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Vocal fold sulcus

STEPHEN T. S. LEE F.R.C.S.Ed.,* S. NIIMI, D.M.Sc.**

Abstract
Vocal fold sulcus is a cause of dysphonia which has not been recognized until recently. Awareness of its existence combined with use of laryngostroboscopy would enhance the management of this group of patients. Five such cases were treated initially by voice therapy and subsequently combined with microlaryngeal Teflon injections of the vocal cord. Representative photomicrographs and the end results of treatment are presented. A good voice, subjectively and objectively, was obtained in three patients, with satisfactory improvement in the other two.

Introduction

Vocal fold sulcus, also known as sulcus vocalis, is a condition wherein a longitudinal groove is seen running parallel to the margins of the true vocal cord about midway between its superior and inferior edges. The involved cord often appears atrophic and lowered resulting in an oval glottic chink. Excessive adduction of the ventricular folds during adduction may also be noted. Itoh *et al.* (1983) were among the few authors to draw attention to this condition.

Material and methods

Of patients presenting with hoarseness to the Voice Unit of the University Hospital over a five month period (1989), five were diagnosed to have vocal cord sulcus. The clinical presentation and findings as well as therapy utilized are presented.

Case reports

Case 1

29-year-old male businessman presented with 10 year history of voice change. The voice was weak, low pitched, monotonous and breathy. Laryngoscopy revealed bilateral vocal cord sulcis with atrophy (Fig. 1). Mobility of both cords was normal with persistent oval shaped glottic gap on adduction. Stroboscopy revealed decreased vibratory mucosal waves bilaterally. Maximum phonation time averaged 15 seconds on two occasions. Voice therapy for three months did not result in any improvement. Under general anaesthesia, the vocal folds were examined via a microlaryngeal approach with ×25 magnification (400 mm lens) to exclude other minute pathology. Teflon injection of the vocal cord utilizing a Bruning's syringe was then performed. 0.4 ml of Teflon paste was injected into the tissues lateral to the vocal cord at the mid-point of the left vocal cord which corresponded to the point of maximum diameter of the glottic gap on cord adduction. Absolute voice rest was implemented in the first five post-operative days after which he was allowed minimal voice use for a further two weeks. Following this, voice therapy was continued. The patient was satisfied with his voice improvement at his post-operative visit at four months. It was noted to be louder and non-breathy although the pitch and monotony was unchanged. Maximum phonation time averaged 25 seconds. Laryngoscopy revealed partial reduction in glottic gap on adduction with loss of bowing of the left vocal cord. The vibratory wave on stroboscopy was unchanged.

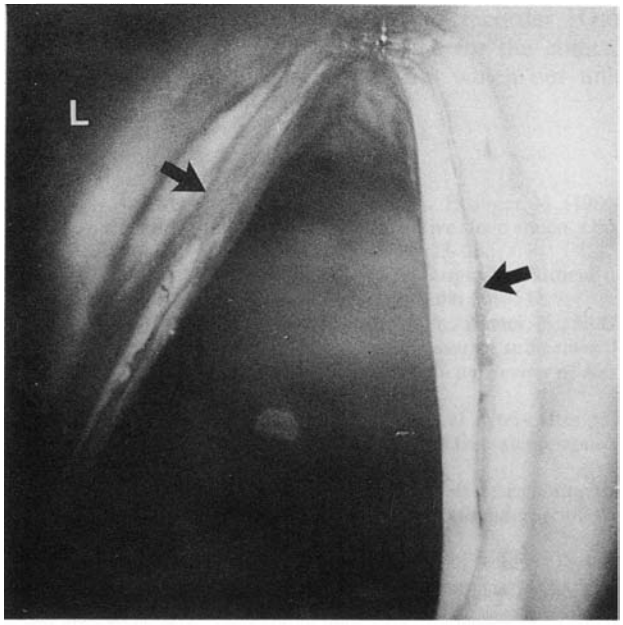


FIG. 1
Photomicrograph illustrating bilateral vocal cord sulcis. Note atrophic appearance of true cords particularly the left. (L)

*Lecturer, Department of Otorhinolaryngology, Faculty of Medicine, University of Malaya, 59100 Kuala Lumpur, Malaysia.
**Professor, Research Institute of Logopedics & Phoniatrics, University of Tokyo, 7-3-1 Hongo, Tokyo, Japan.
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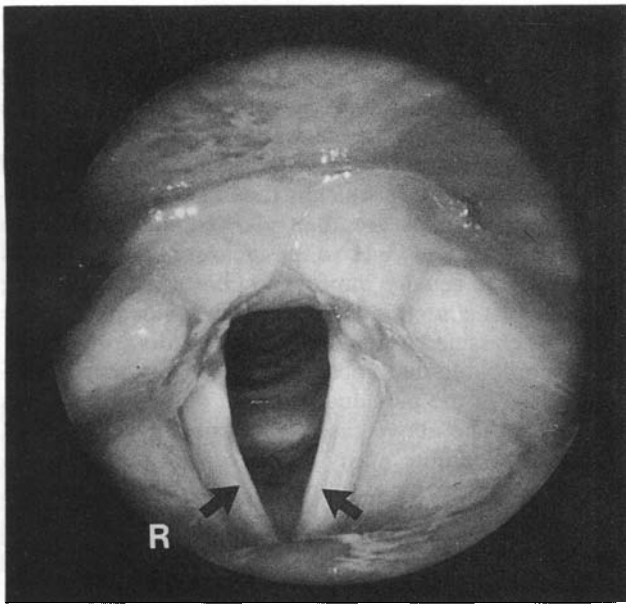


FIG. 2
Photomicrograph illustrating bilateral vocal cord sulcis which is more prominent on the right. (R)

Case 2

A 22-year-old female secretary presenting with four year history of a weak monotonous breathy voice. A prominent vocal cord sulcus with symmetrically mobile cords was found on laryngoscopy (Fig. 2). Stroboscopically, a decreased vibratory mucosal wave was identified. Maximum phonation time averaged 12 seconds. Pre-operative voice therapy for three months resulted in marginal voice improvement which she found to be unsatisfactory. 0.3 ml of Teflon paste was injected on the right cord as in case 1. She assessed her own voice improvement at three months as good. It was louder and less breathy. Maximum phonation time averaged 29 seconds. Laryngostroboscopy revealed almost complete closure of her glottic gap with minimal impairment of the mucosal wave form.

Cases 3, 4 and 5

A similar diagnosis of vocal cord sulcus made with pre-operative vocal therapy and unilateral Teflon intracordal injection (Table I). In bilateral sulcus, the side judged to have the more prominent sulcus and/or atrophy was injected.

Discussion

Vocal cord sulcus and furrows have only recently been recognized as pathological conditions which cause hoarseness. The English literature in the last decade on this condition is scarce (Itoh *et al.*, 1983; Lindestad *et al.*, 1985).

Sulcus vocalis represents an invagination or furrowing on the vocal fold edge extending partially or entirely along the length of the membranous portion of the cords. On a histological level, this is seen as an extension of an epithelial lined pocket descending into the submucosal layers of the vocal fold with variable adherence to the vocal ligament depending on the extent of inflammatory reaction generated (Bouchayer and Cornut, 1988). This results in bowed vocal fold edges, glottic incompetence particularly in bilateral cases and excessive ventricular fold adduction. Itoh *et al.* (1983) reserve the term 'sulcus vocalis' for all patients with vocal fold furrows as the single identifiable major pathology causing hoarseness.

In contrast, Bouchayer and Cornut (1988) distinguish between glottic sulcus and glottic furrow by reserving the latter term for the more severe wide atrophic furrows which have prominent ridges accompanied by a dehiscence of the fibroelastic fibres of the vocal ligament. This allows a direct adherence of the epithelial lining at the depth of the furrow to the vocalis muscle fibres.

There is no consensus on the origin of glottic sulcus. Data exist to back both acquired and congenital theories.

In support of the acquired theory is the epidemiological data demonstrating onset of hoarseness after the third or fourth decade. Onset of hoarseness was after the age of 40 years in 140 of 192 (72.9 per cent) patients (Itoh *et al.*, 1983). In another series of 58 patients, the highest incidence was in the 30–50 year age group with no patients in the 0–10 year age group (Ishii *et al.*, 1967). Acquired inflammatory or age related causes have been suggested. (Hirano, 1975; Shin, 1976).

Bouchayer and Cornut (1985) favour a congenital theory which considers vocal fold epidermoid cysts, glottic sulci and vocal fold mucosal bridges as a spectrum of conditions with a common aetiology. Six arguments put forward in support were:

(1) 55 per cent of 157 patients with diagnosis of either epidermoid cyst, glottic sulcus, mucosal bridge or a combination had onset of dysphonia in childhood
(2) Both the sulcus and epidermoid cyst were found in childhood in 15 per cent of this series
(3) The two lesions were found in patients with no history of vocal overwork or laryngitis
(4) 15 per cent association of sulcus and epidermoid cysts
(5) The lesions once removed completely did not return and

TABLE 1
DETAILS OF CASES 1, 2, 3, 4 AND 5

Case Number	1	2	3	4	5
Age	29	22	19	31	40
Duration of hoarseness (years)	10	4	6	10	1
Laterality	Bilateral	Bilateral	Bilateral	Bilateral	Unilateral
Preinjection Maximum phonation time (MPT) (seconds)	15	12	11	14	16
3 month post-operative MPT (seconds)	25	29	20	16	30
Subjective voice improvement	Satisfactory	Good	Satisfactory	Satisfactory	Good
Glottic gap closure	Partial	Complete	Partial	Partial	Complete

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(6) Existence of one family with several members having sulcus and cysts.

Bouchayer and Cornut (1988) postulated that discharge of the keratinous content of the cyst medially result in sulcus whereas opening of the cyst on the superior and inferior surface of the fold results in the mucosal bridge. This explanation may account for unilateral sulcus but it would seem less probable in bilateral sulcus cases as this would require rupture of bilaterally placed epidermoid cysts. This is particularly relevant to the series of Itoh *et al.* (1983) as 63 per cent of the cases were bilateral.

It is likely that no single theory can account for all cases of vocal sulcus and that each may be relevant in different cases. A congenital hypothesis does not adequately explain the remaining 45 per cent of 157 cases (Bouchayer and Cornut, 1985) which developed symptoms late beyond childhood nor the absence of epidermoid cysts/mucosal bridges occurring simultaneously with glottic sulci in large series of Japanese patients (Itoh *et al.*, 1983; Ishi *et al.*, 1967). The acquired hypothesis, however, does not account for those groups of patients with early onset presentation.

Options for therapy of glottic sulcus range from masterly inactivity particularly if asymptomatic or mild symptoms only are present, vocal therapy, vocal fold injection and excision of the sulcus. Vocal fold injections was the only surgical technique utilized in the Japanese series (Itoh *et al.*, 1983). Although we did not explore through a mucosal incision the cranial aspect of the cord, our own careful examination under high magnification did not reveal any minute openings of a cyst. We noted incomplete closure of the glottis and, stroboscopically, stiffness of the mucous membrane of the inner part of the vocal cord. Hence it appeared reasonable to use Teflon injections to improve the voice quality. Good or satisfactory results were obtained in our cases. Longer term follow-up will show whether the voice improvement is maintained. Almost complete closure of the glottic gap was achieved in unilateral cases and this corresponded with better subjective voice improvement. Only partial closure was obtained in bilateral cases and perhaps better improvement may be possible with Teflon injection of the second side.

The excision technique is well described by Bouchayer and Cornut, (1985). Following preliminary injection of hydrocortisone suspension into the involved cord, the depth of the sulcus was freed away from the vocal cord ligament via an incision on the superior surface of the vocal cord. Incisions are then placed around the lips of the sulcus which is then resected. The resultant mucosal flaps are then allowed to approximate together. The end voice in these cases of glottic sulci is variable but usually improved. Glottic chink bowing may persist and this is particularly evident in those patients classified as having glottic furrows.

It is probable that vocal cord sulcus has been underdiagnosed in the past due to a lack of awareness of its existence. The above cases emphasise that vocal cord sulcus is a definite entity which can be diagnosed on laryngostroboscopic examination and for which therapy exists which can improve the voice quality although normal voice may not always be attained.

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Address for correspondence:
S. T. S. Lee F.R.C.S.Ed.,
Lecturer,
Department of Otorhinolaryngology,
Faculty of Medicine,
University of Malaya,
59100 Kuala Lumpur,
Malaysia.

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