The relationship between peak cough flow and respiratory function testing (spirometry), and the factors that influence this, post bilateral sequential single lung transplantation: a cross-sectional feasibility study at a single centre cardiothoracic transplantation unit

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BACKGROUND

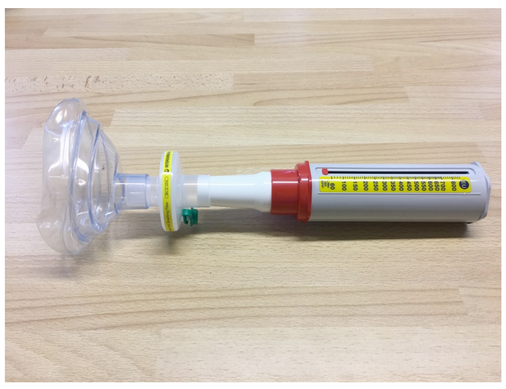
- Chronic lung allograft dysfunction (CLAD) is the leading cause of mortality post bilateral sequential single lung transplantation (BSSLTx)[1, 2]
- CLAD is associated with recurrent respiratory tract infections (RTI)[2]
- Adequate cough strength is the main defence mechanism against RTI[4] and this is known to be impaired post BSSLTx[5]
- Peak cough flow (PCF) is a recognised clinical predictor tool in other disease populations[6] with normal adult PCF 440-1200 L/min[7]
- PCF ≥ 270 L/min = adequate cough. PCF ≤ 160 L/min = inefficient cough[6]

AIMS

- To evaluate the feasibility of recruitment and conducting PCF testing alongside standard care
- To examine the relationship between PCF and spirometry: forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1)
- To examine other factors that influence PCF

METHODS

- Baseline characteristics collected
- FVC and FEV_1 measured by pneumotachograph on day of PCF testing
- Best of 3-5 PCF attempts measured with portable peak flow meter (mini Wright Standard Range Peak Flow Meter™)
- Health related quality of life (HRQoL) measure (EuroQol EQ-5D-5L™) completed



RESULTS

- Study methods feasible
- 91.90% recruitment rate, PCF test well tolerated
- *n* = 34 (61.8% male, 91.7% white British)

Table 1: participant characteristics (mean (SD) unless otherwise stated)

Age (years)	58.50 (17)
Height (cm)	168.84 (11.01)
Weight (kg)	72.02 (18.83)
BMI kg/m^2	25.12 (24.60)
FVC (L/sec)	3.25 (1.07)
FEV_1 (L/sec)	2.66 (1.09)
PCF (L/min) median (IQR 25-75%)	220 (150)
Total hospital LOS (days) median (IQR 25-75%)	35.50 (30)
Time elapsed post BSSLTx (days) median (IQR 25-75%)	972 (1692)
EQ-5D-5L™ VAS Score (0-100)	72.56 (17.23)
EQ-5D-5L™ Value State (0-1) median (IQR 25-75%)	0.82 (0.23)

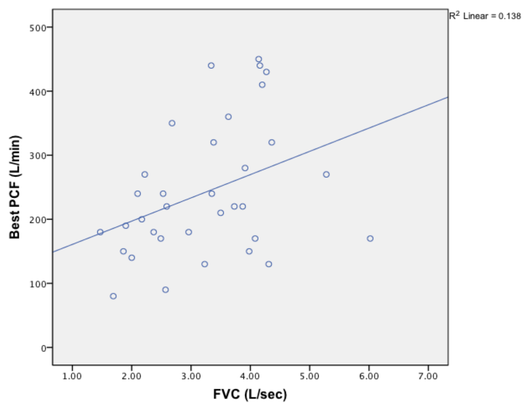


Figure A: Best PCF (L/min) versus FVC (L/sec)

Moderate positive correlations (*rho* = .389, *n* = 34, *p* = .023)

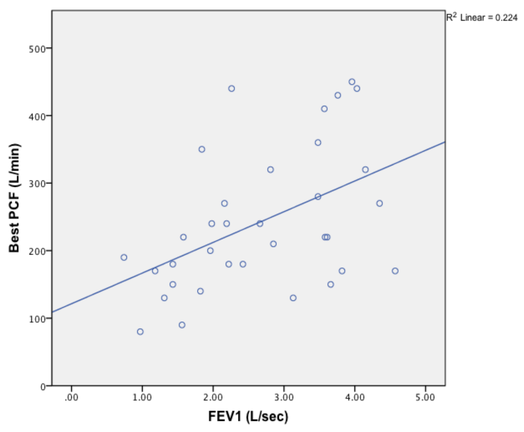


Figure B: Best PCF (L/min) versus FEV_1 (L/sec)

Moderate positive correlations (*rho* = .471, *n* = 34, *p* = .005)

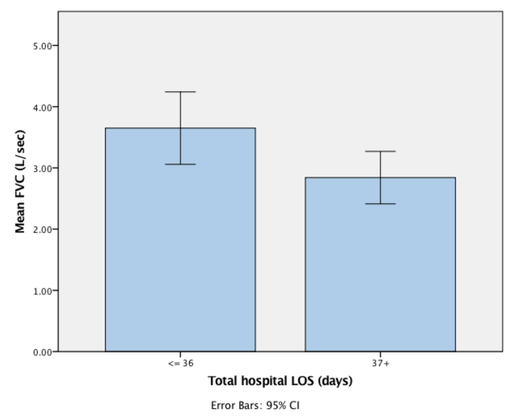


Figure C: Mean FVC (L/sec) versus Total Hospital LOS (days)

Significantly higher FVC (*p* = .024) in patients with a total hospital LOS ≤ 36 days compared to those > 37 days

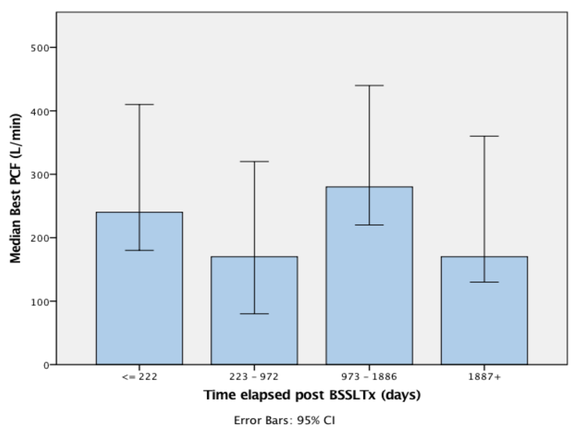


Figure D: Median PCF (L/min) versus Time Elapsed Post BSSLTx (days)

Significant differences in PCF as grouped into number of days elapsed post BSSLTx

CONCLUSION AND RECOMMENDATIONS

- Study methods feasible and PCF test well tolerated
- Positive correlation shown between PCF and spirometry (FVC and FEV_1), even when controlling for other variables
- Significantly higher FVC associated with hospital LOS < 36 days
- PCF changed with time elapsed post BSSLTx: significant difference (*p* = .007) noted between 223-972 days versus 973 – 1886 post operatively
- HRQoL did not appear to influence respiratory performance
- CLAD classification had moderate or strong negative correlations with PCF, FVC and FEV_1
- CLAD severity found to be worse dependant on time elapsed post BSSLTx
- A larger longitudinal study needs to be carried out with an increased sample size (estimated to be 244), revised sampling technique and consideration of additional respiratory outcome measures such as respiratory muscle testing

References:
1. Meyer, K. (2013) 'Lung transplantation', *F1000Prime Reports*, 5 16), pp. 1-10
2. Verleden, G., Raghu, G., Meyer, K., Glanville, A. and Corris, P. (2014) 'A new classification system for chronic lung allograft dysfunction', *The Journal of Heart and Lung Transplantation,* Elsevier, 33(2), pp. 127-133
3. Yeung, J. and Keshavjee, S. (2014) 'Overview of clinical lung transplantation', *Cold Spring Harbor Perspectives in Medicine*, 4(1), pp. 1-14
4. Chang, A. (2006) 'The physiology of cough', *Paediatric Respiratory Reviews*, 7, pp. 2-8
5. Duarte, A. and Myers, A. (2012) 'Cough Reflex in Lung Transplant Recipients', Lung, 190, pp. 23-27
6. Hull, J., Aniapravan, R., Cham, E., Chatwin, M., Furton, J., Gallagher, J., Gibson, N., Gordon J., Hughes, I. and McCulloch, R. (2012) 'British Thoracic Society guideline for respiratory management of children with neuromuscular weakness', *Thorax*, 67, pp. i1-i40
7. Bianchi, C. and Baiardi, P. (2008) Cough Peak Flows : Standard Values for Children and Adolescents, *American Journal of Physical Medicine and Rehabilitation*, 87 (6), pp. 461–467

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