

Suspension microlaryngoscopic surgery and indirect microlaryngostroboscopic surgery for benign lesions of the vocal folds

F. G. DIKKERS, A. M. SULTER

Abstract

A prospective study was designed to compare the effects on voice capacities after either suspension microlaryngoscopic surgery or indirect microlaryngostroboscopic surgery. Patients where the clinical diagnosis 'dysphonia due to a benign lesion of the vocal fold' was made, and who could be operated in either way, entered the study. Post-operative voice evaluation was performed on 21 patients after suspension microlaryngoscopic or indirect microlaryngostroboscopic surgery. The long-term voice results following indirect microlaryngostroboscopic surgery and suspension microlaryngoscopic surgery demonstrate a statistically significant improvement for the maximum intensity, maximum dynamic intensity range, dynamic intensity range at habitual speaking pitch, and melodic pitch range. In selected cases indirect microlaryngostroboscopic surgery offers a very good functional result.

Key words: Vocal folds; Laryngoscopy; Laryngeal diseases

Introduction

Since the early 1860s, when Lewin, von Bruns as well as Walker may have performed the first endolaryngeal phonosurgical operation (Weir, 1990), laryngologists have looked for refined methods for surgical correction of organic dysphonias.

Organic dysphonias due to benign lesions of the vocal folds are caused by either a disturbance of the vocal fold mucosal vibratory wave pattern or a secondary incomplete glottis closure, or a combination of these two factors. The objective of surgical intervention is to achieve an improvement in voice function, rather than to make the edge of the vocal fold as straight as possible. Therefore factors that interfere with a normal vibratory mucosal wave pattern should be eliminated, and glottis closure should be improved.

Suspension microlaryngoscopic surgery, introduced by Scalco *et al.* (1960) and popularized by Kleinsasser (1974 a, b), is generally accepted as the treatment of choice for such lesions. However, in the Charité Hospital, Berlin, indirect microlaryngostroboscopic surgery under topical anaesthesia became the therapy of choice for most of these lesions (Seidner *et al.*, 1972), with good results.

Since 1986, indirect microlaryngostroboscopic surgery under topical anaesthesia has been performed in our department as a standard outpatient procedure for 30–50 per cent of the patients requiring vocal fold surgery (Mahieu and Dikkers, 1992). Indirect microlaryngostroboscopic surgery under topical anaesthesia has several

advantages: during surgery functional monitoring is possible; during surgery the larynx is in a physiological position; and it is an outpatient procedure. Limitations are: (1) submucosal cysts and Reinke oedema are considered less suitable for this technique as it allows only single-handed instrumentation; (2) the technique is not easy to master, and (3) one requires a cooperative patient.

A prospective study was designed to compare the results of indirect microlaryngostroboscopic surgery under topical anaesthesia with the results of suspension microlaryngoscopic surgery under general anaesthesia.

Subjects and methods

All patients referred to our department because of dysphonia due to a macroscopically benign lesion of the vocal folds and who were considered suitable for either treatment entered the study (Figures 1 and 2).

Exclusion criteria were: (1) the type and extent of the swelling. Submucosal swellings, Reinke oedema, swellings with a wide pedicle and very large swellings were considered less suitable for single-handed indirect microlaryngeal surgery, and were excluded from the study (Figure 3); (2) anatomical relationships. Protruding teeth, lingual tonsils, short mandible and impaired cervical mobility may interfere with suspension microlaryngoscopy, but do not restrict indirect microlaryngostroboscopic surgery. The form and size of the epiglottis do not generally interfere with indirect microlaryngostroboscopic surgery.

From the Department of Otorhinolaryngology, University Hospital Groningen, Groningen, The Netherlands.

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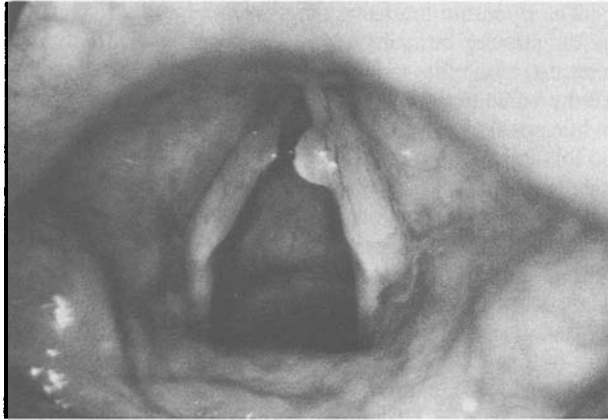


FIG. 1

Polyp on right hand true vocal fold is appropriate for indirect microlaryngostroboscopic surgery and suspension microlaryngoscopy.

The mode of operation, either suspension microlaryngoscopic surgery with the suspension technique under general anaesthesia and insufflation, or indirect microlaryngostroboscopic surgery under topical anaesthesia with spontaneous breathing, was chosen by the patient. Randomization of the trial was obtained by the patient's preference.

The following data were recorded: age at operation, sex, profession, relevant laryngeal history, smoking habits, site, side and size of the lesion, and standardized clinical diagnosis (Dikkers and Schutte, 1991).

Laryngeal videostroboscopy was performed pre-operatively, two weeks and also three months after the operation, using a 90° von Stuckrad telescope (von Stuckrad and Lakatos, 1975) connected to a stroboscope (Bruel and Kjaer; type 4914). Criteria as formulated by Kitzing (1985) were used for interpretation. Laryngostroboscopic examination formed the basis for surgical treatment of the dysphonia.

Phonetograms were made before and three months after the operation. They were registered according to the standards recommended by the Union of European Phoniatrians (Schutte and Seidner, 1983). Several parameters from the phonetograms were selected for analysis: maximal vocal intensity (MAXIN), maximal dynamic intensity range (MAXDYN), dynamic intensity range at habitual speaking pitch (DYNRAN), and melodic pitch

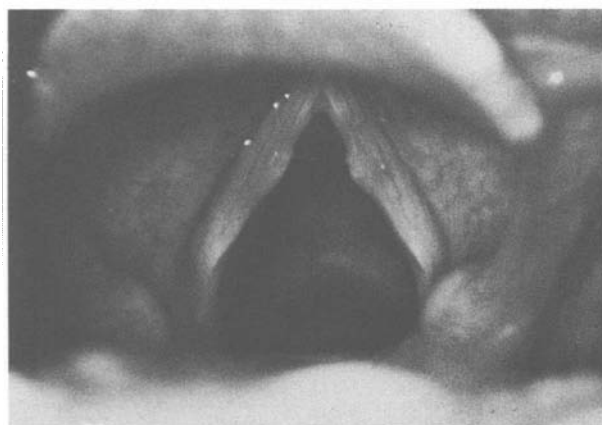


FIG. 2

Vocal fold nodules, appropriate for indirect microlaryngostroboscopic surgery and suspension microlaryngoscopy.

range (OCTAAF). In addition to these data, the maximal phonation time of the vowel 'a' (ALANG) was recorded.

Suspension microlaryngoscopic surgery

Suspension microlaryngoscopic surgery takes place under general anaesthesia and artificial ventilation. A Portmann or Bouchayer laryngoscope is used.

A post-operative period of two and a half days of voice rest is prescribed. One day after the operation the patient is allowed to leave the clinic.

Indirect microlaryngostroboscopic surgery

Indirect microlaryngostroboscopic surgery takes place under topical anaesthesia. The patient remains seated during the procedure. Practical details of the procedure have been described elsewhere (Mahieu and Dikkers, 1992).

A post-operative period of two and a half days of voice rest is prescribed. About an hour after the operation the patient leaves the hospital.

Statistical analysis

Patient characteristics were compared using a chi-square test and analysis of variance (ANOVA). Voice parameters were analysed using *t*-tests for related measurements (Shearer, 1982), with as null hypothesis: no difference between either surgical method.

Results

Twenty-seven patients entered the study. In 12 patients the lesion was operated upon under topical anaesthesia; and guided by microstroboscopic monitoring. Fifteen patients underwent suspension microlaryngoscopy under general anaesthesia. Only those patients who were suitable for both procedures, indirect microlaryngostroboscopic surgery as well as suspension microlaryngoscopic surgery, were included in this study. The mode of operation was chosen by the patient. In this way, no bias occurred concerning size or site of the lesion (chi-square, $p > 0.4$).

Each of the subgroups was reduced by three patients because of insufficient data, leaving 12 in the SMS (sus-



FIG. 3

Bilateral Reinke oedema, excluded from the study, because of inappropriateness for indirect microlaryngostroboscopic surgery.

TABLE I
PATIENT CHARACTERISTICS

	Suspension microlaryngoscopy (SMS) technique (n = 12)	Indirect microlaryngos- troscopy (IMS) technique (n = 9)
Male/female ratio	5/7	2/7
Mean age (years)	34.0	39.8
Range of age (years)	12–53	19–71
s.d. age	12.1	18.5

pension microlaryngoscopic surgery) group and nine in the IMS (indirect microlaryngostroboscopic surgery) group. In each group two patients considered their subjective positive result too good to return to our outpatient clinic. One patient moved abroad, and the sixth patient did not return without further specification.

Patient characteristics are given in Table I. Sex and age of the patients were not correlated to the type of surgery (chi-square and ANOVA-test, respectively).

The mean voice results and levels of significance are presented in Table II. Both groups demonstrated a statistically significant improvement for the maximum intensity, maximum dynamic intensity range, dynamic intensity range at habitual speaking pitch, and melodic pitch range. The improvement of the maximal phonation time of the vowel 'a' was not statistically significant for both groups.

Discussion

The goal of vocal rehabilitation or surgical treatment of a benign lesion of the vocal folds is the restoration of the usable and, when possible, normal voice for all conditions that impair or prevent vocal function. Therapy thus aims at restoration of a voice that is well produced, resilient under prolonged use, and can satisfactorily serve as an instrument for communication and for professional or artistic use.

The voice results three months after both suspension microlaryngoscopic surgery and indirect microlaryngostroboscopic surgery were very good. These results were comparable to the results of an earlier, short-term study analysing a group of 31 patients (27 females and four males: mean age 29.7 years, range 16–74 years: no patient overlapping with the current series) (Mahieu and Dikkers, 1992).

The dynamic intensity range of the habitual speaking pitch should be considered to be of special clinical interest, since this voice parameter displays the potential of the voice in the situation in which it is mostly used, i.e. while speaking (Brodnitz, 1963). The mean improvement in this voice parameter was 6.9 dB for all patients (statistically significant: $p < 0.01$), 6.1 dB for the SMS group (statistically significant: $p < 0.05$) and 7.9 dB for the IMS group (statistically significant: $p < 0.01$). The difference in improvement between the two groups is statistically non-significant ($p > 0.5$).

Results of voice surgery are assessed by evaluation of the output of the voice source. A well-defined method with which to quantify voice potentialities is the phoneogram (Damsté, 1970), in which an individual's maximum and minimum loudness along the entire frequency range is registered. Because voice production in normal conversation is limited to a part of the frequency range, we had a special interest in the dynamic aspects of voice use at a specific frequency: the dynamic intensity range at the habitual speaking pitch. This investigation shows specific improvement in this value. In addition to objective parameters it would have been possible to include subjective voice assessments, e.g. in the form of a perceptive judgment by trained listeners (Isshiki and Takeuchi, 1970). Because of the subjective character of this approach it was avoided in this study.

Comparing post-operative voice results between the two methods should also include a critical analysis of the possibility of obtaining an inferior result with one of the methods. Though inferior results using the IMS technique are not likely to happen, because of peroperative interaction with the patient, the probability of encountering this situation can be described with the power of the *t*-test used in comparing group results (Welkowitz *et al.*, 1982). Considering a post-operative difference of 5 dB as statistically significant (Gramming *et al.*, 1991) with a standard deviation of 8 dB for the loudness parameters, and a harmonic group size of 10.3, a power of about 0.5 is obtained. This means that the possibility of obtaining a significant result for the DYNRAN value—i.e. a worse post-operative result for dynamic intensity range at habitual speaking pitch using IMS in comparison with SMS—is 0.5. To assess a high power level of 0.8 in this study a group size of 30 should have been created.

However, the IMS technique offers a number of important advantages over the conventional SMS technique: firstly, there is functional control during surgery;

TABLE II
PRE- AND POST-OPERATIVE VOICE PARAMETERS IN SMS AND IMS GROUPS (SEE TEXT FOR ABBREVIATIONS)

Voice parameter (mean)	SMS group (n = 12)		IMS group (n = 9)		All patients (n = 21)	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
MAXIN (dB)	91.9	100.0*	93.6	100.2*	92.6	100.1**
(SD)	11.4	6.2	9.1	6.6	10.3	6.2
MAXDYN (dB)	29.2	36.2**	30.0	38.7*	29.5	37.2**
(SD)	10.2	6.4	6.1	7.6	8.5	6.9
DYNRAN (dB)	21.7	27.8*	24.9	32.8**	23.0	29.9**
(SD)	10.0	5.2	9.3	6.6	9.6	6.2
OCTAAF (semitones)	27.8	32.1**	28.9	33.4*	28.3	32.7**
(SD)	8.0	7.5	5.4	4.2	6.9	6.2
ALANG (s)	11.2	22.3	10.6	12.7	10.9	18.2
(SD)	8.8	25.9	2.7	6.3	6.7	20.2

*Improvement statistically significant: $p < 0.05$, *t*-test.

**Improvement statistically significant: $p < 0.01$, *t*-test.

secondly, there is improvement in estimation of the extent of the lesion on the vocal fold and its influence on phonation; thirdly, during indirect microlaryngostroboscopic surgery the larynx is in a physiologically normal position, in contrast to its position during suspension microlaryngoscopy.

A limitation to indirect microlaryngostroboscopic surgery is that only single-handed instrumentation is possible. Reinke oedema and submucosal swellings are therefore less suited for this technique, as these lesions are located in the submucosa. The size of a swelling rarely prevents indirect microlaryngeal surgery. For vocal fold nodules, small polyps and pseudocysts indirect microlaryngostroboscopic surgery can be a very elegant treatment.

Either surgical procedure improves voice characteristics. In indirect microlaryngostroboscopic surgery general anaesthesia is not necessary. The intervention method is quick and is performed as an outpatient procedure. Voice results can be acquired immediately in an interactive way. Therefore, despite the fact that the statistical power of the comparison is suboptimal, the indirect microlaryngostroboscopic surgical technique is an asset in the treatment of organic dysphonia.

Conclusions

Various superficially located benign lesions of the vocal folds can be treated with a very good functional result using the indirect microlaryngostroboscopic surgical technique. An optimally trained phonosurgeon should have both the direct and indirect phonosurgical technique at his disposal and should be able to choose the optimal treatment modality for the individual patient.

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Address for correspondence:
 Dr Frederik G. Dikkers,
 Department of Otorhinolaryngology,
 University Hospital Groningen,
 Oostersingel 59,
 9713 EZ Groningen,
 The Netherlands.

Fax: 31–50–696726