

Ventilation of a 7 Year Old Victim of Crush Injury to the Upper Chest with Tracheal Bronchial Tears Using High Frequency Jet Ventilation

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A previously healthy 7 year old girl experienced a severe crush injury to the upper chest area resulting in severe bilateral lung contusions and pneumothoraces along with extensive tearing of the membranous portion of the trachea involving both the left and right main stem bronchus. The patient required complicated and prolonged surgical repair of the airway.

Ventilation of this patient proved extremely difficult post operatively due to the patient's extremely poor lung compliance and the need to keep her airway pressures at a minimum. Initial attempts to ventilate this patient included high frequency oscillation, conventional ventilation, and high frequency positive pressure ventilation. These attempts were unsuccessful with inability to decrease the patient's PaCO₂ to less than 170 mm Hg or increase the patient's arterial pH to greater than 6.80.

Although the patient weighed nearly 25 kg, she was successfully ventilated using high-frequency jet ventilation (HFJV) via the Bunnell Life Pulse™ ventilator and a LifePort™ endotracheal tube adapter for use with the patient's standard 5.5mm endotracheal tube. After one hour and 15 minutes of HFJV, arterial pH increased to 7.21 with a significant decrease of PaCO₂ to 72 mmHg. After two hours and 10 minutes of HFJV, arterial pH increased to 7.52 with a PaCO₂ of 26 mmHg.

The patient's overall respiratory status continued to improve following this allowing extubation 11 days after admission and discharge home 14 days after admission. Follow up bronchoscopy performed one week after surgery showed healing of the tracheobronchial tear without granuloma formation or presence of tracheitis.

HFJV has been used for years with success in infants and adults for various conditions where conventional ventilation has failed including bronchopleural fistulas, severe ARDS and traumatic large airway disruption. Despite this fact, HFJV has traditionally not been considered for use in mid-range pediatric patients due to limitations of the available high-frequency jet ventilators and associated accessories in respect to the patient's size and weight.

In this case the high-frequency jet ventilator used, although particularly indicated for use with infants, proved flexible enough for use in an older child with use of an adapter. Further studies should be considered to expand the age range for use of HFJV in children.

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