

Operating Room Fires: Drapes and Oxygen Contamination of the Surgical Field

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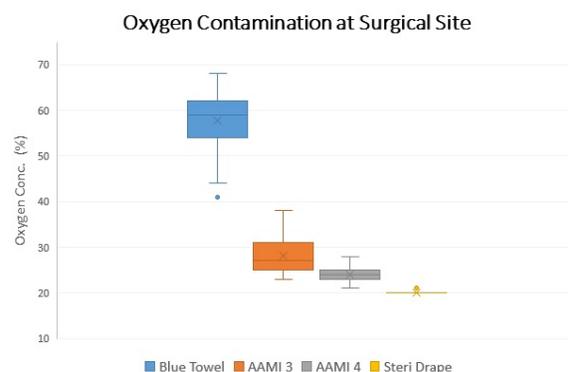
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Introduction: Surgical fires are a high-profile, preventable threat causing patient morbidity and mortality and occur more than 600 times per year. Ninety-percent of these fires are associated with open oxygen sources (such as the simple face mask and nasal cannula) leading to oxygen-enriched atmospheres about the face and neck. The degree to which oxygen potentially collects or pools under the surgical drapes and on the operating field through surgical drapes is not well described. Surgical drapes are composed of varying materials, therefore, we hypothesized that oxygen permeability would vary with each drape. We sought to measure under-drape pooling and surgical site oxygen contamination by measuring oxygen concentration under simulated clinical conditions with various drapes.

Methods: Experiments took place in an operating room environment with high air turnover (15-20 room exchanges/hour) to represent clinical conditions. A negative pressure ventilation mannequin model was utilized with a respiratory rate of 12 BPM and TV 500 mL. Oxygen was administered at 10 LPM via simple face mask, and the model draped in the standard fashion for a surgical procedure at the glabellar region. A multi-gas analyzer (Dräger Inc., Telford, PA) was used to measure oxygen concentration at two locations: at the surgical site and under the drape nearest the surgical site. Four commercially available surgical drapes were tested. Oxygen concentration was measured at both locations every five seconds over one minute for a total of twelve measurements, and repeated for thirty trials with each drape.

Results:

Of the four drapes tested, Cardinal Hill Standard Disposable Woven 100% Cotton OR Blue Towel (no AAMI level), Cardinal Hill AAMI level 3 Utility Drape, Cardinal Hill AAMI level 4 Procedural Drape, and 3M™ Steri-Drape™ 1030 Medium Drape with Adhesive Aperture, the under-drape oxygen concentration average was 64.49%



and was not statistically different among drapes. In contrast, oxygen concentration at the surgical site was moderately elevated with AAMI 3 and AAMI 4 drapes, and extremely elevated with OR blue towels (mean oxygen concentration 58%, $p=0.0001$). The 3M™ Steri-Drape™ provided an impermeable protective barrier with no surgical site oxygen contamination.

Conclusions: Surgical draping can lead to under-drape oxygen pooling with very high oxygen concentrations and does not significantly differ among tested drapes. Oxygen contamination of the surgical site varied widely based on drape material, with surgical towels leading to high oxygen contamination while plastic occlusive drapes did not. Drape selection may impact operating room fire risk.

References:

- (1) Mehta SP, et al. Operating room fires: a closed claims analysis. *Anesthesiology* 2013;118:1133-9.
- (2) Culp Jr WC, et al. Flammability of surgical drapes and materials in varying concentrations of oxygen. *Anesthesiology* 2013; 119:770-6.