Relationship between Peak Cough Expiratory Flow Rate, Inspiratory Cough Flow Rate & Pulmonary Physiologic Capacity in Individuals with Amyotrophic Lateral Sclerosis.

AERODIGESTIVE RESEARCH CORE
ARC Laboratory
www.arc.phhp.ufl.edu

Kasey L. McElheny, Jennifer L. Chapin, Lauren DiBiase, Amber Anderson, Lauren Tabor, James Wymer, Emily K. Plowman.

UFHealth
UNIVERSITY OF FLORIDA HEALTH

BACKGROUND:

- Peak expiratory flow (PEF) is an important metric directly related to an individual's physiologic ability to defend the airway and expel tracheal aspirate (Tabor et al., 2019).
- PEF is reduced in ALS and associated with unsafe swallowing (Plowman, 2016) and global dysphagia status (Plowman, 2019).
- It is currently unclear what physiologic factors contribute to reductions in PEF in individuals with ALS.

AIM:

Examine relationships between peak expiratory flow rate generated during voluntary cough (i.e. cough strength) with inspiratory and expiratory pressure generation capacity (MIP, MEP), forced vital capacity, & cough peak inspiratory flow rate in ALS.

METHODS:

Participant Demographics:

- 101 ALS individuals (El-Escorial Criteria Revisited) participated.
- Mean age: 63 years (SD: 10.6), 54M / 47F, mean ALSFRS-R: 36 (SD: 7.6).

Assessments & Outcomes:

- Participants attended a single testing session and underwent voluntary cough spirometry testing and pulmonary function testing.

Voluntary Cough Spirometry:

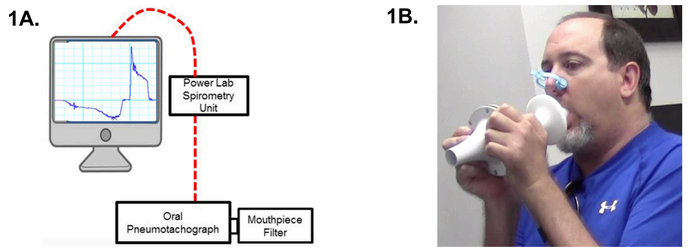


Figure 1. Schematic of voluntary cough spirometry testing set up (1A); Participant completing testing (1B).

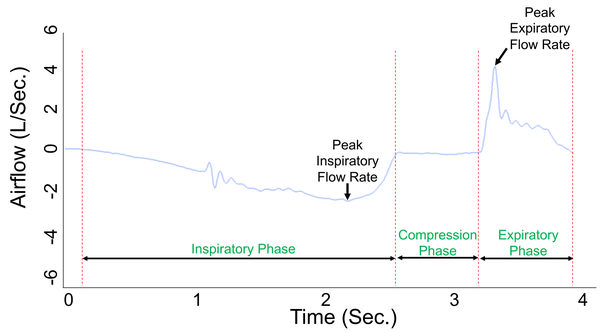
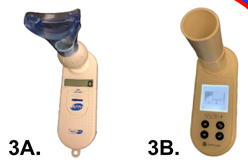


Figure 2. Example of voluntary cough airflow spirometry waveform.

Pulmonary Function Testing:

- Maximal Inspiratory Pressure (MIP, 3A)
- Maximal Expiratory Pressure (MEP, 3A)
- Forced Vital Capacity (FVC, 3B)



Statistics:

Descriptive statistics and Spearman's Rho correlation analyses were conducted using SPSS (Version 25.0).

RESULTS:

Peak Inspiratory Flow Rate Demonstrates the Strongest Association with Peak Expiratory Flow Rate:

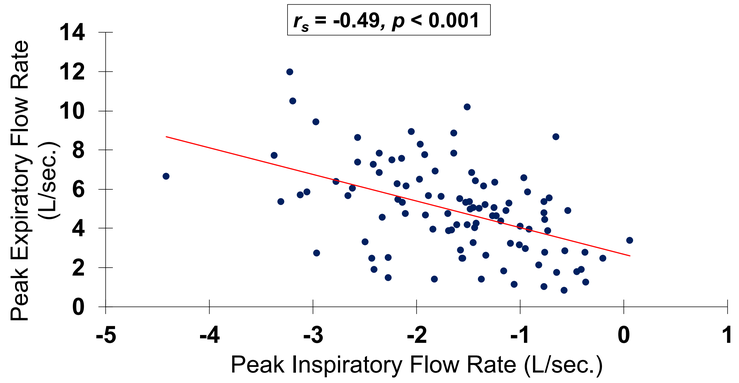


Figure 4. Larger (negative) peak inspiratory flow rates were associated with larger peak expiratory flow rates, r_s = -0.49, p < 0.001.

Maximal Inspiratory Pressure Demonstrates a Moderate Association with Peak Expiratory Flow Rate:

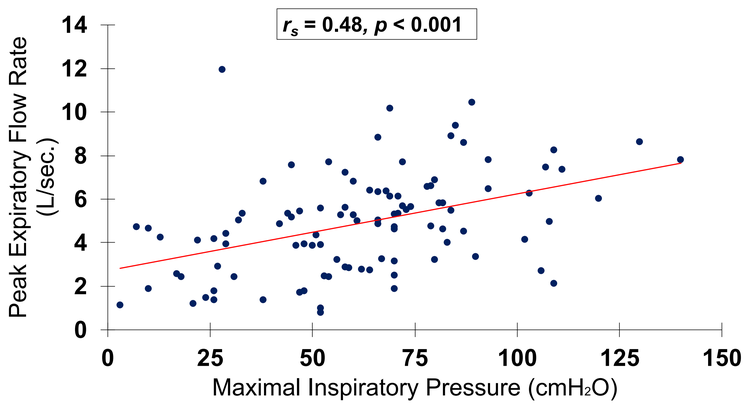


Figure 5. Greater inspiratory pressure generating ability (MIP) was associated with higher peak expiratory flow rates, r_s = 0.48, p < 0.001.

Maximal Expiratory Pressure is Associated with Peak Expiratory Flow Rate:

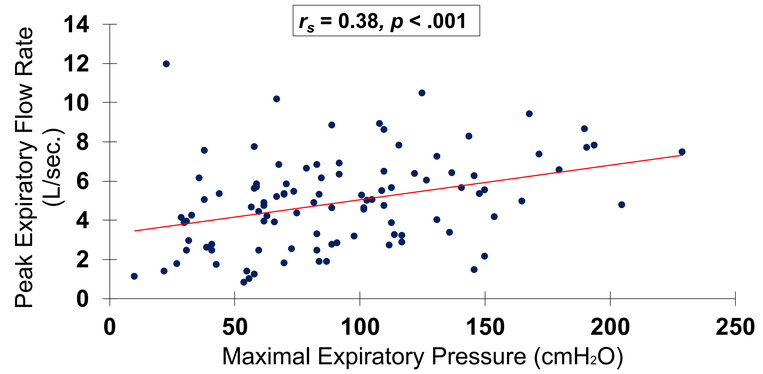


Figure 6. Greater expiratory pressure generating ability (MEP) was associated with higher peak expiratory flow rates, r_s = 0.38, p <0.001.

Forced Vital Capacity is Weakly Associated with Peak Expiratory Flow Rate:

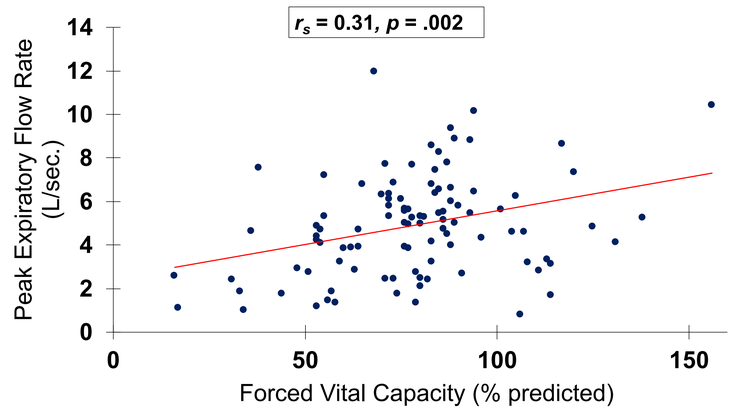


Figure 7. Higher FVC was associated with higher peak expiratory flow rates during voluntary cough, r_s = 0.31, p = 0.002.

CONCLUSIONS:

- Peak ***inspiratory*** flow and inspiratory pressure generating ability were most strongly associated with peak expiratory flow during voluntary cough in this group of individuals with ALS.
- Larger inspiratory airflow volumes during voluntary cough likely provides a mechanical advantage during the subsequent expiratory phase of cough, resulting in a stronger cough response.
- Strategies that optimize increased *inspiratory* pressure generating abilities and flow rates during the inspiratory phase of cough could represent therapeutic targets not previously thought to be a candidate to aide airway clearance abilities in individuals with ALS.
- We are currently continuing to assess potential predictors of cough strength in a larger dataset powered for logistic regression analyses.

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