Lung Function More Than A Decade After World Trade Center (wtc) Exposure: The Influences Of Bronchial Reactivity And Corticosteroid Therapy

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Rationale
Inhalation of dust and toxins during rescue/recovery work at the WTC site led to an average 439ml decline in FEV1 for FDNY firefighters in the first post-9/11 year. ~15% demonstrated new obstructive airways disease (OAD) and ~25% demonstrated bronchial hyperreactivity (BHR). This study assesses the subsequent (2002-2013) course of BHR and lung function among those with and without OAD, BHR, and corticosteroid treatment.
Methods
From January to October 2013, 154 firefighters (72% never-smokers) with normal pre-9/11 spirometry, who had received methacholine challenge tests (MCT) within 2 years of 9/11/2001, underwent full lung function testing, including repeat MCT performed off respiratory medications. To adjust for aging, FEV1 was expressed as percent predicted (FEV1%). The difference between the 2013 FEV1% and the 1st post-9/11 FEV1% was used to describe lung function change subsequent to the initial post-9/11 decline.
Results
Initially, post-9/11, 23 firefighters (15%) had BHR (PC20<8mg/ml); 6 of them (26%) were negative (PC20>16mg/ml) in 2013. Of 118 firefighters with initially negative MCTs, 17 (14%) were positive in 2013. 117 firefighters (76%) reported using inhaled and/or oral corticosteroids between 2001-2013. The initial pre-9/11 to post-9/11 FEV1% decline averaged 9.8 percentage points. Thereafter, FEV1% tended to decline further, averaging a 2.7 percentage point decrease over the subsequent 11 years. Excluding 2 firefighters with restrictive disease, a multiple regression model with dependent variable "subsequent" (2002-2013) change in FEV1%, showed significant negative contributions from initial change in FEV1% and smoking ($p \leq .005$), and a positive contribution from approximate steroid dose ($p=.03$). Contribution of a composite index of BHR to the model approached statistical significance, with more reactive subjects tending to show decreasing FEV1% ($p=.08$). As shown in the figure, in firefighters without OAD (top two lines), the presence of BHR predicted greater decline in lung function between 2002-2013; in those with OAD (bottom two lines), the presence of BHR predicted absence of response to treatment ($p<.04$ for influence of OAD and of BHR on the 2002-2013 change in FEV1%, by 2-way ANOVA).
Conclusion
Among WTC-exposed firefighters, new-onset OAD is often, but not always, accompanied by BHR, which may persist for a decade or longer. BHR is significantly associated with worsening lung function between 2002-2013, and helps to explain the persistence of OAD among many firefighters. Post-exposure corticosteroid treatment ameliorated some of the excess lung function decline. These findings suggest a substantial role of airway inflammatory disease in WTC-associated OAD.

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