RESPIRATORY CARE

The Science Journal of the American Association for Respiratory Care

2006 OPEN FORUM Abstracts

A MODEL FOR TEACHING HIGH-FLOW AND LOW-FLOW OXYGEN SYSTEMS

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Background: Respiratory care students sometimes have difficulty grasping fundamental concepts related to high-flow and low-flow oxygen systems. The key element that typically slows the education process in this area is helping students understand the important interrelationship between the patient's inspiratory flowrate and the total flowrate produced by an oxygen device. The purpose for developing this model was to create a mechanism which gives students real-time feedback of various respiratory parameters when ventilatory changes occur in a simulated patient or when changes are made to these types of oxygen systems.

Method: We created our model by incorporating a Hans-Rudolph Series 1101 Breathing Simulator with an Armstrong Medical Adult Intubation Manikin. Using large bore tubing and appropriate adapters the manikin's trachea was connected to the breathing simulator's outlet so that as the simulator operates, air flows in and out through the manikin's mouth and nares or endotracheal tube. This essentially creates a "breathing patient" and allows tidal volume, respiratory rate, I:E ratio, and inspiratory flowrate to be independently monitored and controlled by making adjustments to the computerized simulator. By placing an oxygen analyzer in-line with the trachea, the additional observation of tracheal FIO2 can be made as flow and FIO2 are adjusted on the oxygen device or as the patient's minute ventilation or inspiratory flowrate is increased or decreased.

Results: We found that our model gave students a supplementary tool to help them master the basic concepts of high-flow and low-flow oxygen systems. For example, a group of students performed three bench tests using our model. In the first test students set the model to simulate a normally breathing patient (V_T 500 ml, f 12). After applying a non-rebreathing mask at 15 l/m, they observed that the tracheal FIO2 was 0.82. With the non-rebreathing mask still running at 15 l/m, they made the model hyperpneic and tachypneic (V_T 900 ml, f 24) and observed that the tracheal FiO2 had dropped to 0.56. In the second test, the students set the model to simulate a tidal volume of 500 ml and respiratory rate of 15. After applying a nasal