

Ultrastructural detection of environmental nanoparticles in circulating blood

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The increase in the incidence of acute myeloid leukemia (AML) may suggest a possible environmental etiology. PM_{2.5} was declared by the International Agency for Research on Cancer (WHO organ) a Class I carcinogen. To date, no reports have focused on particulate environmental pollution together with AML. The study investigated the presence and composition of particulate matter in circulating blood with a Environmental Scanning Electron Microscope coupled with an Energy Dispersive Spectroscopy for the elemental analysis of the samples. 38 peripheral blood samples, 19 AML cases and 19 healthy controls, were analysed. A significant overload of particulate matter-derived nanoparticles linked or aggregated to blood components was found in AML patients, while almost absent in matched healthy controls. Two tailed Student's t-test, MANOVA and Principal Component Analysis indicated that the total numbers of aggregates and particles were statistically different between cases and controls (MANOVA, $P < 0.001$ and $P = 0.009$ respectively). The particles detected showed to contain highly reactive, non-biocompatible and non-biodegradable metals; in particular, micro- and nano-sized particles grouped in organic/inorganic clusters, with statistically higher frequency of a subgroup of elements in AML samples. The demonstration, of an overload of nanoparticles linked to blood components in AML patients suggests a possible, additional, pathogenetic mechanism for AML development.

References

- [1] Gatti et al. (2008) ESEM evaluations of muscle/nanoparticles interface in a rat model. *J Mater Sci: Mater Med*; 19(4):1515-22.
- [2] Choi et al. (2010) Gene expression analysis of so called asian dust extracts in human acute myeloid leukemia cells. *Toxicol Res*; 26(1):21-28.
- [3] Sanchez-Guerra et al. (2015) Effects of particulate matter exposure on blood 5-hydroxymethylation: results from the Beijing truck driver air pollution study. *Epigenetics*; 10(7): 633-642.

Keywords

ESEM; environmental pollution; nanoparticles; circulating blood; acute myeloid leukemia.