Higher Respiratory Microplastic Burden in Patients with Lung Malignancy

Ilias E. Dimeas [a,b], George E. Zakynthinos [c], Christos Salmas [d], Athanasios Pagonis [b], Konstantinos Tourlakopoulos [b], Achilleas Sarris [d], Eleni Karetsi [b], Charalampos Varsamas [b], Maria Giannaki [d], Ioannis Diamantis [e], Paraskevi Kirgou [b], Sotirios I. Sinis [b], Stavros P. Anastopoulos [b,f], Cormac McCarthy [a,g], Patrick D. Mitchell [h,i], Michael P. Keane [a,g], Maria Perraki [j], Evangelos Oikonomou [d], Ioannis D. Papanikolaou [e], Zoe Daniil [b]

a. School of Medicine, University College Dublin, Ireland; b. Department of Respiratory Medicine, University Hospital of Larissa, Faculty of Medicine, University of Thessaly, Greece; c. 3rd Department of Cardiology, "Sotiria" Chest Diseases Hospital, Medical School, National and Kapodistrian University of Athens, Greece; d. Laboratory of Mineralogy-Geology, Department of Natural Resources and Agricultural Engineering, Agricultural University of Athens, Greece; e. Department of Cardiothoracic Surgery, University Hospital of Larissa, Greece; f. Department of Geology and Geoenvironment, National and Kapodistrian University of Athens, Greece; g. Department of Respiratory Medicine, St. Vincent's University Hospital, Dublin, Ireland; h. Respiratory Department, Tallaght University Hospital, Dublin, Ireland; i. School of Medicine, Trinity College Dublin, Ireland; j. School of Mining and Metallurgical Engineering, Division of Geo-Sciences, National Technical University of Athens, Greece

Introduction

- Microplastics are emerging airborne environmental pollutants detected in human BAL and lung tissue
- Their distribution across respiratory compartments and their relationship with lung malignancy remain poorly understood

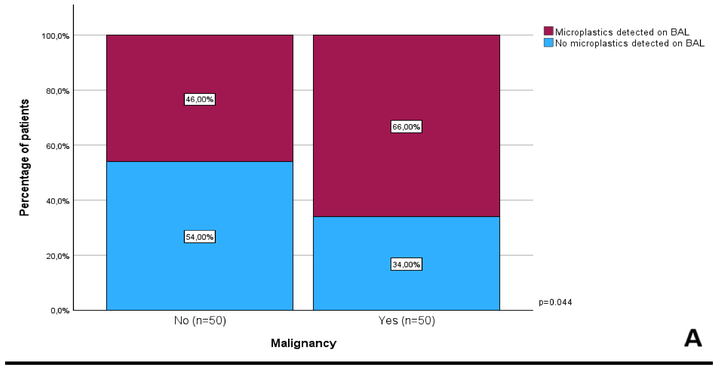
Aim: To compare microplastic burden in BAL and paired airway tissue between patients with newly diagnosed lung malignancy and control subjects undergoing bronchoscopy for non-chronic respiratory indications

Methods

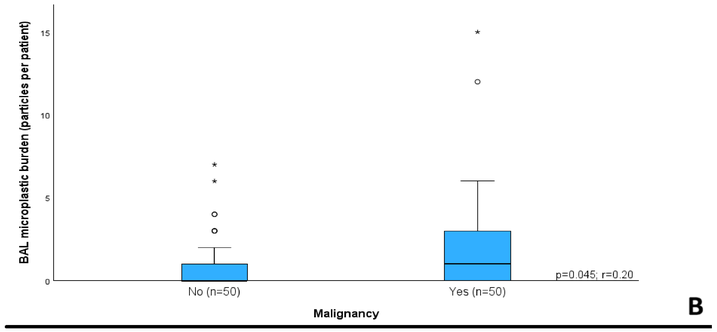
- Prospective observational study of 100 adults undergoing diagnostic bronchoscopy
- Lung malignancy (n=50) vs bronchoscopy controls (n=50)
- BAL sampling in all participants
- Paired tissue sampling in a subset (n=50; 26 cancer, 24 controls)
- KOH digestion and vacuum filtration
- Contamination-controlled sample processing
- Microscopic microplastic identification & micro-Raman spectroscopy confirmation and characterisation

Results

- A total of 150 respiratory samples (100 BAL and 50 tissue samples) were analysed. Overall, 232 microplastic particles were identified, with microplastics detected in 70% of patients and 60% of samples
- Patients with lung malignancy demonstrated both a higher frequency of BAL microplastic detection (66% vs 46%, p=0.044) and a greater BAL microplastic burden (p=0.045) than bronchoscopy controls

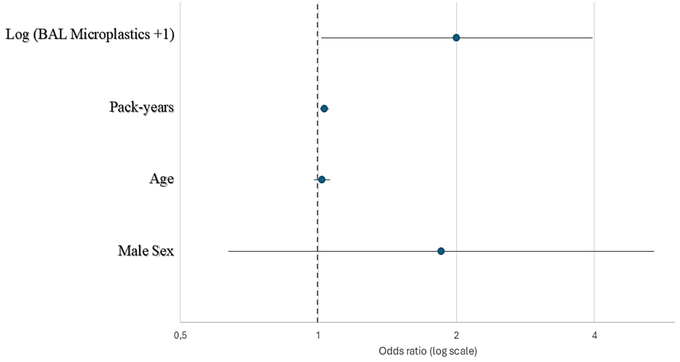


A

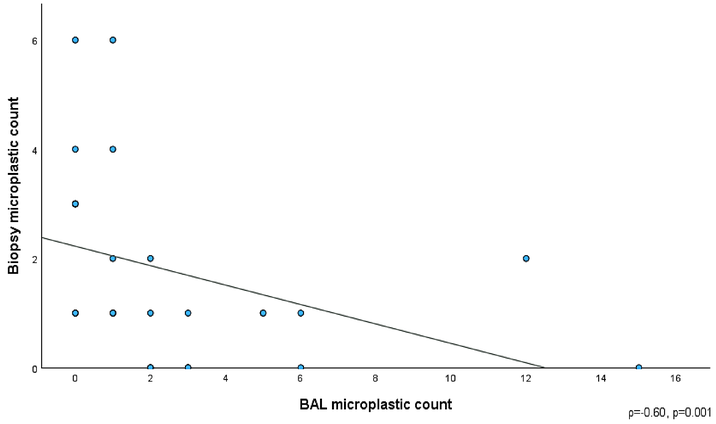


B

- In the paired BAL-tissue cohort, overall microplastic detection and total burden were also higher in patients with lung malignancy (p=0.020 and p=0.025, respectively).
- Higher BAL microplastic burden remained independently associated with lung malignancy after adjustment for age, sex, and smoking exposure (OR 2.00, 95% CI 1.01-3.95; p=0.046)



- Within patients with lung malignancy, BAL and tissue microplastic burdens demonstrated a significant inverse relationship (ρ = -0.60, p = 0.001)



Conclusions

- Respiratory microplastic burden was higher in patients with lung malignancy than in bronchoscopy controls, both in BAL samples and in the combined BAL–tissue cohort
- The association between microplastic burden and lung malignancy remained significant after adjustment for smoking exposure
- An inverse relationship between BAL and tissue microplastic burden was observed in patients with lung malignancy, supporting compartment-specific pulmonary particle dynamics