Abstract

BACKGROUND: An abnormally high incidence of lung disease has been observed in the residents of Libby, Montana, which has been attributed to occupational and environmental exposure to fibrous amphiboles originating from a nearby contaminated vermiculite mine. The composition of Libby amphibole (LA) is complex and minimal toxicity data are available. In this study, we conduct a comparative particle toxicity analysis of LA compared with standard reference asbestiform amphibole samples.

METHODS: Primary human airway epithelial cells (HAEC) were exposed to two different LA samples as well as standard amphibole reference samples. Analysis of the samples included a complete particle size distribution analysis, calculation of surface area by electron microscopy and by gas adsorption and quantification of surface-conjugated iron and hydroxyl radical production by the fibers. Interleukin-8 mRNA levels were quantified by qRT-PCR to measure relative pro-inflammatory response induced in HAEC in response to amphibole fiber exposure. The relative contribution of key physicochemical **determinants** on the observed pro-inflammatory response were also evaluated.

RESULTS: The RTI amosite reference sample contained the longest fibers and demonstrated the greatest potency at increasing IL-8 transcript levels when evaluated on an equal mass basis. The two LA samples and the UICC amosite reference sample consisted of similar particle numbers per milligram as well as similar particle size distributions and induced comparable levels of IL-8 mRNA. A strong correlation was observed between the elongated particle (aspect ratio ≥3:1) dose metrics of length and external surface area. Expression of the IL-8 data with respect to either of these metrics eliminated the differential response between the RTI amosite sample and the other samples that was observed when HAEC were exposed on an equal mass basis.

CONCLUSIONS: On an equal mass basis, LA is as potent as the UICC amosite reference sample at inducing a pro-inflammatory response in HAEC but is less potent than the RTI amosite sample. The results of this study show that the particle length and particle surface area are highly correlated metrics that contribute significantly to the toxicological potential of these amphibole samples with respect to the inflammogenic response induced in airway epithelial cells.