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TITLE: GLOTTIC COMPETENCE IN POSTOPERATIVE PATIENTS USING 2% AMMONIA

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INTRODUCTION: The technique of ammonia inhalation to assess glottic competence has been used to evaluate the effects of age, topical anesthesia and intravenous medications on laryngeal function.¹⁻³ We performed serial pre and postoperative evaluations of glottic competence in a heterogeneous group of surgical patients using this technique to measure the effect of endotracheal intubation on glottic function.

Methods. Twenty-three patients, ages 21-70 years, scheduled for elective surgery were included in the study, nineteen scheduled for major thoracic or abdominal surgery requiring endotracheal intubation and four patients scheduled for surgical procedures that did not require endotracheal intubation. The protocol for this investigation was approved by the Committee on Studies Involving Human Subjects, and we obtained informed consent from each patient. A 13 L Collins recording spirometer was modified in the manner of Hinkle and Tatum to deliver mixtures of 2% ammonia in air into the circuit just proximal to the mouthpiece.² A 50 cc. glass syringe was filled with increments of either 2.5, 5, 10, 20 or 40 ml. of 2% ammonia in air and diluted to a total volume of 50 ml. with room air. Once a regular pattern of respiration was established, the ammonia-air mixture was injected rapidly into the circuit during expiration. The kymograph tracing was observed during the next inspiration, and each positive response to ammonia inhalation was noted. A positive response to the ammonia-air mixture was defined as either: 1) a check in inspiration, followed by a resumption of inspiration; 2) a cough; 3) a check in inspiration, followed by inhalation. The final criterion was satisfied if the inspired volume after the ammonia-air injection was one-third or less of the previously recorded tidal volume. The glottic threshold to ammonia inhalation was defined as the smallest volume of 2% ammonia in the ammonia-air mixture that elicited a positive response at least three times out of five. Thresholds were obtained preoperatively. Eleven patients who agreed to follow-up study had a repeat threshold determined twenty-four hours postextubation, or twenty-four hours postoperatively, in the case of nonintubated patients. Data were analyzed using binomial probability and Fisher's Exact Test.

Results: The distribution of preoperative glottic thresholds to ammonia inhalation is presented in Table I. Twenty patients (86%) responded to 40 ml. or less of 2% ammonia in air. Eight intubated and three nonintubated patients were studied at 24 hours postextubation or surgery, respectively. The duration of intubation was from three to nine hours in all patients except for one, who was intubated for nine days. All intubated patients had an increase in threshold to ammonia inhalation compared to their preoperative determination. (Binomial probability=.004), of two patients who had spinal anesthetics supplemented with intravenous sedation and one patient who had a mask general anesthetic, one had an increase in glottic threshold to ammonia inhalation twenty-four hours post-

operatively. The difference in increased postoperative thresholds between the intubated and nonintubated groups is significant ($p=.05$, Fisher's Exact Test.)

Discussion. Our findings using the ammonia inhalation technique to assess glottic competence differ from those of other investigators. The wide variation in preoperative thresholds found in our patients differs from the findings of Hinkle and Claeys.^{1,2} Pontoppidan found similar variations, which he attributed to age.³ While age differences may account for some of our observed variation, smoking habits, underlying pathology and chronic medications may also explain the altered response in our hospitalized population. Other studies have documented the alteration of normal glottic function for up to eight hours postextubation.⁴ Our findings are consistent with those of others and support the suggestion that the sensory function of the larynx is obtunded, and that this alteration in normal function persists for at least twenty-four hours postextubation in patients intubated for surgery. The contrasting rapid return to normal response in two of our three nonintubated patients implicates endotracheal intubation in this loss of function.

Conclusions. 1) The ammonia inhalation technique for the assessment of glottic competence offers the advantages of bedside availability and safety of repeated evaluations. 2) The requirement for patient cooperation limits the technique's usefulness, in patients who are unstable, uncomfortable, or obtunded. 3) There is wide variability of individual responses.

References.

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TABLE I: PREOPERATIVE RESPONSE TO 2% AMMONIA IN AIR

DOSE NH ₃ , ML/BREATH	2.5	5	10	20	40
CUMULATIVE PERCENT RESPONDING	8	17	30	60	86