

Introduction

Nebulised bronchodilators are a mainstay of acute COPD exacerbation treatment. No clinical studies assessing the clinical response to bronchodilators delivered by varying nebuliser devices exist.

Aim

To assess the clinical efficacy of the vibrating mesh (VM) nebuliser (*Aerogen Ultra Image A*) as compared to the standard oxygen-driven small volume (SV) nebuliser (*Hudson micromist Image B*) in a cohort of patients hospitalised with an acute exacerbation of COPD.



Participants

- Acute exacerbation of COPD within one week of admission
- Clinically stable
- Prescribed regular nebulised salbutamol/ipratropium bromide combination therapy (held pre-testing)

Test Procedure

- Randomised to VM Mesh or SV nebuliser group
- Completion, in the PFT laboratory, of:
 - Borg Breathlessness Score
 - Cough Peak Flow
 - Spirometry
 - Body Plethysmography
 - Impulse Oscillometry (IOS)
- Administration of 2.5mg salbutamol/0.5mg ipratropium bromide by VM or SV nebuliser
- One-hour post-bronchodilator all assessments repeated in same sequence

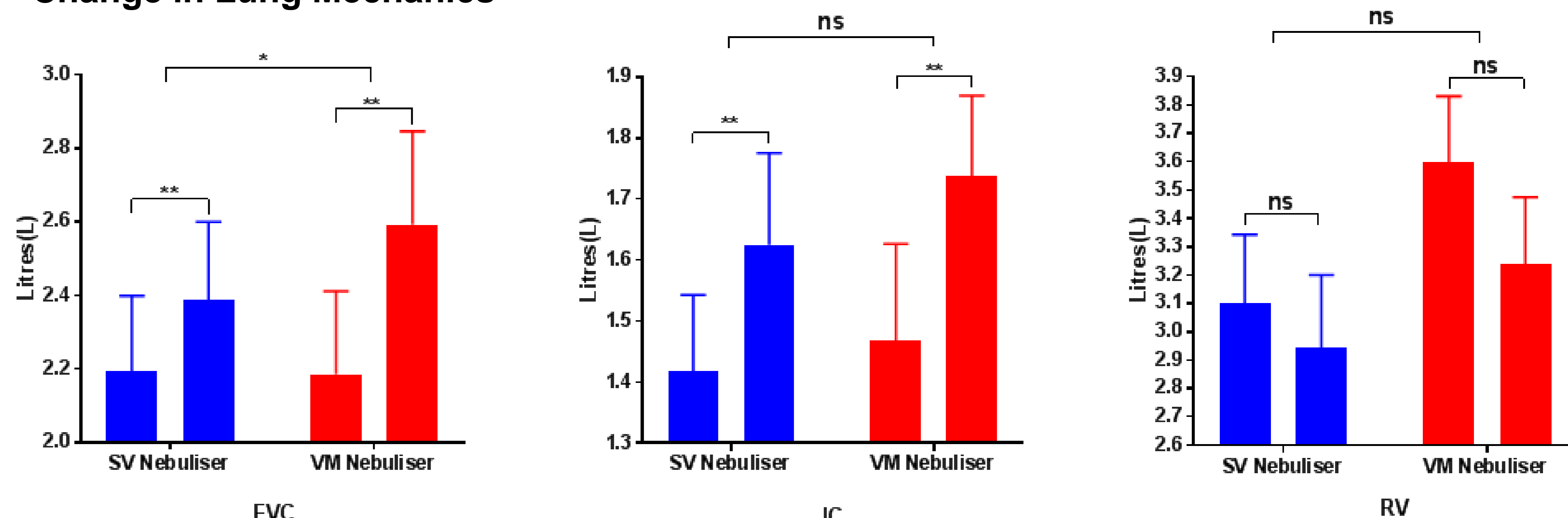
Outcome Measures and Analysis

- Paired t-test or Wilcoxon signrank test for within group pre to post-bronchodilator change in lung mechanics, flow response parameters, airway impedance, cough peak flow and symptom scores
- Unpaired t-test or Wilcoxon ranksum tests for comparison of post-bronchodilator change between group
- Linear regression analysis to assess relationship between changes in continuous variables

Baseline Demographics	ALL	Vibrating Mesh Nebuliser	Small Volume Nebuliser	P value
N	32	16	16	
Male (%)	59	50	69	0.28
Age	71.1 (1.4)	71.9 (1.9)	70.2 (2.1)	0.53
Current Smoker (%)	35	20	50	0.08
Baseline FEV ₁ (L)	1.2 (0.5)	1.1 (0.5)	1.3 (0.5)	0.36
FEV ₁ (%)	48.2 (3.2)	46.4 (4.7)	49.9 (4.5)	0.60
FVC (L)	2.5 (0.9)	2.3 (0.2)	2.6 (0.3)	0.53
FVC (%)	79.8 (4.3)	79.8 (5.9)	79.9 (6.4)	0.99
Median number of exacerbations in last 1 year	5 (4)	3 (4)	5 (4)	0.46
Median time from admission to study (days)	5 (4)	3.5 (3)	4 (2)	0.38

Values reported as mean (SEM) unless otherwise stated. N=Number; FEV₁ -Forced expiratory volume in one second; FVC- Forced Vital Capacity; IC-Inspiratory Capacity; L-Litres

Change in Lung Mechanics

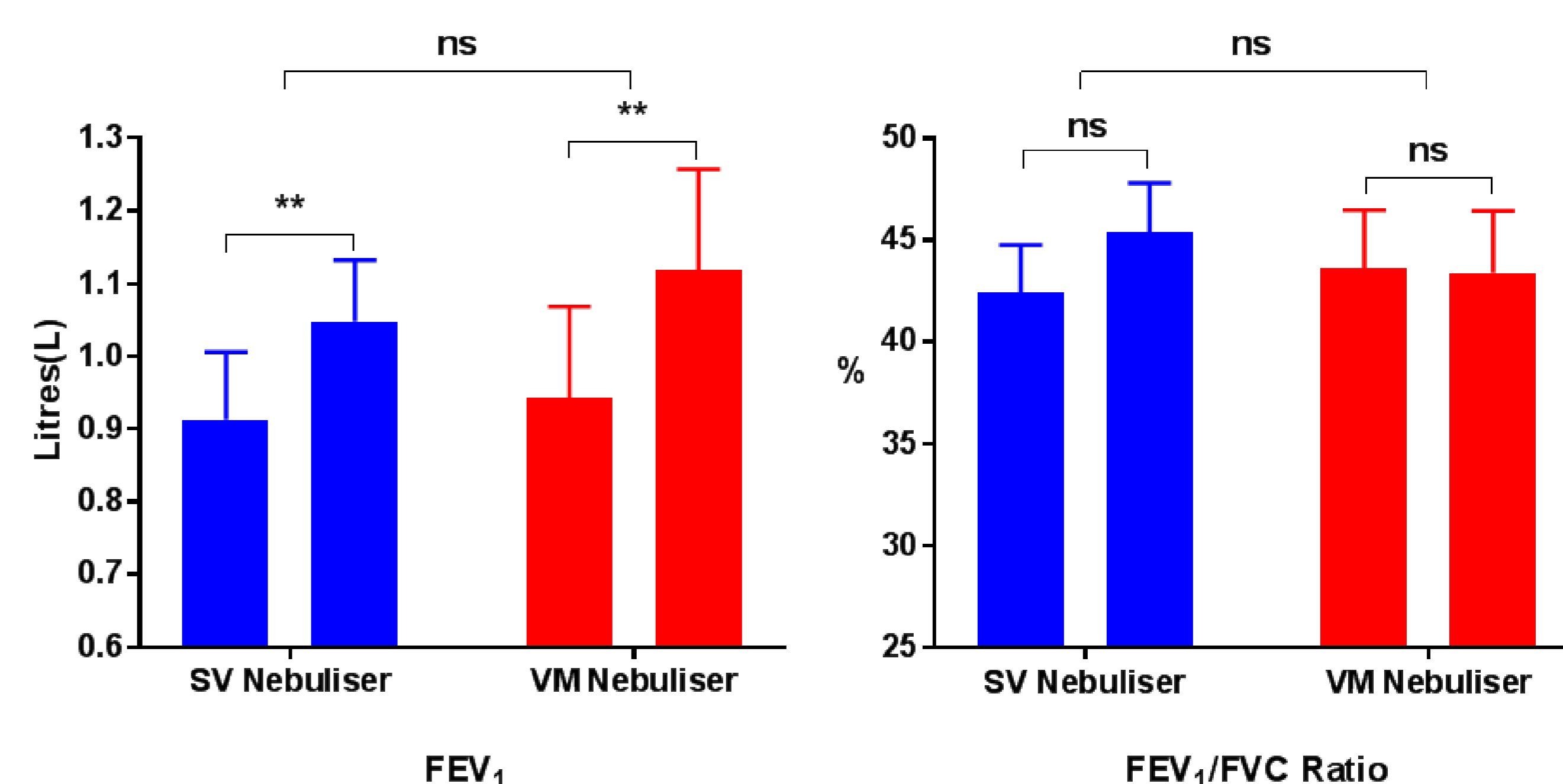


* Significance at $p \leq 0.05$, ** $p < 0.01$

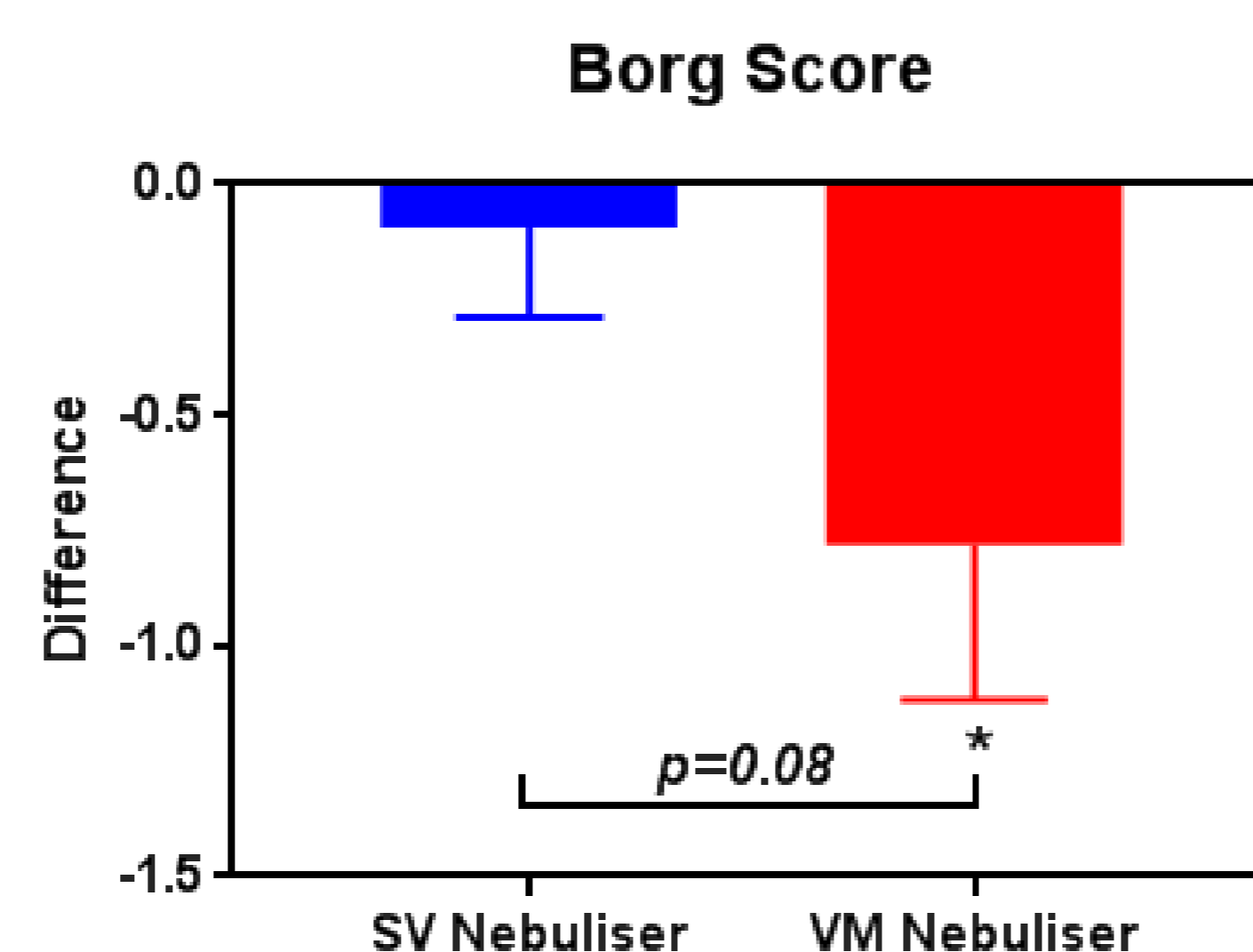
The VM nebuliser group demonstrated a greater volume response to bronchodilators with clinically significant increases in FVC (>12% and >200ml), IC (>10% of predicted) and reduction in RV (>300ml).

FEV₁ increased significantly in both groups but increases did not exceed 200ml. The FEV₁/FVC ratio was preserved.

Change in Flow Response Parameters



Borg Breathless Score decreased significantly in the VM group only. There was no definite linear association between change in volume of flow response parameters and Borg score. Both groups had comparable increases in Cough Peak Flow.



Conclusion

- Bronchodilator delivery by vibrating mesh nebulisers result in a significantly greater improvement in FVC and a larger volume response to bronchodilators in patients experiencing an acute exacerbation of COPD, as compared to standard small volume nebulisers.
- This was accompanied by a significant decrease in symptom scores.
- We and others have previously shown that exacerbation recovery is associated with increases in respirable lung volume. Therefore there is a potential that greater bronchodilator delivery with these devices may hasten exacerbation recovery but this has yet to be explored.