

Recovery of function after intracordal autologous fat injection for unilateral recurrent laryngeal nerve paralysis

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Abstract

The present report documents the successful outcome in three patients with a unilateral recurrent laryngeal nerve paralysis managed with an intracordal injection of autologous fat who ultimately experienced a complete recovery of function. Such data demonstrates the safety of intracordal autologous fat injection in patients who ultimately recover function.

Key words: Vocal cord paralysis; Surgery, operative

Introduction

According to the committee on Speech, Voice, and Swallowing Disorders of the American Academy of Otolaryngology – Head and Neck Surgery, laryngeal framework surgery, and injection laryngoplasty are the main surgical procedures available to palliate the consequences of a unilateral recurrent laryngeal nerve paralysis (Benninger *et al.*, 1994). Numerous materials such as Teflon, silicon, Gelfoam, collagen, fascia, and fat have been used at the time of injection laryngoplasty (Benninger *et al.*, 1994).

Following the initial report by Mikaelian *et al.* (1991) of the successful use of autologous fat, we elected at our department to use this material when performing injection laryngoplasty in patients with a unilateral recurrent laryngeal nerve paralysis. During the period 1995–1997, 30 patients with a unilateral recurrent laryngeal nerve paralysis were managed at our department with an intracordal injection of autologous fat, and three (10 per cent) ultimately experienced recovery of function. Based on a review of the medical charts and operative files of these three patients, the present report analyzes the outcome of speech and voice in patients recovering from a unilateral recurrent laryngeal nerve paralysis.

Case reports

Case 1

A 69-year-old man was referred to our clinic for severe dysphonia and grade 1 aspiration according to Pearson's scale (Pearson, 1981) following left pneumonectomy with mediastinal lymph node dissection for squamous cell carcinoma of the lung, classified as T₂ N₁. Indirect laryngoscopy revealed a left recurrent laryngeal nerve paralysis. Under fibre-optic nasendoscopy, occasional laryngeal penetration was noted when evaluating swallowing with pureed food coloured with methylene blue. Selected speech and voice parameters recorded using the

Computed Speech Lab and Multidimensional Voice Program from Kay Elemetrics (Kay Elemetrics) are presented in Table I. Treatment was an intracordal autologous fat injection. The day after the intracordal injection, oral alimentation was normal without evidence of laryngeal penetration and the voice was subjectively considered as greatly improved by the patient. Three months following the injection, the patient felt that his voice was still improved while the left hemilarynx remained paralyzed. This subjective improvement was confirmed by the acoustic recordings of selected speech and voice parameters (Table I). At six months following the intracordal injection of autologous fat, clinical examination noted a complete recovery of the laryngeal motion without synkinesis with a normal voice. Acoustic recordings were performed and are presented in Table I. The patient is alive without evidence of disease nine months from the intracordal injection of autologous fat.

Case 2

A 70-year-old woman was referred to our clinic for severe dysphonia and grade 2 aspiration according to Pearson's scale (Pearson, 1981) after left pneumonectomy and mediastinal lymph node dissection for pulmonary adenocarcinoma, classified as T₂N₂. Clinical examination revealed a left recurrent nerve paralysis with laryngeal penetration when evaluating swallowing with pureed food coloured with methylene blue. A naso-gastric feeding tube was inserted and the patient was febrile. Acoustic recording was not available. Treatment was an intracordal autologous fat injection. The day after injection, oral alimentation was achieved without evidence of laryngeal penetration, the naso-gastric feeding tube was removed, and the voice was subjectively considered as greatly improved by the patient. At 10 months following the intracordal injection of autologous fat, clinical examination

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Accepted for publication: 10 August 1998.

TABLE I
ACOUSTIC RECORDINGS OF SELECTED SPEECH AND VOICE PARAMETERS

	Pre-injection	Three month post-injection	Recovery
<i>Case 1</i>			
Fundamental frequency (hertz)	116	112	101
Maximum phonation time (s)	3	9	11
Speech rate (words/minute)	112	152	147
Phrase grouping	6	16	18
Jitter (%)	17.1	2.9	1.8
Shimmer (%)	14.7	6.7	4.5
Noise to harmonics ratio (%)	0.8	0.1	0.1
<i>Case 3</i>			
Fundamental frequency (hertz)	165	119	137
Maximum phonation time (s)	5	12	11
Speech rate (words/minute)	130	134	134
Phrase grouping	10	29	26
Jitter (%)	0.4	1.1	1.5
Shimmer (%)	2.9	5.1	4.1
Noise to harmonics ratio (%)	0.1	0.1	0.1

noted a complete recovery of the laryngeal motion without synkinesis and a normal voice. The patient died three months later from distant metastasis.

Case 3

A 44-year-old man was referred to our clinic for severe dysphonia after left pneumonectomy and mediastinal lymph node dissection for squamous cell carcinoma of the lung, classified as T₂N₂. Clinical examination revealed a left recurrent laryngeal nerve paralysis without laryngeal penetration when evaluating swallowing with puréed food coloured with methylene blue. Selected speech and voice parameters recorded using the Computed Speech Lab and Multidimensional Voice Program from Kay Elemetrics (Kay Elemetrics) are presented in Table I. Treatment was an intracordal autologous fat injection. The day after injection, the voice was subjectively considered as greatly improved by the patient. At three months follow-up the left hemilarynx remained paralyzed but the patient felt that his voice was greatly improved. This impression was confirmed by the post-operative acoustic recordings (Table I). At six months following the intracordal injection of autologous fat, clinical examination noted a complete recovery of the laryngeal motion without synkinesis and a normal voice. Acoustic recordings were performed and are presented in Table I. The patient is alive without evidence of disease 28 months from the intracordal injection of autologous fat.

Discussion

Injection laryngoplasty and laryngeal framework surgery are the surgical options commonly considered worldwide in patients with a recurrent laryngeal nerve paralysis (Benninger *et al.*, 1994). Both approaches present several advantages and disadvantages. Laryngeal framework surgery with thyroplasty is performed under local anaesthesia and the size of the implant might be tailored to achieve the best phonatory results (Benninger *et al.*, 1994; Hoffman and McCulloch, 1996). Disadvantages of the thyroplasty approach include the need for a cervical incision, and the risk for cartilage infection, cervical haematoma, or secondary displacement of the implant (Benninger *et al.*, 1994; Hoffman and McCulloch, 1996). Injection laryngoplasty avoids the need for a cervical incision but requires a general anaesthesia although some authors advocate the use of a percutaneous approach (Benninger *et al.*, 1994; Hoffman and McCulloch, 1996).

Whatever method is elicited, there is a considerable debate in the medical literature regarding the material to be used and the proper time for the surgical management of such patients (Hoffman and McCulloch, 1996). At our department, in patients with minimal dysphonia and without swallowing problems, we do not advocate surgical rehabilitation and rather rely upon speech therapy. On the other hand, in patients with laryngeal penetration at the time of swallowing and non-efficient cough, we avoid such a 'watch and wait' policy as such symptoms might result in pneumonia from aspiration which, especially in patients recovering from a pneumonectomy, might lead to a fatal outcome. Similarly, in patients with unsuccessful speech therapy rehabilitation and/or severe dysphonia, surgical rehabilitation is considered.

The otolaryngologist – head and neck surgeon must also keep in mind that recovery from the recurrent laryngeal nerve paralysis is possible if there is no permanent damage to the nerve. In such patients, when an injection laryngoplasty is selected, the use of conventional materials such as Teflon or silicon is not advisable as these materials once injected within the thyroarytenoid muscle will severely impair the motion of the true vocal fold at the time of recovery (Hoffman and McCulloch, 1996). When there is a reasonable chance for a return of function, the use of Gelfoam or collagen has been advocated (Hoffman and McCulloch, 1996). However, Gelfoam provides only a short-term temporary improvement (Hoffman and McCulloch, 1996) while a 20–30 per cent regression of the results has been reported when using collagen (Remacle *et al.*, 1995).

With the recent increase in Europe of Creutzfeldt-Jacob's disease related to the surgical use of bovine collagen-based materials, we decided at our department not to use collagen anymore and instead turned to autologous fat when performing injection laryngoplasty to palliate the consequences of a unilateral recurrent laryngeal nerve paralysis. In the present report, the autologous fat was harvested from the lower abdomen using lipoaspiration. The autologous fat was then injected, transorally under general anaesthesia, into the paralyzed thyroarytenoid muscle using one site of injection lateral to the vocal process of the arytenoid cartilage. In all patients a whole barrel of a Bruning syringe was injected resulting in rotation of the vocal process and a convex bowing of the paralyzed true vocal fold with approximately a 50 per cent overcorrection past midline. As demonstrated in Table I, such an overcorrection resulted in an improvement in the objective parameters of speech and voice when compared

with the pre-injection data. This overcorrection did not increase the degree of dysphonia but resulted in a better quality of voice according to the patient's subjective evaluation. It must be recalled that these three patients initially presented with a severe dysphonia. No adverse reaction was observed in the post-operative period.

The main drawback of intracordal injection of autologous fat is the unpredictable degree of resorption of this material once injected within the thyroarytenoid muscle leading all authors (Hill *et al.*, 1991; Mikaelian *et al.*, 1991; Brandenburg *et al.*, 1992; Brandenburg *et al.*, 1996; Bauer *et al.*, 1995; Mikus *et al.*, 1995; Zaretsky *et al.*, 1995; Shindo *et al.*, 1996; Shaw *et al.*, 1997) to suggest that overcorrection at the time of injection should always be performed to achieve long-lasting improvement. In our series, successful rehabilitation of speech, voice (Table I), and swallowing was always achieved after injection laryngoplasty using autologous fat. Such data is in agreement with the series reported by Brandenburg *et al.* (1996), Shindo *et al.* (1996), and Shaw *et al.* (1997). The immediate improvement, in terms of swallowing and speech (Table I), noted in the present series after the intracordal injection of autologous fat was maintained during the whole duration of the paralysis. Although one might consider that a resting tone in the paralyzed side might be responsible for the persistent improvement noted by the third post-injection month, we feel that the improvement was mainly due to the boluses of fat injected as 1) the larynx was clinically paralyzed, and 2) no swallowing disorder was noted when compared with the pre-operative evaluation.

More interesting in our opinion is the fact that the injection of autologous fat did not alter the recovery of function (Table I). This demonstrates that the boluses of autologous fat injected within the thyroarytenoid muscle did not impair the motion of the true vocal fold at the time of recovery. Therefore, in our opinion, autologous fat should be considered as a highly valuable material when injection laryngoplasty is advised in patients with a unilateral recurrent laryngeal nerve paralysis in whom a possible return of function is expected.

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