

Title: THE TIME COURSE OF HEMOGLOBIN DESATURATION DURING THE IMMEDIATE POSTANESTHETIC PERIOD IN CHILDREN

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INTRODUCTION: Recent studies using pulse oximetry have shown that hypoxemia following general anesthesia is common in otherwise healthy children regardless of age or the duration of anesthesia (1). Similar studies during the transport of adults and pediatric patients from the operating room (OR) to the postanesthetic recovery room (PAR) indicated that hypoxemia is common and occurs within 5 min after inspired gas mixture is switched from 100% O₂ to room air (2,3). These findings imply that alveolar O₂ is diluted rapidly by nitrogen wash-in with spontaneous air breathing and that the benefit of O₂ breathing does not last long enough for even a short trip from the OR to the PAR. Since alveolar ventilation in relation to resting lung volume (FRC) is greater in infants than in older children (4), we hypothesized that the benefit of O₂ breathing is even shorter in infants and young children than in older children. The purpose of this study was to determine the time for oxygen saturation (SaO₂) to reach the lowest plateau after the inspired gas was switched from 100% O₂ to room air, to critically evaluate the need for O₂ during transport.

METHODS: As part of clinical monitoring we measured pre- and postanesthetic SaO₂ by pulse oximeter (Nellcor, Model N-100, Hayward CA) in 64 infants and children with ASA physical status I (n = 52) and II (n = 12) undergoing elective surgery not involving thoracic or major abdominal procedures. Average age was 5.1 yr (range, 7 wk to 13 yr). Twenty-eight patients had inhalation anesthesia alone and 36 received narcotics either as premedication or as part of general anesthesia. Thirty-nine patients were given nondepolarizing muscle relaxants and were intubated; the remaining 24 had anesthesia via face mask. Muscle relaxants were reversed at the end of surgical procedures with atropine and neostigmine. In all patients SaO₂ was measured preoperatively in room air by placing the sensor of a pulse oximeter on a fingertip or a toe. Postoperatively all patients breathed 100% O₂ by mask for at least 3 min after nitrous oxide was turned off and spontaneous breathing well established. After the mask was lifted, patients were allowed to breath room air spontaneously for an additional 3 min while SaO₂ was monitored continuously and recorded at 30-s intervals. If SaO₂ dropped below 90% during this period of simulated transport, O₂ was given by mask and measurement was discontinued. All patients in whom SaO₂ was below 95% after this period of observation were transported to the PAR with supplemental O₂ insufflation by mask. Paired and unpaired t-tests were used for statistical analysis.

RESULTS AND DISCUSSION: Preanesthetic (control) SaO₂ was 98.2 ± 0.16 (SEM)%. Before the O₂ mask was lifted at the end of anesthesia SaO₂ was usually

100%. By 1 min of room-air breathing average SaO₂ decreased to 96.4 ± 0.40% (p < 0.001 compared with controls); at 2 min it dropped to the lowest level (94.6 ± 0.55%, p < 0.001). Average time to reach the steady lowest level of SaO₂, indicating completion of O₂ wash-out, was 2.05 ± 0.08 min; mean lowest SaO₂ was 92.8 ± 0.64%. In patients younger than 4 yr, time to the lowest SaO₂ level was 1.76 ± 0.11 min, significantly (p < 0.005) shorter than in patients 4 yr and older (2.28 ± 0.10 min). This difference indicates that infants and young children indeed reach the lowest SaO₂ more rapidly, most likely because they have relatively small FRC in relation to body weight and alveolar ventilation.

Hypoxemia, defined as SaO₂ at or below 91% (estimated PaO₂ = 60 mmHg), occurred in 16 patients (25%). As in our previous study (1), there was no significant difference in the incidence or the level of SaO₂ in relation to age, duration of anesthesia, or anesthetic technique (inhalation only versus narcotics). In addition, there was no difference in SaO₂ between patients with ASA physical status I and II. Thus, the benefit of 100% O₂ breathing to increase oxygenation in spontaneously breathing children during the immediate postanesthetic period does not last for more than 2 min of room-air breathing; its benefit is even shorter in children younger than 4 yr. Since 25% of these children become hypoxemic within 3 min of removal of the O₂ mask, supplemental oxygen during transport from the OR to the PAR is recommended as a routine procedure in pediatric anesthesia.

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