Long-term accuracy of 5 current pulmonary function instruments in the measurement of DLCO

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ABSTRACT

Five new pulmonary function test (PFT) instruments (Collins CR, JaegerUSA Masterscreen, Diffusion M, Morgan Transflow PFT System, Medical Graphics Pulirion Diffusion System, SensorMedics Vmax 22D) were tested with a DLCO simulator using 3 precision gas mixtures and 3 different inspiratory volumes. An additional precision gas mixture was supplied to each instrument, as its normal DLCO test gas, so that accuracy differences between inspired and inspired gas concentrations could be determined. Testing was performed on days 1, 2, 3, 6, and 11. At each testing day, 18 test gas/inspiratory volume combinations were injected into each device 5 times (45 total tests). Simulator-derived target values were calculated from the breath-hold time reported from the instrument and precision gas-volume calculations. Indicated instrument measurements of DLCO were compared to their simulator-derived target values. The mean absolute bias in DLCO across all tests (median [interquartile range]) for each PFT instrument on each day is presented in Figure 1.

METHODS

• All instruments were calibrated on days of testing.
• All instruments remained powered on for the duration of the study.
• There was no apparent systematic drift in bias observed over the 90-day period of the study.
• The methods employed in this study represent an approach to assessing the longitudinal accuracy of PFT instruments in the measurement of DLCO.
• The models were:
  - JaegerUSA Masterscreen Diffusion TP
  - SensorMedics Vmax 22D
  - Medical Graphics Pulirion Diffusion System
  - Morgan Transflow Test PFT System
  - Collins CR Handhold Test PFT System

RESULTS

• Six repetitions of 9 test gas/inspiratory volume combinations were injected into each instrument 5 times (90 total tests) and 90 different gas-volume combinations were obtained.
• The following DLCO endpoints were recorded:
  - Diffusion capacity (DLCO)
  - Alveolar volume (VA)
  - Respiratory volume (VR)

STUDY DESIGN

• Six repetitions of 9 test gas/inspiratory volume combinations were injected into each instrument over a 90-day period according to the schedule in Table 1.
• To ensure complete Waking of the system, the first half of a group of 6 repetitions was obtained from the analysis.
• Three different tracer gas mixtures were evaluated in a “constant” condition representing approximately physiological levels of each tracer, each with a broad range of DLCO values.
• With three different tracer gases (Oxygen, Nitrogen, Helium) along with standard test gas, the study was performed to encompass all three tracer gases.
• The following DLCO targets were used:
  - Diffusion capacity (DLCO)
  - Alveolar volume (VA)

DISCUSSION

• The methods employed in this study represent an approach to assessing the longitudinal accuracy of PFT instruments in the measurement of DLCO.
• The methods represent analyses collected on 1 instrument per manufacturer and may not be representative of all of their models.
• The following DLCO endpoints were recorded:
  - Diffusion capacity (DLCO)
  - Alveolar volume (VA)
  - Respiratory volume (VR)

CONCLUSIONS

• This is the first large-scale study utilizing a DLCO simulator to test DLCO instruments.
• The methods employed in this study represent an approach to assessing the longitudinal accuracy of PFT instruments in the measurement of DLCO.
• The methods represent analyses collected on 1 instrument per manufacturer and may not be representative of all of their models.
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