

Autonomous Control of Inspired Oxygen Concentration during Mechanical Ventilation of the Critically Injured Trauma Patient.

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Background

Transport of mechanically ventilated patients in a combat zone presents challenges including conservation of resources. In the battlefield setting, the provision of adequate oxygen supplies remains a significant issue. Autonomous control of oxygen concentration may allow a reduction in mission load.

Methods

Trauma patients requiring ventilation and inspired oxygen concentration (FiO₂) greater than 0.35 were evaluated for study. Patients were randomized to consecutive 4-hour periods of autonomous control or standard care. The system for autonomous control consisted of a ventilator, oximeter, and a portable computer. The portable computer housed the control algorithm and collected ventilator and oxygen saturation (SpO₂) data every 5 seconds. The controller goal was to maintain SpO₂ at 94% +/- 2% via discrete changes of 1% to 5%. Ventilator settings and SpO₂ were recorded every 5 seconds for analysis.

Results

Fifteen patients were enrolled in this study. Oxygen saturation was maintained in the 92% to 96% saturation range 33% +/- 36% of the time during clinician control versus 83% +/- 21% during autonomous control. Oxygen usage was reduced by 44% during autonomous control. There was a slight difference in the total duration of SpO₂ episodes less than 88% between groups (6.02 +/- 0.83 vs. 6.87 +/- 0.46 minutes, $p < 0.05$). There were no differences in the number of episodes of SpO₂ <88%.

Conclusion

Autonomous control of FiO₂ offers the opportunity for a reduction in oxygen usage, allowing a weight and resource reduction, without increasing risk of hypoxemia in ventilated trauma patients.