Chondrolaryngoplasty Under General Anesthesia Using a Flexible Fiberoptic Laryngoscope and Laryngeal Mask Airway

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Objectives: To describe a surgical and anesthetic technique for chondrolaryngoplasty (“tracheal shaving”) involving external translaryngeal needle insertion under general anesthesia, using a flexible fiberoptic bronchoscope and laryngeal mask airway.

Design: Retrospective review of 31 patients who underwent chondrolaryngoplasty performed by a single surgeon.

Setting: Academic medical center.

Patients: Thirty-one consecutive patients presenting for aesthetic treatment of their thyroid cartilage.

Results: The procedures were all successful, with no voice complications and only 1 transient anesthetic complication.

Conclusion: Chondrolaryngoplasty with translaryngeal needle placement to identify the level of the anterior commissure is a safe, effective surgical technique that minimizes the most significant risks of the surgical procedure.


Chondrolaryngoplasty or “tracheal shaving” is a cosmetic surgical technique described by Wolfort and Parry in 1975 and later modified from the original technique by Wolfort et al. An additional approach to chondrolaryngoplasty, in conjunction with endoscopic examination, has been recently described. At our institution, this cosmetic technique is frequently performed for transgendered women (male to female) for whom the prominent “Adam’s apple” serves as a masculine marker. Not only transgendered women seek this procedure, however. Several natal men and women have also undergone chondrolaryngoplasty by the senior author (J.H.S.) to improve their appearance.

The surgical technique involves reducing or shaving the thyroid cartilage prominence, thereby minimizing the appearance of this male physical characteristic. An optimal result involves removal of all anteriorly projecting thyroid cartilage. However, this aesthetic result must be tempered by minimizing the risks of destabilizing the anterior commissure tendon, a potentially disastrous and irreversible injury to a patient’s voice. This injury is especially devastating for transgendered women, for whom lowering of the voice is a particularly difficult handicap to overcome. To minimize this risk, we perform fiberoptic laryngoscopy during the procedure and place a 22-gauge needle through the laryngeal cartilage to identify the level of the anterior commissure.

Chondrolaryngoplasty can be performed under either local anesthesia with sedation or general anesthesia with endotracheal intubation. Of course, endotracheal intubation greatly limits the ability to use fiberoptic laryngoscopy to identify the level of the anterior commissure of the true vocal cords at the time of surgery. Local anesthesia works well, although potential disadvantages of this anesthetic approach include patient anxiety and increased surgical difficulty owing to poor patient cooperation or reflexive coughing and swallowing. The surgical technique described by Wolfort et al has been performed safely under general anesthesia with endotracheal intubation. However, as mentioned, the presence of an endotracheal tube greatly limits the usefulness of flexible laryngoscopy, and the position of a localizing needle passed through the laryngeal cartilage relative to the anterior commissure may not be clear.

The safe and effective uses of combined laryngeal mask airway (LMA) and...
flexible laryngoscopy or bronchoscopy during general anesthesia for otolaryngologic therapeutic interventions in adults and for a diagnostic intervention in a neonate have been described.4-6 Dr Spiegel’s patients typically undergo additional facial plastic surgical procedures that require general anesthesia and thus endotracheal tube placement following chondrolaryngoplasty. However, to use fiberoptic localization of the anterior commissure and marking with a needle, the patient must not have an endotracheal tube in place during the tracheal shave procedure. We have circumvented this problem by having the procedure begin with an LMA for the tracheal shave, after which an endotracheal tube is placed.

**METHODS**

From February 2005 through August 2006, 31 healthy adults, American Society of Anesthesiologists (ASA) physical status I or II, underwent chondrolaryngoplasty under general anesthesia. Additional patients underwent chondrolaryngoplasty performed under local anesthesia with sedation, and they are not included in this report. Fiberoptic laryngoscopy was done with a flexible fiberoptic bronchoscope (FFB) with a distal chip camera, Evis Lucera BF-6C260 videobronchoscope, CV-260 video processor, and CLV-260 light source (the individually listed pieces of FFB were all manufactured by Keymed LTD, Olympus, Central Valley, Pennsylvania, and shipped as 1 unit).

**ANESTHETIC MANAGEMENT**

Premedications consisted of dexamethasone sodium phosphate, 10 mg intravenously, and midazolam, 2 to 7 mg intravenously. Standard ASA monitoring was performed. Induction was achieved with propofol, 1.8 to 3 mg/kg, fentanyl citrate, 0.6 to 3.3 µg/kg, and lidocaine hydrochloride, 0.5 to 1.4 mg/kg. Either a North America Classic (San Diego, California) or an Ambu (Glen Burnie, Maryland) LMA, size 4 or 5, was inserted. Adequate LMA placement was confirmed by capnography, visible chest rise during positive pressure ventilation, adequate seal at 20 cm H2O, and adequate exhaled gas volume. A fiberoptic swivel connector was attached to the LMA for FFB insertion. Spontaneous ventilation was maintained while delivering isoflurane, isoflurane and nitrous oxide, sevoflurane, sevoflurane and nitrous oxide, or desflurane. The operating room and equipment were arranged before induction (Figure 1). The FFB display tower was placed in full view of both the surgeon and the anesthesia care provider. On completion of the chondrolaryngoplasty, if more cosmetic surgery was scheduled, the LMA was converted to an endotracheal tube (ETT); otherwise, the administration of anesthetic was terminated shortly thereafter. After the patient’s emergence from anesthesia, the LMA or ETT was removed, and the patient was transferred to the recovery room. Postoperative patients were

![Figure 1. Positioning of operating room equipment for chondrolaryngoplasty with endoscopic visualization of the true vocal folds through the laryngeal mask airway. Note endoscopy cart to the left of the patient’s headrest where both the anesthesiologist and the right-handed surgeon will clearly see the image.](https://jamanetwork.com/otolaryngology/ent)
monitored in the hospital for at least 4 hours to watch for airway compromise. No patients developed stridor or had hoarseness at 4 hours after the procedure.

OPERATIVE TECHNIQUE

After the surgical field is cleaned and prepared with an iodine-based surgical preparation, the thyroid cartilage notch (Adam's apple) is marked with a surgical marker (Figure 2). An incision in the crease of the cervicomental angle of approximately 2 cm is marked. If a deep neck rhytid is present overlying the larynx, the patient is presented with the option of making the surgical incision within this rhytid. The incision site and area over the thyroid cartilage are injected with 1% lidocaine hydrochloride with 1:100,000 epinephrine. The incision is made, and subcutaneous dissection is performed to the area of the thyroid cartilage. Blunt dissection between the strap muscles exposes the overlying perichondrium of the thyroid cartilage. An incision is made through the perichondrium along the anterior angle of the thyroid cartilage, extending to the left and right superiorly along the superior edge of the cartilage. Subperichondrial dissection is then performed to expose the cartilage (Figure 3). A curved hook is placed on the posterior surface of the thyroid cartilage in the midline at the base of the notch, and superior-to-anterior retraction is performed.

At this point, the anesthesiologist advances the fiberoptic endoscope through the LMA until the anterior commissure of the larynx is visible. This can be challenging because retraction on the cartilage can move the laryngeal inlet to a position more anterior than normal. Not all styles of LMA are created equal. In our institution, we have discovered that the reusable, sterilizable LMA functions better for endoscopy than the disposable, single-use LMA. Once a good view of the commissure is obtained, the surgeon takes a 22-gauge needle and inserts it in the midline (Figure 4). The needle is inserted at a point above which the surgeon would like to remove all cartilage for maximal cosmetic result. Owing to ossification of the cartilage with age, the needle may need to be placed with a twisting, drilling motion. Although this can require patience, there have been no patients in whom a gentle drilling motion with a 22-gauge needle failed to pass through the cartilage. We have tried this procedure with a thinner needle but find that 22-gauge needles are the smallest that reliably can be passed through the often ossified thyroid cartilage. Once the needle is passed through the midline, its position is visible on the video screen (Figure 4). The surgeon chooses to leave at least 2 mm of cartilage and tissue above the superior surface of the true vocal cords to provide a high certainty of adequate support. If the needle is too low, it is withdrawn and passed again more superiorly. The safety of placing small holes through the laryngeal cartilage has been established by prior reports. Occasionally there is anteriorly projecting cartilage inferior to the level of the anterior commissure. When this occurs, it is necessary to accept a less-than-ideal cosmetic result rather than to risk lowering the voice. On occasion, it may be possible to shave part of the projecting cartilage (less than full thickness), although this procedure subjects the patient’s voice to increased risk and is not recommended for the surgeon who only occasionally performs chondrolaryngoplasty.

Once a safe level has been identified, this level is marked on the cartilage, and the needle and endoscope may be withdrawn. Visible or palpable anteriorly projecting cartilage superior to the mark is then removed, but not including, the inner perichondrium. Bleeding is carefully controlled with a bipolar cautery, then the strap muscles are reaproximated in the midline, and the wound is closed in layers. No drains have been necessary.
RESULTS

Our 31 patients had a mean age, height, and weight of 41 years (range, 20-67 years), 1.78 m (range, 1.53-1.88 m), and 74.2 kg (range, 56.8-100 kg), respectively. Twenty-five patients underwent additional facial plastic surgery, whereas 6 patients underwent chondrolaryngoplasty only. No intraoperative or postoperative surgical complications occurred. None of our patients reported any change in their voice. All but 1 reported satisfaction with the degree of improvement they achieved. The 1 dissatisfied patient would prefer additional improvement, but the insertion into the patient's anterior commissure is such that additional improvement is not possible without excessive risk to displacement of the anterior commissure and lowering of the voice.

There was 1 anesthetic complication. During translaryngeal needle insertion, a small amount of blood from the insertion site was noted to extend over the vocal cords during fiberoptic examination, which immediately triggered a laryngospasm. No airflow was confirmed by loss of exhaled gas measurement and by the presence of new air leak around the LMA during attempts at positive pressure ventilation. Propofol, 50 mg intravenously, and succinylcholine chloride, 20 mg intravenously, were given immediately, with rapid reversal of the laryngospasm and adequate ventilation. The patient's hemodynamics remained stable, and the oxygen saturation remained 99% during this episode. Otherwise, no difficulties in advancing the flexible fiberoptic bronchoscope through the LMA, or LMA to ETT conversion difficulties, occurred. Postoperatively, no evidence of pulmonary edema or respiratory distress were noted. Topical lidocaine sprayed onto the vocal folds at the time of endoscopy may mitigate the risk of this occurrence.

COMMENT

Chondrolaryngoplasty is a safe cosmetic procedure regularly performed at our institution both alone and preceding extensive facial surgical procedures lasting up to 10 additional hours. The efficacy and safety of this procedure in reducing Adam's apple prominence have been described previously but not with the use of fiberoptic identification of the level of the anterior commissure of the true vocal cords.1,2 The safe and optimal completion of our described technique, devised by 1 of us (J.H.S), requires collaboration by both surgeon and anesthesiologist. Results may be significant (Figure 5).

The LMA is an ideal airway device for chondrolaryngoplasty, mainly because it allows the surgeon to optimize tracheal shaving while minimizing injury to the vocal cords. Inadvertent injury to the anterior commissure can destabilize the vocal cords, thereby producing irreversible voice change. Direct guidance of translaryngeal needle placement was facilitated by direct endoscopic imaging of the glottic structures while maintaining ventilation through the LMA.

Laryngospasm is a known complication of vocal cord irritation in the presence of a light plane of anesthesia. Afferent superior laryngeal nerve stimulation mediates this reflex closure.8 The rescue treatment was a low dosage of depolarizing agent. Increasing the depth of anesthesia might have been an acceptable option had the laryngospasm not been so severe and rapid. The use of the LMA for better airway control than that provided by sedation techniques has been supported recently.4 Our recent anesthetic complication, nonetheless, highlights the lack of absolute airway protection an LMA provides, especially during laryngospasm. Furthermore, the availability of endoscopy during this event allowed for immediate diagnosis and a quick and efficient response, which minimized any delay in ventilation and oxygenation to the patient. Laryngotracheal topical anesthesia spray (such as lidocaine) may minimize this risk.

In conclusion, the LMA in conjunction with fiberoptic bronchoscopy under general anesthesia is a safe anesthetic approach to chondrolaryngoplasty that further enhances the ability of the surgeon to protect the patient from lowering of the vocal pitch and loss of vocal quality. The surgeon can minimize the risk of vocal cord disruption while maximizing a safe cosmetic result, and the anesthesiologist can rapidly detect ventilatory compromise through direct vision of the airway.

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REFERENCES