Comprehensive Outcome Researches of Intralesional Steroid Injection on Benign Vocal Fold Lesions

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Summary: Objective. This study investigated multidimensional treatment outcomes, including prognostic factors and side effects of vocal fold steroid injection (VFSI).

Methods. We recruited 126 consecutive patients, including patients with 49 nodules, 47 polyps, and 30 mucus retention cysts. All the patients received VFSI under local anesthesia in the office settings. Treatment outcomes were evaluated 1 and 2 months after the procedure, including endoscopic evaluation, perceptual voice quality (GRB scores), acoustic analysis, and 10-item Voice Handicap Index (VHI-10).

Results. More than 80% of the patients reported subjective improvements after VFSI. Objective measurements revealed significant improvements from baseline in most of the outcome parameters ($P < 0.05$). Higher occupational vocal demands and fibrotic vocal nodules were significantly associated with poorer clinical responses as measured by the VHI-10 and GRB scores, respectively. For vocal polyps, dysphonia for more than 12 months were significantly associated with higher postoperative VHI-10 scores, whereas patients with laryngopharyngeal reflux (LPR) showed significantly poor postoperative voice quality as measured by GRB scores. Side effects after VFSI included hematoma (27%), triamcinolone deposits (4%), and vocal atrophy (1%), which resolved spontaneously within 1–2 months. Presentation with vocal fold ectasias/varicosities and higher vocal demands were significantly correlated with postoperative vocal hematoma.

Conclusions. This study demonstrated significant improvements after VFSI in vocal nodules, polyps, and cysts. Occupational vocal demand and subtypes of vocal nodules are closely related to the treatment outcomes after VFSI, whereas symptom duration and LPR were significant prognostic factors for VFSI treatment outcomes in vocal polyps. Side effects after receiving VFSI were mostly self-limited without sequel, whereas the incidence rates might be varied by the injection approach and the timing for postoperative follow-up.

Key Words: Nodules–Polyp–Cyst–Triamcinolone–Dexamethasone–Occupation–Vocal demand–Laryngopharyngeal reflux–Hematoma–Atrophy–Ectasias–Varicosity.

INTRODUCTION

Benign vocal fold lesions, such as vocal nodules, polyp, and cyst, refer to unilateral or bilateral lesions of the midmembranous portion of the vocal fold that lie within the superficial lamina propria (ie, the Reinke's space).[1] Common clinical presentations of these lesions include dysphonia, voice fatigue, dryness or tightness of voice, narrowed vocal range, and deteriorated voice quality (husky or breathy character). Because most of these patients have an occupational dependence on their voices, noisy working environments, or inappropriate phonation habits; in most circumstances, behavioral modification remains the first-line management, followed by phonomicrosurgery.[2,3] However, when compliance with conservative management is poor, when the risk from general anesthesia is high, when the patient is unwilling to have an operation, or in case of recurrence after surgery, very few options remain for patients.

Intralesional steroid injection has been advocated in the management of inflammatory laryngeal diseases such as sarcoidosis, systemic lupus erythematosus, and Wegener's granulomatosis.[4–6] A recent study demonstrated that office-based laryngeal procedures are well tolerated in the outpatient department with limited impact on the hemodynamic profiles.[7] Compared with surgeries in the operating room under general anesthesia, office-based procedures not only avoid potential risks and discomforts associated with general anesthesia but also offer the advantages of real-time monitoring of vocal function and considerable savings of medical expenses.[8–10]

A number of studies have advocated the potential role of vocal fold steroid injection (VFSI) for the treatment of benign vocal fold lesions.[11–13] However, few studies have investigated the treatment outcomes between different disease entities. Moreover, the prognostic factors of VFSI (eg, laryngopharyngeal reflux [LPR] and occupational vocal demand) have rarely been reported in the literature.[14] Although side effects after VFSI have been noted in the literature, the incidence rates varied widely.[14] Therefore, the objectives of this study are to conduct comprehensive researches that reports multidimensional treatment outcomes and prognostic factors between different categories of vocal lesions and to investigate the incidence rates and risk factors of side effects after VFSI.

METHODS

Study subjects

This study prospectively recruited consecutive patients who had received VFSI from January 2012 to December 2013 at a tertiary teaching hospital. The inclusion criteria include vocal nodules, polyp, and mucus retention cyst. Clinical diagnoses

Accepted for publication November 5, 2014.

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Journal of Voice, Vol. 29, No. 5, pp. 578-587
0892-1997/$36.00
© 2015 The Voice Foundation
http://dx.doi.org/10.1016/j.jvoice.2014.11.002

were based on the appearance of the vocal fold edge and the vibratory property of the mucosa revealed by videolaryngostroboscopy (VLS), based on the published nomenclature and diagnostic paradigm.[1] Vocal nodules were classified as (1) soft (ie, mid-membranous thickening without fibrotic change of the epithelium or limitation of the mucosal wave) or (2) hard (ie, hyperkeratosis of the epithelium, fibrotic appearance with some limitation of mucosal wave propagation). Vocal polyps were classified as hemorrhagic (vascular), fusiform (wide-based), pedunculated, and fibrous.[15] The presence of ectasias (defined as spheroidal, tangible, subepithelial hemangioma) and varices (defined as enlarged, aberrant, and tortuous vessels) were recorded as well.[16,17] Patients with keratin cysts were excluded. Patients who had received previous phonomicrosurgery were also excluded from the study. The study protocol has been approved by the Research Ethics Review Committee.

All of the clinical and demographical factors were collected at the initial clinical visit, including age, gender, duration of dysphonic symptoms, smoking, occupational vocal demand, as well as the 10-item Voice Handicap Index (VHI-10),[18] and Reflux Symptom Index (RSI).[19] Subjects with RSI scores of more than 13 points were defined as positive for LPR. We reviewed the occupations of each patient and classified them into (1) professional voice users (eg, singers, actor/actress, radio broadcast, and singing student); (2) high voice users (eg, teachers, clergy, lecturer, sales, tour guide, aerobic exercise coach, and patients who work in noisy environment; or (3) routine voice users, as suggested in the literature.[20] Professional and high voice users were labeled as having "high" occupational vocal demand, and the others were labeled as having "routine" occupational vocal demand.

Vocal Fold Steroid Injection

The VFSI was performed under local anesthesia of the pharynx and larynx,[21] and the patient was instructed to pull out and hold the tongue, while the surgeon uses the nondominant hand to operate the rigid laryngoscope. Under visual guidance, 0.1 mL, 1:1 mixture of triamcinolone acetonide (10 mg/mL) and dexamethasone sodium phosphate (5 mg/mL) was injected by curved injection needle (Model 16–50050, Medtronic Xomed Jacksonville, Florida, USA) into the Reinke's space of the vocal lesions.[22] For patients who were intolerant of the above transoral procedure,[23] transnasal injection via the working channel of a flexible nasopharyngoscope could be applied with an endoscopic injection apparatus (Model NM-101C-0427 Olympus, Aomori, Japan.), which includes a reusable metallic external sheath (MAJ-655) and a disposable flexible needle tract with a 27G rigid tip (MAJ-656).[24] All the patients received postoperative voice rest for 3 days.

Outcome evaluation

Treatment outcomes were evaluated before, 1 month, and 2 months after the procedure. Perceptual evaluation of voice quality was performed using the GRB scales and scored as 0: normal, 1: slightly deviated, 2: moderately deviated, and 3: extremely deviated.[25] Scores from the three subscales (grade, roughness, and breathiness) were summed up for statistical inferences. Acoustic analysis was conducted by recording a 3-second sample of the sustained vowel sound /a:/ at a comfortable level of loudness, with a microphone-to-mouth distance of approximately 15–20 cm, using a high-quality microphone (Model: SM58, SHURE Niles, Illinois, USA.) with a digital amplifier (Model: X2u, SHURE). Analyzed parameters include jitter (ie, cycle-to-cycle frequency perturbation), shimmer (ie, cycle-to-cycle amplitude perturbation), and noise-to-harmonic ratio (NHR; *MDVP*, Model 4500; Kay Elematrics, Corp., Lincoln Park, NJ, USA). Under similar settings, we measured maximal phonation time (MPT) by instructing the patient to produce the /a:/ sound for as long as possible after deep inspiration and at a spontaneous, comfortable pitch and loudness level for three consequent trials. The patient-reported outcomes included a Visual Analog Scale (VAS) of voice quality (ranging from zero [worst] to 10 [best]),[26] subjectively perceived resolution of clinical symptoms (categorized as complete remission, more than 50% improvement, 50% improvement or less, no effect, or worsening), and Mandarin-Chinese version of VHI-10.[27]

The vibratory capacity of the vocal fold was evaluated using VLS, which was conducted by instructing the patient to phonate a sustained /ee/ sound with habitual pitch and intensity, using a 70° rigid endoscope and a three-chip CCD camera (Model 2706CA and 20222120; KARL STORZ, Germany) or a digital laryngoscope with the corresponding video processor (VNL-1590 STi and EPK-i; PENTAX). Each session of the VLS test was digitally recorded onto a portable hard disk using a computerized video processor (NHX-B10; Grass Valey, Inc.). Reduction of the lesion size was subjectively evaluated by the primary surgeon (C-.T.W.) during the clinical follow-ups. Intra-rater reliability was tested by randomly re-examining 50% of the original video recordings, in a blinded fashion. Inter-rater reliability was examined in the same method, by an experienced speech therapist (Feng-Chuan Lin, MSc). We also objectively measured the normalized vibration amplitude of the membranous vocal fold by: (1) capturing video clips of maximally opened and closed phases during phonation with correction to the vocal fold length (ie, normalized glottal gap area [NGGA], Image J software, version 1.44; National Institute of Mental Health, Bethesda, MD) and (2) subtract the open phase from the closed phase NGGA (Figure 1).[28,29]

Side effects after VFSI were identified by reviewing postoperative video recordings and included (1) vocal fold hematoma surrounding the injection sites; (2) deposits of injected material, which was defined as the presence of whitish plaque over Reinke's space, with minimal-to-moderate influence of the vibration of mucosal wave; and (3) vocal fold atrophy, which was defined as "bowing" of the vocal fold(s) with the presence of glottic gap and atrophic thyroarytenoid muscle.

Statistics

Treatment outcomes measured at 1 and 2 months postoperatively were compared with baseline measurements using paired *t* tests for the different diagnoses. Intra- and inter-rater reliabilities were examined by Cronbach's alpha coefficient. To

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