La Medicina del Lavoro

Med Lav 2006; *97*, 2: 199-206

Recent developments in human biomonitoring: non-invasive assessment of target tissue dose and effects of pneumotoxic metals

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Key words

Metals; biomonitoring; lung; exhaled breath condensate

Summary

Tobacco smoke and polluted environments substantially increase the lung burden of pneumotoxic chemicals, particularly pneumotoxic metallic elements. To achieve a better understanding of the early events between exposure to inhaled toxicants and the onset of adverse effects on the lung, the characterization of dose at the target organ would be extremely useful. Exhaled breath condensate (EBC), obtained by cooling exhaled air under conditions of spontaneous breathing, is a novel technique that could provide a non-invasive assessment of pulmonary pathobiology. Considering that EBC is water practically free of interfering solutes, it represents an ideal biological matrix for elemental characterization. Published data show that several toxic metals and trace elements are detectable in EBC, raising the possibility of using this medium to quantify the lung tissue dose of pneumotoxic substances. This novel approach may represent a significant advance over the analysis of alternative media (blood, serum, urine, hair), which are not as reliable (owing to interfering substances in the complex matrix) and reflect systemic rather than lung (target tissue) levels of both toxic metals and essential trace elements. Data obtained among workers occupationally exposed to either hard metals or chromium (VI) and in smokers with or without chronic obstructive pulmonary disease (COPD) are reviewed to show that – together with biomarkers of exposure – EBC also allows the simultaneous quantification of biomarkers of effect directly sampled from the epithelial lining fluid, thus providing novel insights on both kinetic and dynamic aspects of metal toxicology.