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What is This?
Comparison of Tolerance and Cost-Effectiveness of Two Nasal Anesthesia Techniques for Transnasal Flexible Laryngoscopy

VyVy N. Young, MD1, Libby J. Smith, DO1, and Clark A. Rosen, MD1

Abstract

Objective. (1) Compare tolerance of aerosolized spray versus syringe administration of topical anesthesia for transnasal flexible laryngoscopy (TFL), (2) analyze cost-effectiveness of both techniques.

Study Design. Prospective, blinded, randomized trial.

Setting. Tertiary academic laryngology practice.

Methods. One hundred and eight patients underwent TFL over 3 months. Patients were randomized to receive equivalent dose 1:1 neosynephrine/4% plain lidocaine mixture via aerosolized spray (“spray”) or application with 1-cc syringe (“syringe”). Patients and physicians independently rated comfort of TFL on 5-point scale (1 = not at all comfortable to 5 = very comfortable). Data were collected on patient and endoscopist experience with TFL and reasons for poor tolerance of laryngoscopy. Cost analyses of disposable spray tips and syringes were calculated.

Results. Both patients and physicians reported very high tolerance of TFL. Patient tolerance appears to be similar between spray- versus syringe-administered anesthesia, although study limitations preclude definitive analysis. Poor tolerance of laryngoscopy was reported in 6.5% with comparable distribution between anesthetic delivery methods. There was no impact of patient prior experience with TFL, and there was no difference between anesthetic methods for TFL performed by resident, fellow, or attending. The difference between costs of the disposable spray tip versus syringe was $1.32 per unit.

Conclusions. Use of a 1-cc syringe is an effective method to provide topical nasal anesthesia for TFL and saves $1.32 per unit compared to disposable spray tips. In our practice, transition to syringe-administered nasal anesthesia is projected to save $1300 per 1000 patients, or an anticipated $1000 per year per physician, with excellent patient tolerance of TFL.

Keywords
laryngoscopy, anesthesia, patient tolerance, office procedure, cost effectiveness

Introduction

Transnasal flexible laryngoscopy is a cornerstone evaluation tool of the otolaryngologist’s practice. Like many other in-office laryngeal procedures, transnasal laryngoscopy is generally very well tolerated.1-4 Typically, a combination of local anesthetic and vasoconstrictor is administered prior to the exam to decrease patient discomfort. Various types of local anesthetics have been utilized in the past, including lidocaine, tetracaine, cocaine, and co-phenylcaine, among others.5-8 Vasoconstrictors commonly include neosynephrine or oxymetazoline. The mechanism of delivery of this anesthetic mix may also vary, with options including atomizers, cottonded pledges, loosened cotton balls, and disposable spray tips.

Recently in our institution, there was a concern about potential cross-contamination between patients when utilizing the standard built-in powered atomizer on the SMR cart often found in otolaryngology offices. This was hypothesized to result from the nondisposable end of the atomizer tip. Accordingly, we have sought alternative options for administration of local nasal anesthesia.

The goal of this study was to evaluate 2 different techniques of administration of a single nasal anesthetic/decongestant mix in terms of cost and patient comfort. We evaluated self-reported patient tolerance of flexible laryngoscopy after nasal anesthetic administration via a commercially available disposable spray tip or spray application with a slip-tip 1-cc syringe. We also calculated the associated cost of these 2

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techniques. Secondary objectives were to determine if there were differences in endoscopist’s perception of the ease of laryngoscopy and if there were differences based on endoscopist or patient prior experience with laryngoscopy.

Methods

Approval was obtained from the Internal Review Board (IRB) of the University of Pittsburgh for this prospective, blinded, randomized trial. All consecutive patients undergoing transnasal flexible laryngoscopy with or without stroboscopy at the University of Pittsburgh Voice Center were identified. Patients with age \(<18\) years, with the inability to read or speak English to complete the post-procedure questionnaire, and who provided incomplete questionnaires were excluded.

All patients received topical anesthetic consisting of 0.5 cc of 1:1 mixture of neosynephrine and 4% plain lidocaine prior to their transnasal flexible laryngoscopy (TFL). Before initiation of this study, we previously determined that 5 manual depressions of the Teleflex atomization device (**Figure 1**) (Item MAD500, Teleflex Medical, Research Triangle Park, North Carolina) was equivalent to 0.5 cc volume delivery. Patients were randomized to receive equivalent doses of the same anesthetic/decongestant mix applied to the nostril via aerosolized spray (“spray”) or via topical application with a 1-cc slip-tip syringe without any needle attached (“syringe”) (**Figure 2**). The syringe administered a jet of medication; no injection was performed. The nasal anesthetic was administered by the medical assistant, and thus the physician performing the TFL was blinded to the type of anesthetic delivery device used throughout the study. The medical assistant used the same technique for administering the medication with both delivery methods. The patient was given a paper tissue and asked to tilt their head back slightly while the medical assistant administered the medication with either the spray device or the syringe. The application device was placed against the nasal vestibule, and the medication was deployed. This technique was performed under direct visualization, without the use of a headlight. The medical assistant performed both techniques under the direct supervision of the attending and was able to demonstrate competency and reproducibility multiple times prior to the initiation of this study. The medical assistant was careful to place the device that delivered the medication in the same location on the nose with both devices. TFL was typically performed within 5 to 10 minutes after administration of the topical anesthetic. TFL were performed by either the (PGY-4) resident, the laryngology fellow, or the attending. The attending physician was present for all TFL exams.

Immediately following the procedure, both patients and physicians independently rated comfort of the TFL on a 5-point Visual Analog Scale (VAS) (see appendix at www.otojournal.org). The low end of the scale (1) represented not at all comfortable and the high end of the scale (5) represented very comfortable. Patients were also asked to indicate if that was their first experience undergoing TFL. If the physician perceived that the patient was uncomfortable during the exam, they were also asked to indicate if the patient’s anatomy, inadequate anesthetic effect in the nose, or inadequate anesthetic effect in the throat played a role. All patient and physician responses were entered into a database (Microsoft Excel 2010, Redmond, Washington).

Analyses were performed of patient tolerance of TFL, physician perception of patient tolerance of TFL and reasons for poor tolerance of TFL, initial versus repeat experience with TFL, and experience level of endoscopist. To evaluate cost efficacy of these techniques, we compared costs of the disposable spray tips and 1-cc syringes. We also calculated the difference in time associated with medical assistant administration of each of these techniques and its associated cost. We also evaluated practice patterns in our office by reviewing CPT codes 31575 and 31579 over a 3-month period to calculate cost to the office for these procedures.

Statistical analyses included comparison of proportions tests (MedCalc v. 12.5.0, 2013, Ostend, Belgium) as well as independent samples test (IBM SPSS Statistics for Windows, Version 20.0, Armonk, New York).

Results

One hundred thirteen consecutive patients undergoing transnasal flexible laryngoscopy or flexible videostroboscopy over a 3-month period were evaluated; 5 were excluded due to incomplete questionnaires by the endoscopist. A total

**Figure 1.** Atomization device, reusable bottle with disposable tip.

**Figure 2.** A 1-cc slip-tip syringe without needle attached.
of 108 patients were subsequently analyzed. Forty-nine patients received syringe-administered anesthesia, and 59 patients received spray-administered anesthesia (Figure 3). TFL was performed by the resident, fellow, and attending in 54, 21, and 33 patients, respectively. Eighty-three patients had undergone TFL in the past; 25 had no prior experience with TFL (Table 1).

There was no significant difference in patient tolerance of laryngoscopy between spray- versus syringe-administered anesthesia, \( r(106) = -0.611, P = .543 \) (Figure 4). Means, standard deviations, and confidence intervals are displayed in Table 2. Endoscopist experience with TFL (resident, fellow, or attending) did not impact patient tolerance of TFL (Table 1), and there was no difference between spray- versus syringe-administered anesthesia among each of these subgroups (data not shown).

There was also no difference in physician impression of patient tolerance of TFL between spray- versus syringe-administered anesthesia. This was equivalent to patients’ reports of tolerance of TFL. The primary emphasis of this project was on patient tolerance of TFL, and thus further analyses will focus on patients’ responses only.

**Table 1. Patients’ Self-Report of Tolerance of Laryngoscopy.**

<table>
<thead>
<tr>
<th>Total No. of Patients</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syringe</td>
<td>49</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Spray</td>
<td>59</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Resident</td>
<td>54</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Fellow</td>
<td>21</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Attending</td>
<td>33</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>First time</td>
<td>25</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Not first time</td>
<td>83</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

\*Five-point Likert scale, with 1 = not at all comfortable up to 5 = very comfortable.
There was no difference in patient tolerance between those undergoing initial versus repeat TFL. Overall, 92% of patients undergoing first-time TFL (n = 25) and 83% of patients undergoing repeat TFL (n = 83) reported “good” experience with this exam (as evidenced by a score of 4 or 5 on the Likert visual analog scale). Within each subgroup based on patient prior TFL experience, there was no difference between spray- versus syringe-administered anesthesia.

Poor tolerance (demonstrated by a score of 1 or 2 on the Likert scale) was reported by 7 out of 108 patients, representing 6.5% of TFL exams. There was no difference in patient tolerance between anesthetic methods ($P = .93$) in 4 patients receiving spray anesthetic and 3 patients receiving syringe-administered anesthetic.

Cost analyses were performed of the spray tips and the 1-cc syringe. Both of these devices are single-use items. Total volume of anesthetic mix was equivalent in both techniques, and therefore the cost of the medication was not included in our cost analysis. In our practice, the cost of the disposable spray tip was $1.40 and of the 1-cc syringe was $0.10 with a cost difference of $1.30/unit. While this difference may seem modest initially, in the busy otolaryngology/laryngology practice, this may multiply into more significant savings over time.

Cost analyses were also performed in relation to the medical assistant’s time in administering the nasal anesthesia. Our practice generates a stock reservoir of anesthetic mix at the start of each clinic day for each examination room. For syringe-administered anesthesia, the medical assistant opens the prepackaged 1-cc syringe, draws up 0.5 cc of solution from the stock reservoir, and then delivers this to the nose as described previously. This took an average of 7.8 seconds to perform. For spray-administered anesthesia, the medical assistant attached the disposable spray tip to the atomizer bottle, secured and primed the spray tip, and then delivered the medication to the nose as described previously. This took an average of 12.4 seconds to perform, with an average difference of 4.6 seconds between these 2 techniques. Assuming an average medical assistant salary to be $13.00/hour, this results in an additional cost savings of approximately 1.6 cents per use of syringe-administered anesthesia.

To assess overall financial impact, we analyzed CPT billing trends in our tertiary laryngology division practice of 3 laryngologists over a 3-month period. During this time, there were approximately two hundred 31575 (flexible laryngoscopy) and six hundred 31579 (stroboscopy) codes billed. Our practice performs both rigid and flexible stroboscopy, with approximately two-thirds performed via flexible technique. Extrapolation from these data suggests approximately 2400 flexible exams per year for our 3-physician division. Assuming 1 application of anesthetic per patient, this could result in approximately $3000 in savings for our 3 laryngologists annually. We estimate that transition to use of syringe-administered anesthesia delivery devices, which demonstrates no decline in patient tolerance of TFL, will result in a savings of about $1000 per physician per year for our group.

### Discussion

This prospective, blinded, randomized study demonstrates that transnasal flexible laryngoscopy is extremely well tolerated by patients. This finding is consistent with multiple other studies.1-4 In our study, patient tolerance of TFL was similar regardless of either patient prior experience with laryngoscopy or endoscopist experience level. Patient tolerance of TFL was also similar between syringe versus spray administration of an anesthetic/decongestant agent.

Although these findings are encouraging and we believe them to be clinically meaningful, it must be noted that there are several limitations to this study. First, to address concerns regarding low statistical power in this study, a larger study would be required to provide additional information to confirm these findings. Additionally, while a Likert scale is a commonly utilized psychometric instrument in this type of research, this scale has not been specifically validated to assess patient comfort with laryngoscopy. To date, there exists no specifically validated survey to examine patient tolerance in this way. Therefore, we cannot comment on the validity of this particular survey or the associated reliability of patient responses. Use of a properly validated survey would provide reliability and validity to these findings.

### Table 2. Comparison of Syringe Versus Spray Anesthesia Delivery Methods.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>P Value</th>
<th>Mean Difference</th>
<th>Standard Error</th>
<th>Difference</th>
<th>95% Confidence Interval of Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray</td>
<td>59</td>
<td>4.339</td>
<td>0.95791</td>
<td>0.543</td>
<td>0.014</td>
<td>−0.11449</td>
<td>0.1875</td>
<td>−0.48622</td>
<td>to 0.25724</td>
</tr>
<tr>
<td>Syringe</td>
<td>49</td>
<td>4.2245</td>
<td>0.98457</td>
<td>0.543</td>
<td>0.536</td>
<td>−0.11449</td>
<td>0.1875</td>
<td>−0.48622</td>
<td>to 0.25724</td>
</tr>
</tbody>
</table>
Other important considerations in relation to this study should be emphasized. The finding that endoscopist experience level did not impact patient tolerance may be counter-intuitive to many. It is important to note that the residents involved in this study were PGY-4 level residents and thus have had considerable previous experience with laryngoscopy over the course of their training and were always accompanied by the attending or fellow. This finding may not be applicable to more significantly less experienced endoscopists.

Additionally, cost analyses and thus cost savings may be impacted by individual and/or institutional differences in the costs of the disposable spray tips versus 1-cc syringes. Although the time differential between spray- versus syringe-administered anesthesia was found to be minimal, it is possible that variations in medical assistant experience, performance, and salary may also impact cost analyses. More importantly, our group has a busy, tertiary laryngology practice. For smaller volume clinics, the cost savings of a transition to syringe-administered anesthesia, as described here, may be reduced.

Finally, TFL is overall a generally very well tolerated procedure. A recent systemic review attempted to evaluate the effectiveness of topical anesthetic regimens. Among the 8 included randomized controlled trials, 5 did not show benefit from use of topical anesthetic treatment. However, these studies were limited by variability of format in and lack of sensitivity of outcome data, and a true meta-analysis was unable to be performed. The authors of this review themselves acknowledge the use of topical nasal anesthetics as an “intuitive and logical practice used daily by many otolaryngologists” and comment on the potential for beneficial effect from lubrication and decongestant agents, which were not specifically evaluated in any of the studies reviewed. They observe that their review suggests that nasal anesthetic regimens may not be necessary for TFL but also suggest that additional investigation is warranted to clarify these issues further. For purposes of the current study, the decision was made not to include an arm without any anesthetic as this is not part of our routine clinical care. Certainly in a future study, this would be an interesting group for additional comparison.

We agree with these authors that a larger study may be required to elicit clinically significant differences between any of these groups. Currently, most otolaryngologists and patients seem to favor the use of nasal anesthesia for improved patient comfort. Our own clinical experience mirrors this observation. This study demonstrates that the use of topical nasal anesthetic/decongestant agents may be advantageous and can be applied via more cost-effective methods.

**Conclusions**

Use of a 1-cc syringe and single-use spray attachments are equivalent delivery methods of topical nasal anesthesia/decongestant mix for TFL. The use of 1-cc syringes saves $1.32 per unit compared to disposable spray tips. In our practice, transition to syringe-administered nasal anesthesia is projected to save $1.32 per patient, or an anticipated $1000 per physician per year. This cost savings can be realized while continuing to maintain excellent patient tolerance of trans-nasal laryngoscopy procedures and avoiding cross-contamination concerns.

**Acknowledgments**

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**Author Contributions**

VyVy N. Young, study design/concept, data acquisition and analysis, manuscript drafting/revision, final approval of manuscript; Libby J. Smith, study design/concept, data acquisition, manuscript revision, final approval of manuscript; Clark A. Rosen, study design/concept, data acquisition and analysis, manuscript revision, final approval of manuscript.

**Disclosures**

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**References**


