COPD Gene Intra-Subject Variability of DLco Measurements Using an Ultrasound-Based Instrument

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Background

- Intra-Subject variability, expressed as Root Mean Square Coefficient of Variation (RMSCV), of Carbon Monoxide Diffusing Capacity (DLco) was reported in 2007 between 6-10% (Jensen, et al. CHEST 2007;132:396–402). COPD Gene uses the ndd EasyOne Pro instrument (Zurich, Switzerland) for DLco measurements. This device utilizes ultrasound for flows, volumes and gas concentrations.

Objective

We report intra-subject variability of DLco in phase II of the COPD Gene study from 2090 subjects.

Methods

DLco was measured in accordance with the 2005 ATS/ERS recommendations with breath-hold time from 8-12 seconds, test gas inspired volume >85% of FVC, and at least two DLco values within 3.0 (ml CO/min/mmHg). Root Mean Square Coefficient of Variation (RMSCV) and range percentiles of intra-subject DLco test values were calculated. Intra-subject S.D. was analyzed across sites with one-way ANOVA.

Results

1,939/2090 (92.8%) DLco tests met the ATS/ERS standards. Number of tests ranged from 14 to 447 across the 21 sites. S.D. across sites ranged between 0.23 to 0.36 DLco units (p=0.6 one-way ANOVA). RMSCV across all sites was estimated at 3.2%.

Discussion

DLco in the COPD Gene study has significantly less intra-subject variation than reported in 2005 in five different instruments. The ndd instrument overall has RMSCV of 3.2%. In 2005 RMSCV was 7.2% (range 4.9 to 9.8%). There was 58% of the total variation from the instrument’s internal variation (range 2.3-6.7%). Study protocols implemented showed that across the 21 sites that variation was not significantly different.

Patient and biological variation has likely been reduced by several factors. COPD Gene intra-subject RMSCV for DLco is < 50% previously reported in 2007. However, precise estimates of the ndd EasyOne Pro instrument’s contribution to total intra-subject variation will require additional testing with a DLco simulator.

Table 1

<table>
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<th>Range (ml/min/mmHg)</th>
<th>Count n</th>
<th>Cumulative Count</th>
<th>Percent</th>
<th>Cumulative %</th>
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<tr>
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</table>

Conclusions

Implementation of testing protocols that implement both quality assurance in pulmonary function measurements and instruments with high precision can significantly reduce intra-individual variability in DLco.

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