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Abstract

Background: As part of our influenza pandemic preparedness, we studied the dispersion distances of exhaled air and aerosolized droplets during application of a jet nebulizer to a human patient simulator (HPS) programmed at normal lung condition and different severities of lung injury.

Methods: The experiments were conducted in a hospital isolation room with a pressure of - 5 Pa. Airflow was marked with intrapulmonary smoke. The jet nebulizer was driven by air at a constant flow rate of 6 L/min, with the mask reservoir filled with sterile water and attached to the HPS via a nebulizer mask. The exhaled leakage jet plume was revealed by a laser light sheet and images captured by high-definition video. Smoke concentration in the plume was estimated from the light scattered by smoke and droplet particles.

Findings: The maximum dispersion distance of smoke particles through the nebulizer side vent was 0.45 m lateral to the HPS at normal lung condition (oxygen consumption, 200 mL/min; lung compliance, 70 mL/cm H₂O), but it increased to 0.54 m in mild lung injury (oxygen consumption, 300 mL/min; lung compliance, 35 mL/cm H₂O), and beyond 0.8 m in severe lung injury (oxygen consumption, 500 mL/min; lung compliance, 10 mL/cm H₂O). More extensive leakage through the side vents of the nebulizer mask was noted with more severe lung injury.

Interpretation: Health-care workers should take extra protective precaution within at least 0.8 m from patients with febrile respiratory illness of unknown etiology receiving treatment via a jet nebulizer even in an isolation room with negative pressure.

Keywords: dispersion exhaled air influenza jet nebulizer severe acute respiratory syndrome