Online Data Supplement

Longitudinal Change in FEV_1 and FVC in Chronic Spinal Cord Injury

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MATERIALS AND METHODS

Between October 1994 and December 2001, 426 participants free from acute illness were recruited for enrollment to examine longitudinal determinants of change in pulmonary function. Participants had to be at least 22 years of age (prior to July 2002, the criterion was 20 years), free of any acute illness or other neurological diseases when tested, and able to breathe spontaneously without tracheostomy. Recruitment was from persons with SCI who had previously received care at VA Boston and non-veterans from the community recruited by advertisement and by mail solicitation to members of the National Spinal Cord Injury Association. Specific details regarding recruitment have been previously described.[E1]

Recruitment was additionally restricted to subjects at least 1 year post-SCI since improvements in pulmonary function occur through the first year.[E2] Longitudinal assessment was restricted to participants with at least two tests with a minimum of 4 years of follow-up through 12/2005 (n=201), and non-white males (n=19) and females (n=8) were excluded. Some participants (n=37) had undergone pulmonary function testing as part of a feasibility study conducted by our group (1989-1993) using the same methodology as the current study and those previous tests were included.[E3] There was no significant difference in SCI level and completeness and age at study entry for persons in the SCI cohort assessed longitudinally and those not assessed. Percent-predicted FEV_1 and FVC at study entry was significantly higher in those assessed longitudinally (p=0.001).

Participants were weighed and supine length measured.[E4] Measured stature at initial assessment or if available later was used. If length measurement was declined or there were joint contractures that precluded accurate assessment, stature was self-reported (9%). Weight was measured in 72% of sessions, self-report used in 15%, and weight from a recent clinic visit used

in 3%, and body mass index (BMI) calculated at each test session. Body mass index (BMI) was divided into normal (BMI <25), overweight (BMI ≥25-<30), and obese (BMI ≥30).

Motor level and completeness of injury were assessed based on American Spinal Injury Association (ASIA) guidelines[E5] in 96% of the test sessions either by a trained physician (428 exams) or a trained research assistant or physical therapist (128 exams).

A respiratory health questionnaire (ATS DLD-78)[E6] with supplemental questions was used. Chronic cough was defined as cough on most days for 3 consecutive months of the year, and chronic phlegm was defined similarly. Any wheeze was defined as wheeze reported on most days or nights, wheezing with a cold, or occasionally apart from a cold. Persistent wheeze was defined as wheeze reported on most days or nights, or with a cold and occasionally apart from colds. Participants were asked if they ever had any chest injuries or operations. Asthma, chronic bronchitis, emphysema, heart disease treated in the past ten years and hypertension were defined as a report of physician diagnosed conditions, and history updated at each test session. Chronic obstructive pulmonary disease (COPD) was defined by report of chronic bronchitis or emphysema.

Spirometry was based on ATS standards[E7] modified for use in SCI, as described previously.[E3,E8] In SCI, participants are more likely than the able-bodied to have short expiratory efforts and to exhibit excessive back extrapolation[E8] (the volume exhaled prior to the development of maximal expiratory flow after the start of a forced expiratory maneuver). Therefore, to study these subjects, we accepted excessive back extrapolation and efforts lasting less than 6 seconds if the effort appeared maximal, there was an acceptable flow-volume loop, and at least a 0.5 second plateau at residual volume.

Testing was done using a 10-liter water-seal spirometer (DSII) in 80% of the tests or an 8-liter water-seal portable spirometer (Survey III) in 6%. Starting in March 2004 (14% of sessions), testing was done using a dry-rolling seal spirometer (CPL system). All equipment and software was manufactured by Collins Pulmonary Diagnostics and Ferraris Respiratory, Louisville, CO. Adjustment for tests performed with different spirometers did not influence results. Maximum inspiratory pressure (MIP) measured at FRC and maximum expiratory pressure (MEP) measured at TLC were reported as the maximum of three values, but MEP was not assessed in the analysis because it was measured in fewer participants since it was measured using a trumpet style mouthpiece introduced later in the study.[E9]

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