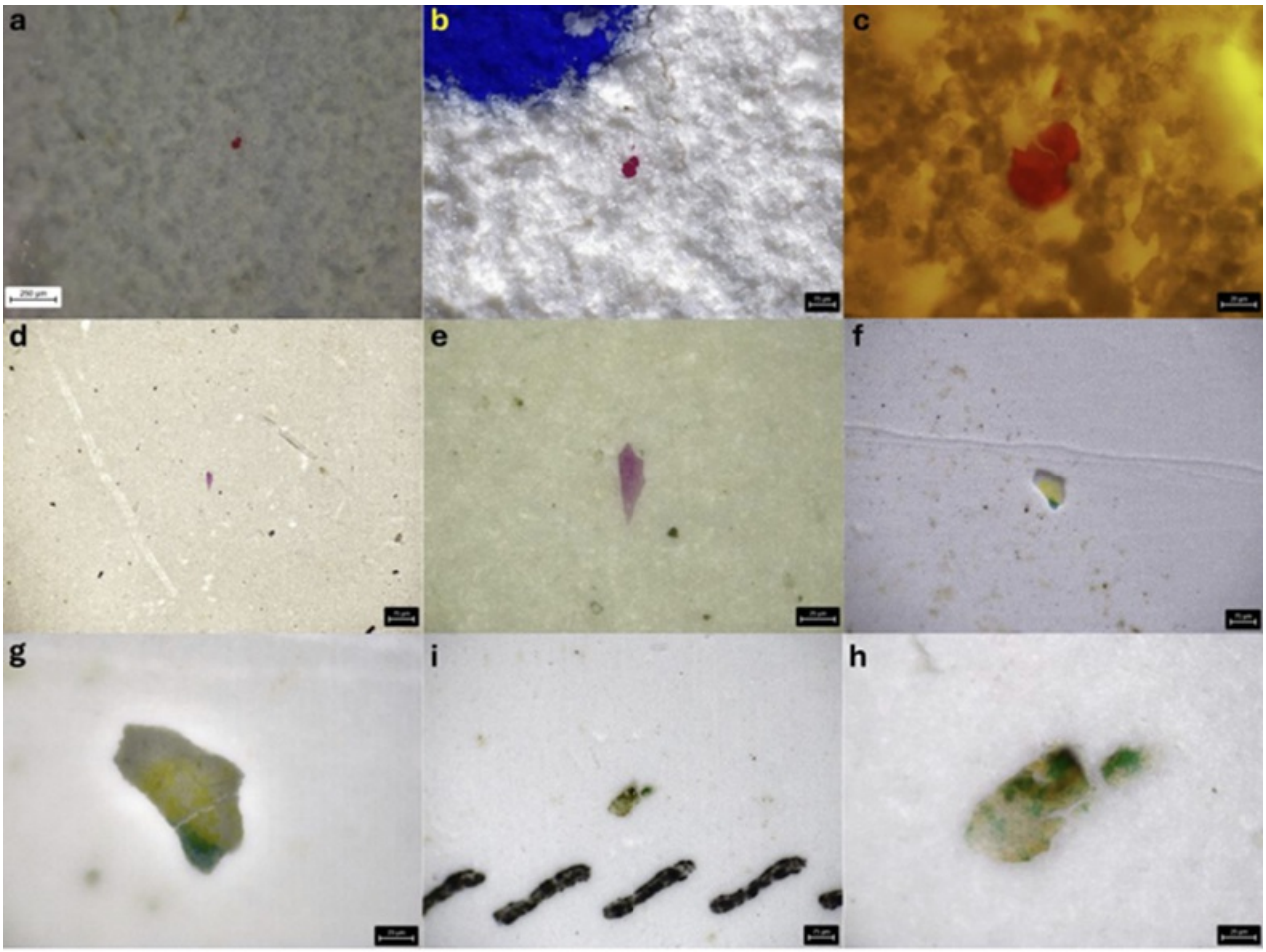

Figure: (a-c) Red particle observed at ×55, ×100, and ×400 magnification in a BAL. (d-e) Red particle observed at ×55 and ×100 magnification in a biopsy sample. (f-g) White particle with blue margins observed at ×100 and ×400 magnification in a biopsy sample. (h-i) White particle with blue inclusions observed at ×100 and ×400 magnification in a biopsy sample.