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Abstract

Purpose: The purpose of this study was to compare the intubation success rates using the I-Gel with three different endotracheal tubes (ETT) in surgical patients without predictors of difficult airway.

- Group PVC = polyvinyl chloride ETT
- Group INT = intubating laryngeal mask airway ETT
- Group FLEX = flexometallic ETT

Background: Supraglottic airway devices can be used as a conduit to intubate patients blindly or with a fiberoptic bronchoscope. The intubating laryngeal mask airway comes with a specially designed armored ETT that facilitates intubation but increases cost. The I-Gel is a unique supraglottic airway device because it has an anatomical shape and gel-filled cuff. The airway channel is shorter and broader compared to other supraglottic devices. This shorter and broader channel may allow an ETT to pass through it more easily. However, the I-Gel does not come with a specially designed companion ETT, nor does the manufacturer provide any recommendations for the types of ETTs to use for intubation via the I-Gel. Previous studies have compared the success rate with a polyvinyl ETT via either an intubating laryngeal mask airway or an I-Gel. No studies have compared blind intubation success rates when using the I-Gel to blindly intubate with either a polyvinyl ETT, intubating laryngeal mask airway ETT, or flexometallic ETT.

Methodology: This was a prospective, randomized controlled trial. Seventy-five ASA I and II patients aged 18-60 years with a Mallampati I or II airway were enrolled. If they had predictors of a difficult airway or ventilation or were an aspiration risk, they were excluded. Subjects were randomized into one of three groups by the type of ETT: Group PVC, Group INT, or Group FLEX.

A standard induction was performed with propofol, fentanyl, and vecuronium. After induction and placement of an appropriately sized I-Gel, a flexible bronchoscope was used to grade the glottic view using the Brimacombe laryngeal mask airway fiberoptic grading score:

- Grade 1- vocal cords not visible
- Grade 2- anterior surface of epiglottis & part of vocal cords visible
- Grade 3- posterior surface of epiglottis with vocal cords
- Grade 4- only vocal cords visible

If the view was a grade 1 or 2 then the I-Gel was removed and reinserted. If the score persisted, then the subject was excluded. If the I-Gel was a size 3, then a 7.0 ETT was passed. If it was a size 4, then a 7.5 ETT was passed. The ETT was lubricated and inserted blindly through the I-Gel. A total of three attempts were allowed. During a second attempt lateral displacement of the larynx was attempted; on the third attempt the ETT size was decreased and blind intubation using lateral displacement of the larynx was attempted. If resistance was met or if
there was an esophageal intubation, the I-Gel was removed, the subject ventilated for one minute, and the attempt at intubation repeated up to a maximum of three attempts. Anesthesia providers were required to have experience blindly intubating via the I-Gel at least 20 times with each type of ETT.

The primary outcome was overall intubation success rate. Secondary outcomes included first attempt success rate, number of maneuvers used, time taken for intubation (time from introducing ETT into I-Gel to appearance of \( E_1 CO_2 \); excludes ventilation time between attempts), cause of failed intubation (resistance or esophageal intubation), and complications. The investigators conducted a pilot study prior to this study and determined the effect size was 0.42 with 90% power at a significance level of \( P < 0.05 \). Sample size (\( N = 75 \) or 25 per group) and statistical analysis was appropriate.

**Result**
No significant differences were found between the groups on baseline demographics. Three patients had a Brimacombe score of 1 or 2 which improved to a 3 or 4 with reinsertion of the I-Gel. First attempt success rate was 16% to 20% higher in Group PVC compared to Group FLEX and Group INT (\( P = 0.04 \); Figure 1). Overall success rate was significantly higher in Group PVC compared to Groups INT and FLEX (\( P = 0.037 \); Figure 1). No differences were found in the frequency of maneuvers to laterally displace the larynx to achieve successful intubation. Time to intubation was similar in Group PVC (10.5 ± 4 sec), Group INT (13 ± 6 sec) and Group FLEX (13 ± 5 sec; \( P = NS \)). Resistance as a cause of failed intubation was similar in Groups PVC (\( n = 3 \)), INT (\( n = 2 \)), and FLEX (\( n = 2 \)); however, the rate of esophageal intubation was significantly higher in Group INT (\( n = 5 \)) and Group FLEX (\( n = 5 \)) compared to Group PVC (\( n = 0 \); \( P < 0.001 \)). No differences were seen in airway trauma between the groups.

![Figure 1. Outcomes](image)

**Conclusion**
Polyvinyl endotracheal tubes had the highest first attempt success rate for blind intubation through an I-Gel compared to an intubating laryngeal mask airway ETT or flexometallic ETT in patients with normal airways.

**Comment**
At my facility we now have I-Gel supraglottic airway devices. So, I was very interested in the results of this study. What this study demonstrated was that first-attempt blind intubation success is around 68% with a
standard polyvinyl ETT in patients without a potential difficult airway who are relaxed with a neuromuscular blocking agent.

However, there are a few caveats. First, optimal intubating conditions are needed—meaning the patient needs to be relaxed. Second, the I-Gel needs to be properly seated. In this study that was defined as a Brimacombe view of grade 3 or 4 via a bronchoscope. Note — this is not the same grading system used for direct laryngoscopy. Fortunately, only 3 patients required reinsertion of the I-Gel to achieve proper seating. Third, about 12% of the time you will need to laterally displace the ETT to get it to blindly pass into the larynx. Fourth, 8% of the time you might have to downsize the ETT. Most importantly, these results only apply to patients with Mallampati 1 or 2 airways and no predictors of difficult airway.

To get proficient with this technique I would practice on a mannequin and on patients without difficult airways. If I was faced with a worst-case scenario of cannot ventilate, cannot intubate and I had an I-Gel then I would place it and confirm I could ventilate. If intubation was required, I would call for help and a bronchoscope and use it to help facilitate intubation. My last resort would be to blindly intubate via the I-Gel. Also, do not forget to generously lubricate the ETT!

Dennis Spence PhD, CRNA

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Patient Safety, Sedation

High-flow versus standard nasal cannula in morbidly obese patients during colonoscopy: A prospective, randomized clinical trial

J Clin Anes 2019;54:19-24
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Riccio CA, Sarmiento S, Minhajuddin A, Nasir D, Fox FA

Abstract

Purpose The purpose of this study was to compare the incidence of desaturation (SpO2 <90%) with high-flow nasal cannula or standard nasal cannula in morbidly obese patients undergoing colonoscopy during propofol sedation. A secondary purpose was to compare the rate of airway interventions and number of desaturation events <90%.

Background Morbidly obese patients are at increased risk for the development of hypoxemia during colonoscopy under anesthesia provider administered propofol sedation. High flow nasal cannula oxygen, upwards of 60 LPM, has been proposed to reduce the risk of airway collapse because it can produce 5 to 6 cm H2O positive pressure. This may prevent airway collapse and subsequent hypoxemia in morbidly obese patients during colonoscopy. However, High Flow Nasal Cannula Oxygen has not been compared to oxygen administered via standard nasal cannula oxygen during propofol sedation.

Methodology This was a prospective, randomized controlled trial at an academic medical center. Morbidly obese patients received anesthesia provider administered propofol sedation for colonoscopy. Patients were excluded if they had severe chronic obstructive pulmonary disease, pregnancy, propofol allergy, pre-procedure hemodynamic instability or were high-risk for aspiration. Sedation consisted of up to 100 mg lidocaine, and bolus of up to 100 mg propofol followed by an infusion titrated to a Richmond Agitation-Sedation Scale score of −3 to −4; moderate to deep sedation. Anesthesia providers were experienced. One provider administered sedation while a second documented care in the electronic medical record. High Flow Nasal Cannula Oxygen was started five minutes before the start of sedation at a setting of 36–40% FiO2 with the flow rate of no more than 60 LPM. In the Standard Nasal Cannula group, oxygen was started five minutes before the start of sedation at 4 LPM. This normally provides 36–40% FiO2. Airway interventions only occurred if oxygen saturation dropped below 90%. At that point, the provider was allowed to intervene by performing any or a combination of: chin lift, jaw thrust, placement of a nasal or oral airway, bag mask ventilation, increasing the FiO2 and/or decreasing the propofol infusion rate.

Statistical analysis and sample size calculations were appropriate. The investigators powered the study to detect a 25% difference in desaturation rates and determined they would need 118 subjects (n = 59 per group). An interim analysis was performed and reviewed by a data monitoring committee who determined it would be futile to continue the study so it was stopped after a total of 59 subjects were enrolled.
Result  There were \( n = 28 \) in the High Flow Nasal Cannula Oxygen group and \( n = 31 \) in the Standard Nasal Cannula group. No significant differences were found in baseline demographics or procedural characteristics except for age (54 vs. 59 years, \( P = 0.02 \)) and the rate of hypertension (64% vs. 90%, \( P = 0.02 \)). Mean BMI was 48.5 Kg/m\(^2\).

The incidence of desaturation was 39% in the High Flow Nasal Cannula Oxygen group and 45% in the Standard Nasal Cannula group (\( P = \text{NS} \)). The median number of desaturation events was 0 in the high flow group and 0 in standard group (\( P = \text{NS} \)). There were 15 airway interventions in the High Flow Nasal Cannula Oxygen group and 14 airway interventions in the Standard Nasal Cannula group (\( P = \text{NS} \)).

Conclusion  No significant differences were found in the rate of desaturation between High Flow Nasal Cannula Oxygen and Standard Nasal Cannula Oxygen in morbidly obese patients undergoing colonoscopy with propofol sedation administered by anesthesia providers.

Comment  High Flow Nasal Cannula Oxygen therapy devices include an air/oxygen blender, an active humidifier, a single heated circuit, and a nasal cannula (see notes at end). High Flow Nasal Cannula Oxygen reportedly reduces anatomical dead space, generates a PEEP effect, can maintain a constant fraction of inspired oxygen, and provides good humidification.\(^1\) In this study, the investigators found no significant differences in the rate of hypoxemia during colonoscopy under propofol sedation. However, the investigators stopped the trial after only half the subjects were enrolled because a preplanned interim analysis found that it would be futile to continue the study based on results from a preplanned O'Brien and Fleming futility test. Only a 6% difference in the incidence of hypoxemia (\( \text{SpO}_2 < 90\% \)) was found between the groups. This would require a sample size of close to 2,200 subjects to detect a significant difference between the groups.

One problem with stopping the study early was that group differences in subject's age and rate of hypertension were found between the two groups. However, the most important variable that impacts the rate of hypoxemia, BMI, was similar. Therefore, I do not think early stopping of the study impacted the results.

A 6% difference in hypoxemia in this population is not enough of a difference for me to consider using this equipment for colonoscopies. I suspect the equipment and consumables are more expensive when compared to a Standard Nasal Cannula. However, if you have the equipment and supplies available, it would be worth trying it out to gain experience with High Flow Nasal Cannula Oxygen.

Dennis Spence PhD, CRNA


NOTE: a figure showing High Flow Nasal Cannula Oxygen equipment and set up can be seen here: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4393594/figure/Fig1/

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Pediatric Anesthesia, Airway

Rates of perioperative respiratory adverse events among Caucasian and African American children undergoing general anesthesia

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DOI: 10.1213/ANE.0000000000003430
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Abstract

Purpose The purpose of this study was to compare the incidence of adverse airway events in African American children vs. Caucasian and other ethnicities.

Background Adverse respiratory events are a major source of adverse events in pediatric patients undergoing general anesthesia. Previous studies generally have not investigated race or ethnicity in relationship to adverse airway events. One study by ENT surgeons reported that African American children were at higher risk for respiratory adverse events after tonsillectomy than other children. African American children also have a higher incidence of obstructive sleep apnea, which is a known risk factor for airway events in the perioperative period.

Methodology This was a retrospective study of 1,148 healthy children aged 2 years to 9 years old undergoing general anesthesia for less than four hours. Exclusion criteria were known difficult airway or preoperative need for supplemental oxygen. Anesthesia and PACU records were examined for demographic information, comorbidities, and for the following outcome variables:

- sat <92% for 2+ minutes
- laryngospasm
- bronchospasm
- persistent cough
- stridor
- reintubation

Result For the entire 1,148 children of all ethnicities, the incidence of adverse airway events was 5.4%. Out of 231 African American children 26 had an adverse event (11.3%). Out of 777 Caucasian children 27 had an adverse event (3.5%, P<0.001). African American children were 3.3 times more likely to have an adverse airway event than Caucasians. There were few Hispanic and other race children but their adverse event rates were intermediate between African Americans and Caucasians. The most common adverse airway events were:

- laryngospasm
- desaturation
- bronchospasm

Several factors independent of ethnicity were observed to be associated with a higher incidence of adverse airway events. These were:

- age 5 or less (P<0.035)
- current or recent URI (P<0.003)
- ETT use (P<0.001)
- deep extubation (P=0.007)

Given the presence of these ethnicity independent risk factors, it is important to note that African American children had a higher incidence of adverse airway events even when these non-ethnic factors were taken into consideration.

Conclusion While a retrospective study, this suggests that African American ethnicity may be an independent risk factor for adverse airway events in pediatric patients. Until more is know about the cause of these increased adverse airway events extra caution is warranted for African-American children.
Comment

Fickle pediatric airways provide anesthetists an opportunity to hone all our airway skills. While intraoperative airway management isn't typically an issue, anesthetic emergence and the early stages of postoperative care are potentially problematic. Adverse airway events are poorly tolerated by children and their lack of reserve can quickly result in cardiovascular decompensation.

Anesthetists are trained to treat adverse airway events; however, prevention is key. This study provides a glimpse into ethnicity's role as an independent risk factor for pediatric adverse airway event. However, its retrospective nature produces data that lacks the hard evidence we yearn for.

At a major children's hospital in Alabama, most of our surgical population was African American. This article's title caught my eye, as it reflected what I believed I had seen clinically. It seemed to me as if the African American children had a tendency to experience more adverse airway events. Personally, I assumed this was due to increased saliva production and/or an increased tongue-to-mouth ratio. I am still unsure what the direct cause of the airway events might be, but I am confident African American children are three times more likely to experience adverse airway events than Caucasian children. Hopefully, we'll know why in the future.

The study also found that ETT use and deep extubations were independent risk factors. I'm not as confident they are truly risk factors. The study's retrospective design left multiple variables uncontrolled, conceivably skewing the results. For example, a 3 year old child with a recent URI may have been intubated and subsequently deep extubated in an unsuccessful attempt to avoid an adverse respiratory event. So then, by default, ETT use and deep extubations might appear to be risk factors for adverse airway events when in fact they were the treatment for a clearly established risk factor.

Ken Taylor, DNP, CRNA