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## Introduction

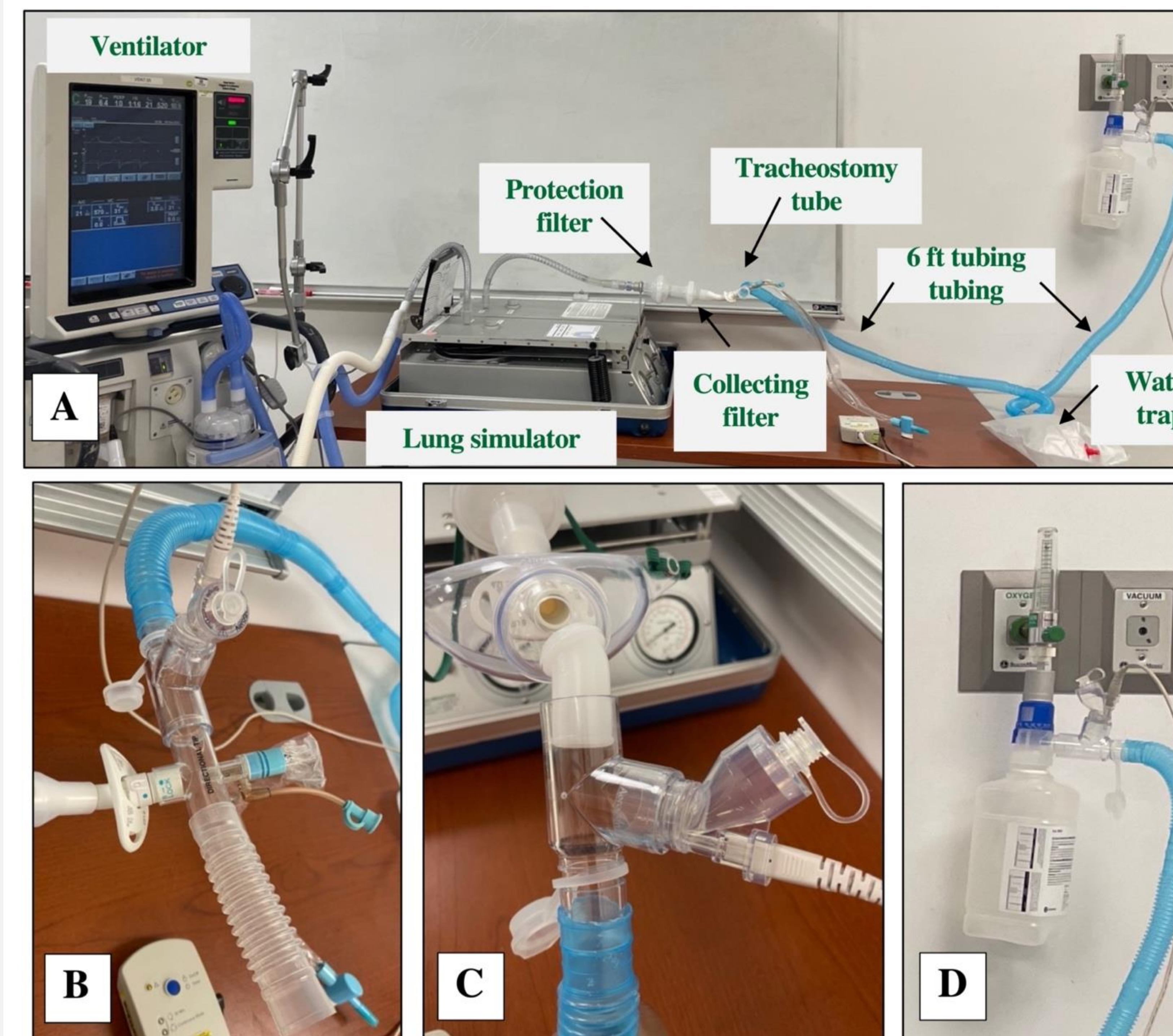
- The optimal aerosol delivery methods for tracheostomized spontaneously breathing patients remain unclear.
- The study assessed the impact of nebulizer placement, flow settings, and interfaces on aerosol delivery using a vibrating mesh nebulizer (VMN) and jet nebulizer (JN) in-line with a large-volume nebulizer (LVN).

## Methods

- A spontaneously breathing tracheostomized adult model was utilized with the defined parameters: (tidal volume 470 mL, respiratory rate 21 breath/min, inspiratory time: 1.1 seconds, and trach tube size 8.0 mm).
- Albuterol sulfate (2.5mg/3mL) was nebulized via VMN and JN placed in-line with LVN, FIO<sub>2</sub> set at 0.28, and tested under these conditions:
  - Gas flows: 2 vs. 6 L/min
  - Nebulizer placements: Proximal and distal to the airway.
  - Interfaces: Trach collar and T-piece
- The inhaled dose with in-line nebulization was compared to conventional nebulization without any form of humidification.
- Drug elution from collecting filter, assayed with ultraviolet spectrophotometry (276 nm).

## Results

- During in-line nebulizer placement with unheated humidification device, the inhaled dose was 2-4 times higher when the gas flow was set at 2 L/min compared to 6 L/min, regardless of the condition (all P < .01).
- In-line VMN with LVN at 2 L/min had a similar inhaled dose to the VMN conventional setup, irrespective of placement or interface. In contrast, both placement and interface affected inhaled dose from in-line JN.



**Figure 1:** A) Study set-up, B) Proximal in-line placement with T-piece, C) Proximal in-line placement with tracheostomy collar, D) Distal in-line placement.

**Table 1:** Percentage of the inhaled dose delivered through tracheostomy tube with proximal and distal nebulizer positions in various conditions

Set-up	Nebulizer	Interface	Flow	Nebulizer placement		P	
				Proximal	Distal		
In-line with LVN	VMN	T-piece	6	9.4 ± 0.2	7.1 ± 0.3	0.009	
			2	20.2 ± 0.9	19.6 ± 0.8	0.675	
			p	0.009	0.009		
		Trach collar	6	5.6 ± 0.6	4.7 ± 0.3	0.028	
			2	19.9 ± 1.1	23.0 ± 1.6	0.016	
			p	0.009	0.009		
Conventional	VMN	Trach collar	2	21.9 ± 1.6			
			JN	Trach collar	14.2 ± 0.8		
					T-piece	12.5 ± 0.2	

Values are presented as mean ± SD

\* Significant difference (p < 0.05)

LVN: large volume nebulizer, VMN: vibrating mesh nebulizer, JN: jet nebulizer

## Conclusions

- Nebulizer placement, interface, and gas flow settings affected Aerosol delivery in-line VMN and JN with unheated humidification using LVN.
- The in-line nebulization at distal placement with appropriate flow adjustments, might provide a convenient and efficient method for administering aerosol treatments to spontaneously breathing tracheostomized patients.

## Disclosure

Dr. Li has affiliations with Fisher & Paykel Healthcare, Aerogen, the Rice Foundation, Heyer, and serves as a section editor for RESPIRATORY CARE. Albuainain reports no conflicts of interest.