Title: PeriAnesthetic Oxygen Saturation vs. Skill of the Anesthetist

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Introduction: Hypoxemia during anesthesia is a continuing problem. This study quantifies oxygen hypoxemia events occurring in surgical patients under anesthesia administered by experienced anesthesiologists, unassisted by resident physicians. We hypothesize that the greater skill and experience of this group would reduce the incidence and depth of perioperative hypoxic events. Previous studies of the practice of resident-faculty teams demonstrated that 48% of the anesthetized patients experienced a reduction in oxygen saturation of greater than 5% \(^1\). In the present studies of solo practice anesthesiologists, working in the same operating rooms, we note that 16% of patients experience desaturation of greater than 5%.

Methods: The study series consist of 87 surgical patients selected for noninvasive 02 saturation measurements during anesthesia in a large general hospital. Most surgical specialties are represented. Age range of patients is 3 weeks to 84 years. 95% of patients are classified ASA 1 or 2. All patients are continuously monitored by means of a spectrophotometric pulse oximeter with its fiberoptic probe attached to a digit. Saturation values are numerically displayed within view of participating anesthesiologists, and continuously recorded throughout each case. Baseline saturation is the arithmetic average of oxygen hemoglobin saturation for the entire period of surgical anesthesia. Hypoxemia is defined as reduction of oxygen saturation 1% or more below baseline. All patients studied are classified into 4 saturation categories: 1. No hypoxemia; 2. Hypoxemia of 1% - 5%; 3. Hypoxemia of 5% - 10%; and 4. Hypoxemia greater than 10%. In the event of more than a single hypoxemia event in the same patient, the maximum reduction is taken as the basis for categorization.

Results (Table): No hypoxemia occurs in 27% of patients studied. However, 16% of patients experience one or more episodes of desaturation greater than 5%. More than half of this group experiences desaturation greater than 10%. Hypoxemia frequently follows induction of anesthesia, e.g. distractions of taping the tube and positioning the patient. Other frequent associations are suctioning the patient; coughing and straining when anesthesia is light; discontinuation of the ventilator; and exubation or removal of the face mask. Hypoxemia is usually absent during endotracheal intubation with relaxants. Anesthesiologists readily respond to oximeter readings in these cases. In cases of anesthesia skill and difficulty, they continuously follow oxygenation status and any effect of corrective measures. Desaturation is frequently transient (0.5 to 2 minutes) but may persist 10 minutes or longer. Injuries due to hypoxia or probe application were not recognized among study patients. The oximeter probe is atraumatic and easily applied to all patients except infants and children less than 2 years of age. Reliable measurements are obtained within 1 minute of initial probe application. Artifacts are rare with the probe attached to an extremity away from the blood pressure cuff or rapid intravenous infusion, both of which impair digital pulse. The instrument functions satisfactorily in moderate hypovolemia and hypothermia. By design it is rugged, with minimal need for maintenance and calibration.

Discussion: Intraoperative hypoxemia occurs less often in surgical patients attended by experienced, well-trained anesthetists than with resident-faculty teams. However, even under this high level of care, supported by oximetry, 10% of patients experience sufficient desaturation (greater than 10% oxygen hemoglobin reduction) to be of concern. Hypoxemia would likely increase if anesthesiologists had no feedback on oxygenation status. The ASA 1 and 2 patients studied had ample cardiorespiratory reserve. A 10% hypoxemia event in this group reduces reserve but does not result in obvious harm. However, erosion of reserve is undesirable. Continuous monitoring verifies reserve. Higher risk groups (ASA 3 and 4) had less reserve and are more sensitive to reduction of oxygen transport. Continuous monitoring would benefit this group at least equally.

### Patients and Hypoxemia Events

<table>
<thead>
<tr>
<th>Category</th>
<th>Patients</th>
<th>Events/ Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Desaturation</td>
<td>24 (27%)</td>
<td>-</td>
</tr>
<tr>
<td>1% - 5%</td>
<td>49 (56%)</td>
<td>126</td>
</tr>
<tr>
<td>5% - 10%</td>
<td>5 (6%)</td>
<td>13</td>
</tr>
<tr>
<td>&gt;10%</td>
<td>9 (10%)</td>
<td>13</td>
</tr>
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