Transcutaneous Teflon® Injection for Unilateral Vocal Cord Paralysis: An Update

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INTRODUCTION

Unilateral vocal cord paralysis can lead to significant impairment of vital laryngeal functions. Airway protection, respiration, and phonation are often compromised due to inadequate glottic closure. Since the turn of the century, a variety of innovative techniques have been introduced in an effort to restore glottic competence in cases of paralytic dysphonia.

In 1911, Brunings described a technique of injecting the paralyzed vocal cord with paraffin by means of a transoral laryngoscopic injection.[1] This technique was eventually abandoned due to frequent extrusion of the implant, with development of a paraffinoma. Arnold revived Brunings' technique of intracordal injections in 1955 using autogenous and homogeneous cartilage particles.[2] Subsequently, a number of materials have been used in an attempt to augment the paralyzed vocal cord, including bovine bone paste,[3] tantalum oxide,[4] silicone,[5] and Teflon.®[6]

Teflon paste (polytef PTEF, Mentor Division of Codman and Shurtleff, Inc., Randolph, Mass.), a polymer of tetraflouroethylene, is a bioinert material that is relatively well tolerated by tissues with no evidence of carcinogenicity.[7] Following histological studies of Teflon® injections in humans, Stone and Arnold[8] stated that there was minimal foreign body reaction at the injection site and that Teflon particles eventually become walled off by a fibrous capsule. In addition, Teflon appears to be poorly resorbed over time.[9]

Particulate polytef (Teflon) suspended in glycerine was introduced as a means of vocal rehabilitation of paralytic dysphonia by Arnold in 1962.[10] Since Food and Drug Administration approval in 1972, numerous investigations have confirmed the safety and efficacy of Teflon injection in the treatment of vocal cord paralysis.[11,12]

The procedure of Teflon injection generally requires suspension laryngoscopy under topical or general anesthesia. Occasionally, however, laryngoscopy is not feasible due to trismus, neck rigidity, or other anatomical considerations. In addition, many patients present as poor surgical risks for general anesthesia. In 1985, the senior author (P.H.W.) described a technique for Teflon injection of the paralyzed vocal cord via a transcutaneous route under local anesthesia.[13] Excellent results were observed in two patients undergoing this method of vocal cord augmentation. The procedure is now routinely applied to all patients with unilateral vocal cord paralysis who will accept local anesthetic. Since 1985, 24 injections have been performed in 21 patients using this approach, with results comparable to traditional techniques.

TECHNIQUE

Our method of transcutaneous Teflon injection has been previously described.[13] After informed consent, the patient is positioned in an upright, comfortable position. Premedication with sedatives or pain medication is avoided because the procedure requires an awake, cooperative patient. Topical anesthesia of the nose, nasopharynx, pharynx, and larynx is achieved by using topical cocaine or Xylocaine® spray and applying anesthetic-soaked cotton pledgets. The neck skin overlying the cricothyroid membrane is then anesthetized using a 1% lidocaine solution. Additional lidocaine is infiltrated at the tips of the greater horns of the hyoid bilaterally for anesthesia of the superior laryngeal nerves. The neck is prepared with povidone-iodine solution and draped with sterile towels.

The procedure requires a surgeon and an assistant. The larynx is observed by means of a videocamera attached to either a Hopkin's rod telescope or a

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flexible fiberoptic telescope. A microphone allows simultaneous monitoring of voice and video signals. A Lewy or Brunings syringe is filled with Teflon paste, and an 18-gauge spinal needle is attached. Note that the 10-inch guarded needle conventionally used for transoral vocal cord injection cannot be used for this technique.

The spinal needle is introduced through the skin and cricothyroid membrane in the midline and advanced into the subglottic lumen. The needle is directed laterally into the anterior third of the paralyzed cord approximately 3 to 4 mm below its upper margin. Positioning can be verified by medial motion of the involved cord with manipulation of the spinal needle. After a test injection to confirm proper needle placement, Teflon is injected until the desired position is achieved. Typically, this requires 0.6 to 0.8 cm^3 of Teflon. A second injection near the anterior portion of the middle third of the vocal cord may be required to achieve the necessary glottic competence. The patient is asked to phonate to document adequate glottic closure as well as sufficient airway patency. The needle and telescope are removed, a sterile bandage is placed over the cutaneous injection site, and the patient is closely observed for signs of respiratory distress. Broad-spectrum antibiotics and analgesics are prescribed postoperatively. We have not found it necessary to administer steroids in this clinical setting. To prevent Teflon from extruding out the needle tract, patients are placed on strict voice rest for 4 to 5 days following injection.

RESULTS

Since 1985, a total of 21 patients with paralytic vocal dysphonia have undergone transcutaneous Teflon injection by the senior author. Two of these patients have been previously reported. Overall, 24 Teflon injections have been performed in this manner. Patient ages ranged from 35 to 91 years, with a mean age of 54 years. There were 15 men and 6 women. Fourteen patients had left-sided vocal cord paralysis, while 7 had right-sided lesions. Causes of vocal paralysis are listed in Table I. All procedures were performed on an outpatient basis. Twenty of the 21 patients in this series demonstrated significant improvement in dysphonia and/or aspiration. One patient continued to demonstrate breathy voice with aspiration despite 3 separate injections. Another patient who had undergone vertical hemilaryngectomy required a second injection of the reconstructed cord to achieve optimal results. Complications included the development of significant airway distress in 1 patient who did not require intubation or tracheostomy. No patient experienced significant bleeding, postoperative pain, infection, or hematoma formation.

TABLE I.
Causes of Vocal Cord Paralysis.

Disorder	No. of Patients
Metastatic disease	5
Postpneumonectomy	5
Esophageal disease/surgery	1
Skull base surgery	2
Posthemilaryngectomy	2
Thymoma/surgery	1
Idiopathic	5

DISCUSSION

Since its introduction in 1962, traditional methods of vocal fold augmentation with Teflon have used a laryngoscopic approach with injection of Teflon under direct visualization. Transcutaneous Teflon injection was originally developed for patients with trismus or other anatomical limitations which precluded direct laryngoscopy. The technique was later expanded to include that subset of patients considered to be poor operative risks. Our initial success with this procedure eventually led us to expand its application to include essentially all patients with unilateral vocal cord paralysis who would accept local anesthetic.

Our results with transcutaneous Teflon injection in cases of unilateral paralytic dysphonia are similar to those of McCaffrey, *et al.*[14] and compare favorably to those reported using conventional transoral techniques.[11,12,14] While admittedly subjective, 20 of the 21 patients undergoing this procedure demonstrated significant improvement in vocal quality and/or aspiration as assessed by both the patient and physician. One patient with severe lateralization of the involved cord demonstrated persistent breathy voice and aspiration despite three separate injections. This type of patient is perhaps better served using augmentation laryngoplasty techniques. Another patient required two separate injections of a surgical neocord to achieve optimal glottic closure. This case highlights the obvious difficulties encountered with injection of scarred, poorly mobile tissue.

The single complication in this series was that of acute airway obstruction requiring admission and conservative medical management. Acute airway obstruction following Teflon injection has been reported to occur in approximatley 1% of cases.[12] Injection of Teflon not only adducts the paralyzed cord, but also gives rise to an acute inflammatory reaction that generally subsides within 1 to 2 weeks.[15] In addition, objective analysis has documented significant inspiratory airflow obstruction persisting up to 10 days following Teflon injection.[16,17] No correlation between the amount of Teflon injected and the degree of airway obstruction appears evident. For these reasons, patients undergoing transcutaneous Teflon injection should be observed closely following the procedure for evidence of respiratory embarrassment. In addition, patients should be instructed to remain locally for at least 24 hours following injection.

While not observed in the present series, all

reported complications associated with conventional Teflon injection procedures are possible with the transcutaneous route.[5,12] These include edema, granuloma formation, infection, laryngeal stenosis, overinjection, and drift or misplacement of Teflon. Caution against overinjection in particular is necessary with this technique because many of these patients are unable to undergo direct laryngoscopy. Removal of Teflon in these instances would require laryngofissure for proper exposure.

Indications for transcutaneous Teflon injection are similar to those proposed with more traditional techniques.[10,18] These include *1.* unilateral vocal cord paralysis secondary to trauma, infection, malignancy, surgery or neurological disease; *2.* glottic incompetence following hemilaryngectomy; and *3.* idiopathic vocal cord paralysis lasting longer than 1 year.

Relative contraindications include *1.* bilateral vocal cord paralysis in the paramedian position; *2.* psychologically unstable patient; *3.* paralysis lasting fewer than 6 months unless due to malignancy or surgery; and *4.* myasthenia laryngis.[10,18]

This procedure offers several clear advantages in the treatment of unilateral vocal cord paralysis. First, patients are awake throughout the procedure, enabling the surgeon to more accurately assess the alteration in vocal quality and glottic competence as a direct result of intracordal injection. Secondly, the risk of overinjection is diminished since luminal patency can be dynamically assessed at all times. Third, video documentation is available throughout the procedure. Simultaneous stroboscopic analysis is feasible as well with this approach. Also, the use of local anesthesia avoids the inherent dangers of general anesthesia in a patient population that is often at increased risk for complications. Transcutaneous Teflon injection also allows vocal rehabilitation in those cases where direct laryngoscopy is not technically feasible. Finally, costs and resource expenditures are greatly reduced because the procedure is performed in an outpatient setting.

Most patients who are likely to benefit from transoral Teflon injection are suitable candidates for transcutaneous injection. As with any surgical procedure, however, proper patient selection is mandatory. The expected difficulties in achieving glottic competence in cases of a severely lateralized cord or a reconstructed neocord should be obvious. Patient cooperation is essential if optimal results are to be obtained.

Despite the recent enthusiasm regarding more sophisticated techniques for treating paralytic dysphonia, such as thyroplasty and nerve pedicle grafts, intracordal Teflon injection still plays a vital role in the treatment of this disorder. The overall effectiveness, safety, simplicity, and cost advantages of transcutaneous Teflon injection in cases of paralytic dysphonia support its widespread use.

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