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World Trade Center neurotoxic exposures are associated with elevated plasma amyloid, total-tau and neurofilament light in responders

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Abstract

Background: The collapse of the World Trade Center towers on September 11th 2001 resulted in a 16-acre environmental toxic disaster. More than 1.2 million tons of construction material and carcinogens including polycyclic aromatic hydrocarbons, gypsum and metals coalesced, resulting in a highly alkaline dust cloud. Police and Law enforcement were among the most highly exposed group.

Method: In this retrospective cohort study, we included a subset of high exposure Responders (n=424) with cross sectional plasma samples of amyloid $\beta_{40,}$ amyloid $\beta_{42,}$ total-tau, neurofilament light and a baseline evaluation of cognitive functioning assessed with the Montreal Cognitive Assessment (MoCA) to examine long-term associations between WTC neurotoxic exposures (e.g. diesel exhaust, chemicals) with levels of proteins associated with neuropathological characteristics of Alzheimer's disease and neurodegeneration. Spearman rho p values adjusted for multiple comparisons using the false discovery rate (FDR=0.05) examined associations with participant characteristics and plasma concentrations. Multivariate regressions ascertained independent effects of WTC neurotoxic exposures in predicting plasma biomarker concentrations.

Result: Responders were on average 54.3 years at blood draw. Worse performance on the baseline MoCA was associated with higher levels of A$\beta_{40.}$ Plasma Aβ_{40} and NfL were inversely correlated with dust exposure, Aβ_{42} and ratio A$\beta_{42\text{-}40}$ were inversely correlated with total hours on site during 9/11-9/14 and working in enclosed work areas was associated with higher concentrations of Aβ_{40} and lower concentrations of ratio A$\beta_{42\text{-}40}$. Diesel exhaust exposure predicted levels of A$\beta_{40,}$ total tau and NfL whereas early exposure predicted Aβ_{42} concentrations and dust exposure predicted ratio A$\beta_{42\text{-}40}$.

Conclusion: Differences across inhaled neurotoxins and time of arrival may have differential long-term effects on blood-based protein biomarkers of neuropathology and brain health.