A 55-Year-Old Patient With Advanced COPD, Tracheostomy Tube, and Sudden Respiratory Distress*

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You are called urgently to the general medical ward to see a 55-year-old woman with advanced COPD and sudden respiratory distress. Two hours previously, you had transferred her out of the ICU, where she had been treated for a COPD exacerbation for 1 month. Two weeks prior to this transfer, she had undergone tracheostomy to assist in weaning her from mechanical ventilation. When she left the ICU, she was alert and comfortable, breathing spontaneously via a cuffed tracheostomy tube (No. 7), and she was able to speak clearly with the periodic use of a one-way tracheostomy valve (Passy-Muir; Irvine, CA).

On examination, she is diaphoretic and only semiconscious, with a BP of 90/60 mm Hg, an irregular pulse of approximately 140 beats/min, and an arterial oxygen saturation of 83% on a fraction of inspired oxygen of 0.35, via tracheostomy mask. Her inspiratory efforts are labored, with a respiratory rate of 20 breaths/min; she exhibits marked intercostal and supraclavicular indrawing, and extreme contraction of the sternocleidomastoid muscles with each inspiratory effort. The student nurse assisting with her care reports that the patient was doing well until the Passy-Muir valve was placed on the tracheostomy tube to permit speech. Which of the following maneuvers is indicated at this time?

A. Electrical cardioversion
B. Removal of the tracheostomy tube and performance of orotracheal intubation
C. Performance of the Heimlich maneuver
D. Removal of the Passy-Muir valve
E. Urgent bronchoscopy

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Answer: D. Removal of the Passy-Muir valve.

The patient has impending asphyxia caused by acute upper-airway obstruction secondary to misuse of the Passy-Muir valve. This valve permits inspiration but not exhalation via the tracheostomy tube. When the cuff is deflated, exhaled air is directed through the glottis, permitting phonation (Fig 1). Failure to deflate the cuff on a cuffed tracheostomy tube, or use of an uncuffed tube with too large a diameter, can create a closed or semiclosed system in which the work of breathing is excessive and exhalation is impossible.

Of the choices offered, removal of the Passy-Muir valve is most likely to help because it will relieve the obstruction to airflow during exhalation and will restore adequate gas exchange, as well as permit suctioning of the trachea and manual ventilation by self-inflating bag if necessary. Simply deflating the cuff on the tracheostomy tube would also relieve expiratory airflow obstruction and improve gas exchange, provided the tracheostomy tube was not too large in diameter. Although mechanical obstruction of the tracheostomy tube should be considered as a possible complication in this setting, it is not very likely in this case, making the choices of urgent bronchoscopy and removal of the tracheostomy tube for oral intubation unnecessary. Similarly, the Heimlich maneuver would be ineffective in this situation, and electrical cardioversion is unlikely to be required, as the presumed acute atrial fibrillation is most likely secondary to the acute upper-airway obstruction and will resolve once obstruction is relieved.

Of the various phonation aids that have been developed for use in patients with chronic tracheostomies and even for patients dependent on mechanical ventilation, the Passy-Muir valve is commonly employed because it is very well tolerated and can be used in patients with neuromuscular diseases. Aspiration during eating has also been reduced with use of this valve, perhaps because it restores a more normal subglottic and glottic airflow during exhalation. Other reported advantages of this valve include a decrease in the amount of bronchial and pharyngeal secretions, improved cough effectiveness, and reestablishment of the ability to smell. It is postulated that secretions are decreased because the air, escaping through the mouth and nose when the valve is in use, contributes to their evaporation. Cough is more effective when a one-way valve is employed because of the restoration of glottic function.

To use the Passy-Muir valve appropriately, patients must have the ability to clear secretions, must have adequate gas exchange and hemodynamic stability, and must have a normal mental state. In addition, adequate training for both patients and therapists is essential, so that vital management issues, such as deflating the cuff on the tracheostomy tube prior to use of the valve, will not be overlooked.

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