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Effects Of Inhalation Of Gas Metal Arc-Stainless Steel Welding Fume On Systemic Inflammation And Atherosclerosis

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Rationale: Pulmonary particulate exposure results in negative cardiovascular events including systemic inflammation and increased atherosclerosis. More specifically, increased mortality due to ischemic heart disease has been shown among welders. In this study we tested the effects of gas metal arc-stainless steel (GMA-SS) welding fume on systemic inflammation and progression of atherosclerosis.

Methods: C57BL/6 mice were exposed for 10 days (d) to GMA-SS by inhalation (40mg/m³ for 3hr/day) and harvested 4hr, 10d, 14d and 28d post-exposure. Systemic inflammation was measured by whole blood cell gene expression, serum protein profiling and cardiovascular tissue gene expression. Atherosclerosis progression was determined using apolipoprotein E knockout (apoE^{-/-}) mice fed the Western diet for one month prior to ten days of exposure (40mg/m³ for 3hr/day) and sacrificed two weeks post-exposure.

Results: In C57BL/6 exposed mice aortic RNA analyzed for 93 target genes by TaqMan array showed only a mild increase for MT-2 (50%) and Hsp70 (60%) 4hr post-exposure with no changes at the later time points. In a panel of 59 serum proteins analyzed 4hr post-exposure none were increased with mild declines in MMP-9, C-reactive protein and leukemia inhibitory factor. There was a trend for increased serum endothelin-1. Whole blood cell microarray revealed several interferon signaling-related genes (e.g. Irf7 and Oasl2) were differentially expressed 4hr and 28d after GMA-SS exposure. In the atherosclerotic susceptible apoE^{-/-} mice, analysis of lung gene expression showed increased inflammatory expression in the GMA-SS exposed mice compared to air exposed shams. GMA-SS exposed apoE^{-/-} mice had increased serum levels of IL-1 β and MAC-3. Atherosclerosis progression in the aorta was determined by the en face method. At the time point chosen for analysis, there was a non-significant trend of increased plaque formation in the GMA-SS exposed mice compared to shams.

Conclusion: In the framework of this study, there were only mild indicators of systemic inflammation following GMA-SS inhalation for 10d without enhanced progression of atherosclerosis.

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