# EPIDERMOID CYSTS, SULCI, AND MUCOSAL BRIDGES OF THE TRUE VOCAL CORD: A REPORT OF 157 CASES.*

MARC BOUCHAYER, MD
Lyon, France

GUY CORNUT, MD
Lyon, France

ROBERT LOIRE, MD
Lyon, France

EDOUARD WITZIG, MD
Geneva, Switzerland

J. BLAISE ROCH, MD
Lyon, France

ROBERT W. BASTIAN, MD
St. Louis, MO.

ABSTRACT.

**Presented is a summary of our experience with 157 patients having a diagnosis of epidermoid cyst, glottic sulcus, or mucosal bridge of the true vocal cord. Each patient in this group was diagnosed and treated jointly by a phoniatrist and microlaryngoscopist and then evaluated for results of surgical and phoniatric therapy.**

**Included in the discussion are methods of examination and diagnosis, microanatomy and histopathology of the lesions, methods of treatment, and results of treatment. An argument for a common etiology for these lesions is advanced.**

Though they are benign entities, vocal cord cysts, sulci, and mucosal bridges have a dramatic impact on voice. The patient, therefore, deserves very careful diagnosis and surgical correction. This is because not only the condition itself, but also the surgery for the condition, can cause dysphonia.

In our experience, joint evaluation and treatment of these patients by surgeon and phoniatrist has led to good results from the standpoint of the appearance of the larynx and the sound of the voice. There follows a description of our evaluation procedures, surgical techniques used, and results obtained from this collaborative effort.

## MATERIAL AND METHODS.

This series comes from the records of 300 patients operated upon (between January 1973 and June 1983) with a diagnosis of epidermoid cyst, mucosal bridge, or glottic sulcus of the vocal cord. From this group, 157 cases were kept for analysis because they produced surgical specimens which allowed exact histopathological diagnosis. Altogether, there were 120 women and 37 men between the ages of 5 and 59. The types of lesions were divided according to Table I.

Evaluation procedures were identical for all cases. At the time of the patient's first visit to the phoniatrist (G. C., J. B. R.), the following data was obtained: detailed history, general head and neck exam, indirect laryngoscopy with magnification and stroboscopy, perceptual vocal typing, and tape recording of vocal samples.

Treatment course was a little more variable, but often began with a supportive medical regimen of short-term anti-inflammatory medications or antibiotics. Vocal reeducation was also instituted prior to surgery, and continued for four to six weeks after this.

The operation itself was done under general anesthetic with endotracheal intubation and Zeiss microscope (350 mm lens at 25X). The same surgeon (M. B.) performed the 204 suspension microlaryngoscopies. Each operation was done with phoniatrist present to help match surgical techniques to the findings of the dynamic phoniatric examination. Intraoperative photographs were taken for all patients, and all specimens were sent to the laboratory for examination by the surgical pathologist (R. L., E. W.).

Specific surgical techniques used on these patients have been summarized by Bouchayer,[1] especially those for the glottic sulcus. For the *epidermoid cyst*, a mucosal incision parallel to the free border of the vocal cord was made on the superior surface of the vocal cord for a length of several millimeters greater than the diameter of the cyst. The cyst was then approached and removed with the aid of a dissector. In general, no mucosa was removed.

For the *sulcus*, the operation (Figs. 1-6) started with an injection of hydrocortisone suspension before dissecting out the sulcus, in that this injection facilitated the dissection. Next, after making a mucosal incision on the superior surface of the cord, the pocket of the sulcus was peeled away from the vocal cord ligament, progressively from anterior to posterior and from superficial to deep. This pocket was then resected through an elliptical incision surrounding the edges of the opening of the sulcus.

The mucosal bridge was divided by its attachment anteriorly and posteriorly (Fig. 16).

We did not use the $CO_2$ laser in the treatment of these lesions; it is, however, employed by other authors.

The first postoperative examination and voice recording oc-

TABLE I.
Summary of Lesions.

| Vocal Cord Lesions | Number of Patients |
|---|---|
| Epidermoid cysts | 55 |
| Unilateral — 41 | |
| Bilateral — 14 | |
| Glottic sulcus | 72 |
| Mucosal bridges | 7 |
| Epidermoid cyst+glottic sulcus+mucosal bridge | 23 |
| Total | 157 |

*From the Polyclinique des Minguettes, Lyon, France.

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Send Reprint Requests to Marc Bouchayer, MD, 21 Rue de la Commune de Paris, Lyon, France.

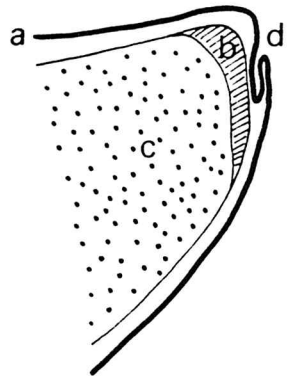



Fig. 1. Coronal section of a vocal cord with a sulcus: a) mucosal cover of the cord, b) vocal ligament, c) muscle, d) entrance to sulcus.

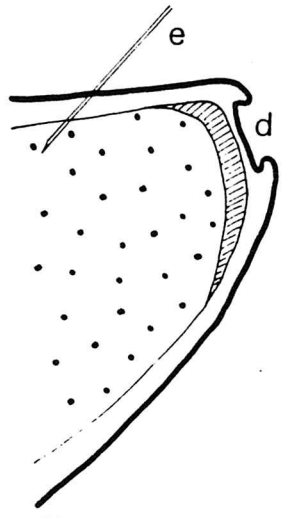



Fig. 2. Lips of sulcus spread apart (d) after cortisone injection, and with needle in place (e).

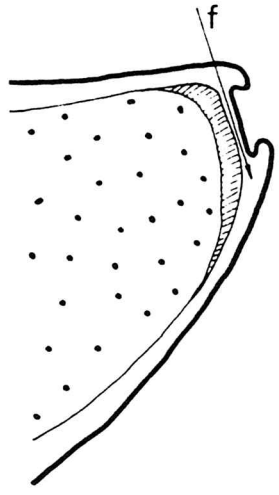



Fig. 3. Incision on superior surface of the cord and plane of dissection (f) of the sulcus.

curred at the end of ten days of absolute voice rest. Careful phoniatric follow-up and vocal reeducation was carried out in every case as well as an examination and voice recording before final discharge. Analyzed were history, physical findings, pathological specimens, and surgical result by visual examination and sound of the voice.

## RESULTS OF ANALYSIS.

### *Preoperative History.*

With cordal cysts and sulci, dysphonia was the major symptom and was usually accompanied by *vocal hyperfunction.* In 55% of these cases, this manner of voice use historically started in early childhood or by school age. If the dysphonia was known to have started in adolescence or after reaching adulthood, it had usually been the result of infection in the ENT area or vocal overwork. Sixty-eight percent of patients in this group used their voices a great deal in the pursuit of their professions.

Some patients had already been seen elsewhere for their vocal problems and had undergone various treatments without success. Several had even been operated on for a "nodule" or "polyp" without improvement in the voice, the actual causative lesion (cyst or sulcus) having been unrecognized.

Symptoms described by patients were also very similar in the two groups: Patients complained of the effortfulness of voicing, easy fatigability of the voice, an unpleasant sound of the voice, and even sensations of pain in the neck radiating to the scapulae and anterior thoracic area.

### *Preoperative Examination.*

*Auditory-Perceptual Examination.* Auditory characteristics were also comparable between the two groups. *1.* There was usually lowering of the "average

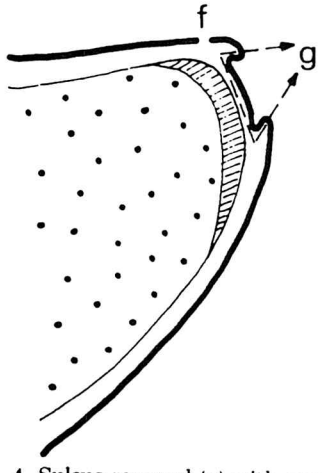



Fig. 4. Sulcus removal (g) with care to spare normal mucosa, and incision superior surface of cord (f).

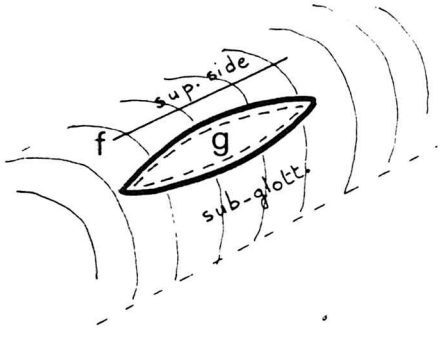



Fig. 5. View of the free edge of the cord showing f - incision on superior surface and g - opening of the sulcus end limits of resection.

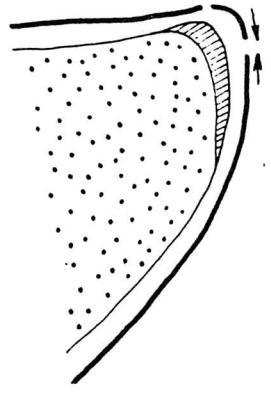


Fig. 6. After resorption of the cortisone, the margins of excision come together without leaving a depression.

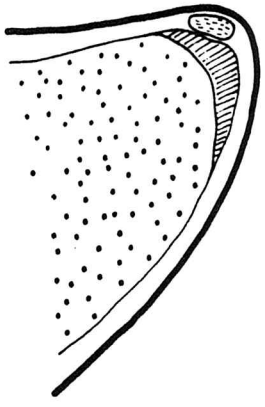


Fig. 7. Epidermoid cyst in the classic location.

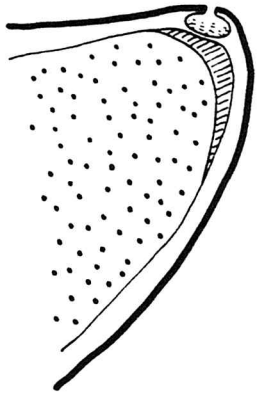


Fig. 8. Epidermoid cyst after spontaneous opening onto the free edge of the cord.

pitch" of the voice, except in the case of the glottic sulcus in men where the pitch was elevated. *2.* Patients tended to speak with a monopitch during running speech. *3.* Vocal loudness was difficult to regulate by patients with cysts and in the case of a glottic sulcus the voice was weak. *4.* Timbre was husky, breathy, and strained. *5.* Pitch breaks were numerous, and diplophonia common. *6.* In the case of the glottic sulcus, the patient tended to use frequent glottal attacks.

*Visual Examination.* Using a magnifying loupe and mirror or 90° telescope, inflammatory changes were seen in 60% of cases.

Of all cases of epidermoid cyst, only 10% were obvious on initial exam as a white or yellow sphere shining through the mucosa, usually on the superior surface of the middle third of the cord. In another 55% of these cases, a cyst was less obvious but suspected because of a subtle localized fullness of one cord, with dilated capillary vessels converging on this point (Figs. 10, 11). Stroboscopy was also helpful in that the vibratory pattern, in contradistinction to that seen with a nodule or polyp, was absent or reduced. The remainder of cases of epidermoid cysts were discovered at the time of operation after mucosal incision and elevation.

For the vocal cord cyst, the dissection was easy at the deep plane of the cyst (where it was sitting on the vocal cord ligament itself), but more difficult in the superficial plane, where it was covered only by epithelium. In several cases, the inferior and lateral poles of the cyst were entangled in a web of connective and elastic fibers coming from the vocal cord ligament.

The *sulcus* was an invagination of the covering epithelium of the vocal cord forming a pocket of variable depth embedded in the submucosa; this pocket was found to be, especially at its deep and lateral borders, in contact with the vocal ligament. The sulcus adhered variably to the vocal ligament, according to the amount of inflammatory reaction which surrounded it. The opening of the pocket was, in general, on the middle third of the free edge of the cord and parallel to it. Sulcus dissection was notably easier when the wall of the sulcus was thick. Bilateral sulci were seen in 55% of the cases.

In 30% of cases of sulci a mucosal bridge was seen which presented like a loop of mucosal parallel to the free edge to which it was attached anteriorly and posteriorly (Fig. 13).

There were what appeared to be transition forms between the cyst and sulcus. Some sulci were deep, but with a small opening and the consequent accu-

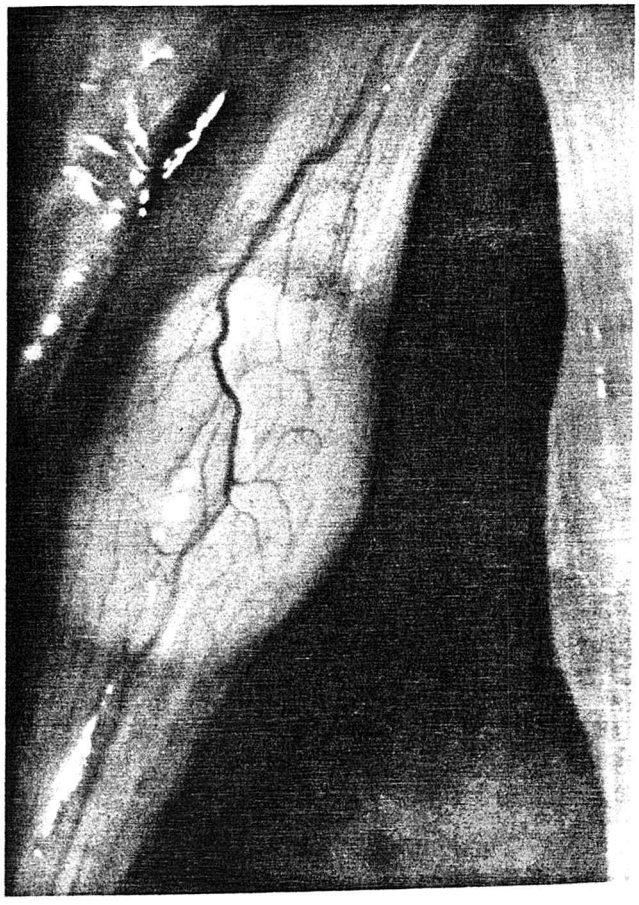


Fig. 9. Obvious cyst (L) true vocal. No. 7702.

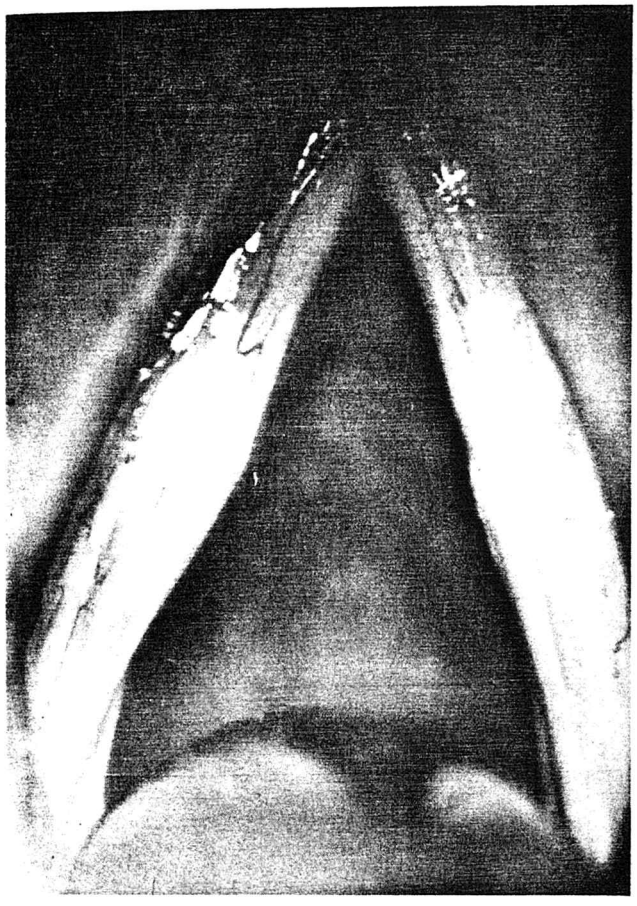


Fig. 10. (Photo 2.) Cyst (L) true vocal cord (difficult to diagnose on indirect laryngoscopy alone). No. 6846.

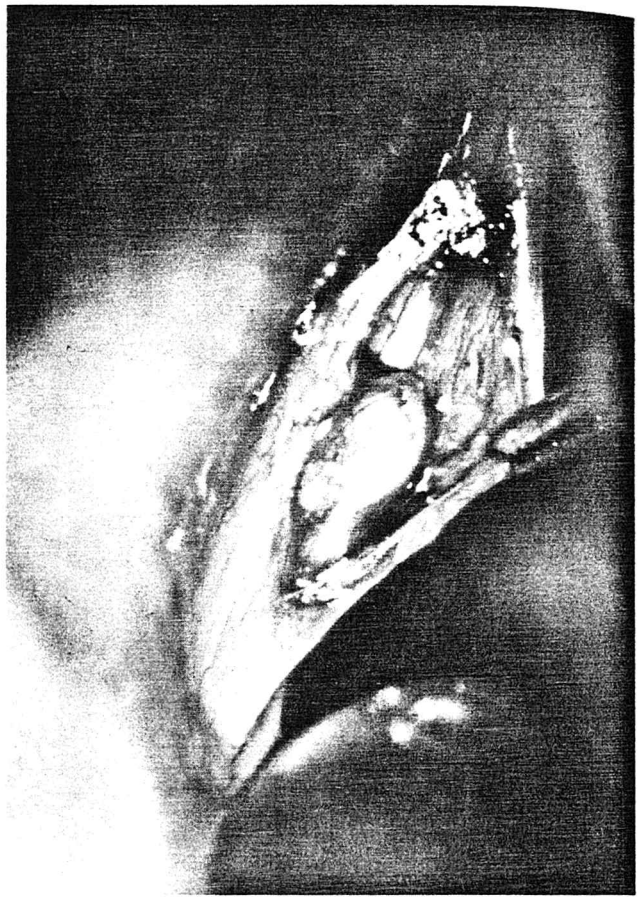
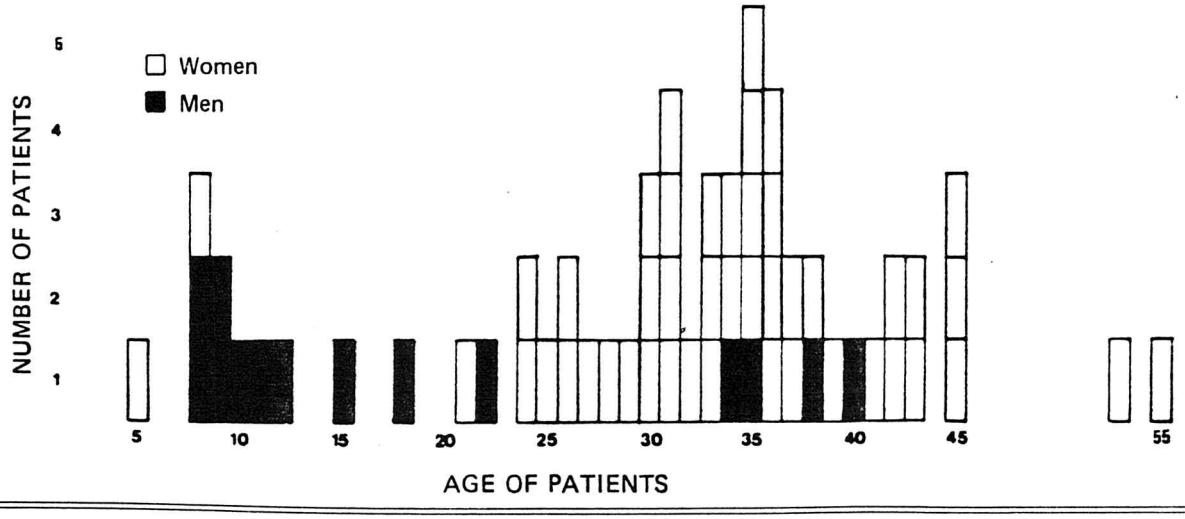


Fig. 11. Same patient as Fig. 10 with cyst surgically exposed. No. 6846.

mulation of squamous material. This type of sulcus looked more like an epidermoid cyst which had opened at the surface of the vocal cord than a true replication of epithelium to form a sulcus (Figs. 7, 8).

*Histopathology.* The *epidermoid cyst* was a true cystic cavity bordered by an epithelium of several cell layers, growing centripetally as keratin and cholesterol crystals accumulated. These cysts were always situated in the submucosal plane (Fig. 14). Most often, there was no sign of inflammation at this level, but in 40% of cases, there was an inflam-

TABLE II.
Epidermoid Cysts.



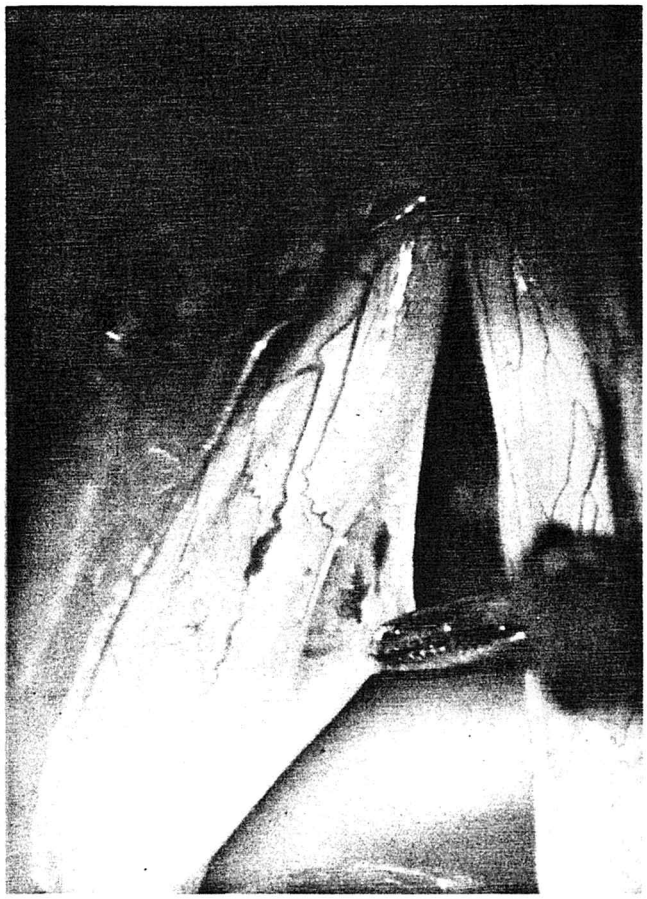


Fig. 12. Sulcus of the (L) true vocal cord in 48-year-old woman. No. 7618.

Fig. 13. Mucosal bridge in 47-year-old woman. No. 6421.

matory reaction with the accumulation of lymphocytes and plasma cells indicating chronic inflammation. Very rarely, there was a reaction which appeared more acute, being composed mostly of polymorphonuclear leukocytes.

The *sulcus* was found to be a true pocket lined by epithelium. The walls were several cell-layers thick and enclosed some retained desquamated keratin in its deepest part. The surrounding areolar plane usually revealed some fibrosis and there was an inflammatory reaction (Fig. 15).

*Mucosal bridge* was constituted by a central axis of connective tissue covered by a stratified epithelium surrounding it (Fig. 16).

It is of note that there was no instance of malignancy associated with any of these lesions.

*Postoperative Examination.*

Upon *indirect examination* at the first postoperative visit (8-10 days after surgery), there was no sign of the incision on the superior surface of the cord. The vocal cord was slightly red and sometimes had a thinned mucosal cover at the free margin or a faint depression on the superior surface.

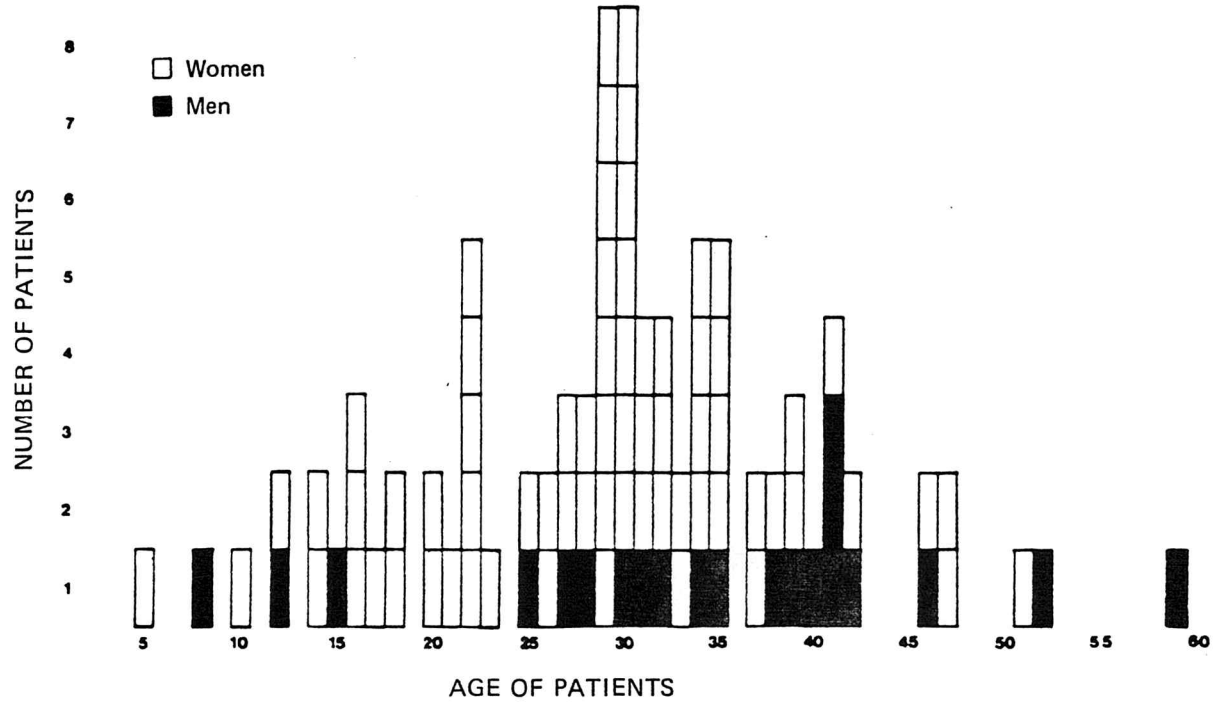
*Stroboscopy* at this early stage revealed very diminished or absent mucosal vibratory wave; usually the "wave" reappeared gradually over time but always remained less than that of the unoperated side. The glottic chink was somewhat bowed in 10% of cases.

After several months, all of these changes tended to diminish considerably. It is important to note that the anatomic appearance of the cord was never perfect. This finding has been confirmed at the time of occasional second operations. In general, however, the cord returned to a more normal mass and suppleness and this explained the improvement noted by the patient.

*Postoperative Voice Examination* (Table V).

In 90% of cases, the combination of microsurgery and vocal reeducation yielded the following improvements: reduction of effort needed for voicing and of the cervical muscle sensations accompanying voice fatigue. The voice became more supple and could be modulated more easily. Change towards a more normal habitual pitch and resonance, along with reduction of harshness, diplophonia, and glottic strokes became apparent. The voice sometimes recovered enough to allow acceptable singing. It is of note, however, that outstanding results were rare (10%) and that there were several poor results (6%), even though the intention of treatment was to give

TABLE III.
Glottic Sulcus. Distribution of Lesions by Sex and Age.




all patients improvement in voice symptomatology and vocal quality.

## DISCUSSION.

The origin of epidermoid cysts and glottic sulci has not been perfectly elucidated. Two opposing hypotheses have been advanced and each may carry some validity.

The first hypothesis is that these are *acquired* lesions. Van Caneghen,[18] in 1928, supported by the fact that the dysphonia of his glottic sulcus patients appeared in adulthood, invoked a traumatic or infectious etiology (such as tuberculosis). Ash and Raum,[2] in 1956, also mentioned the possibility of a traumatic etiology for epidermoid cysts by analogy with the etiology of cysts of the skin.

The second major hypothesis is that the lesions are *congenital*. Congenital anomalies surviving from the fourth and sixth branchial arch in the course of development of the larynx could explain the fact that cysts, sulci, and mucosal bridges are seen together, and these entities represent, therefore, three different stages in the evolution of the same congenital entity. In 1958, Arnold,[1] basing his argument on the comparative anatomical works of Deniker,[8] Giacomini,[8] Citelli,[5] and Grabert,[8] espoused this view.

Cornut, Bouchayer, and Roch[14] brought six clinical observations to the argument for a congenital

TABLE IV.
Results of Treatment.

| Visible Changes of the Vocal Cords | | First Post-op Visit (N=203) | Last Follow-Up After Vocal Reeducation and Healing (N=181) |
|---|---|---|---|
| Inflammation | +++ | 11 | 3 |
| | ++ | | |
| Cordal depression | Significant | 9 | 3 |
| | Subtle | 23 | 6 |
| Vibratory pattern (Strobe) | Very reduced | 14 | 9 |
| | Absent | 12 | 1 |
| Bowed cord | | 15 | 1 |
| Total | | 117 | 31 |

Fig. 14. Epidermoid cyst, removed intact. Visible are the stratified epithelium cyst wall enlarging centripetally (1) and the desquamated keratin contents of the cyst (2). Also present is a tiny fragment of connective tissue (at −), without specific characteristics. No. 1348/83. (H&E, original magnification x100.)

origin for these lesions. *1.* Dysphonia starts in childhood in 55% of cases. *2.* Both the sulcus and the epidermoid cyst were found in childhood in 15% of their cases. *3.* The two lesions can be found in patients who have no history of vocal overwork or laryngitis. *4.* The association of the sulcus and epidermoid cyst is not rare (15% of their cases). *5.* The lesions once removed completely do not return. *6.* Cases of sulcus and cysts occurring in several members of one family[16,17] have been described.

SUMMARY.

The epidermoid cyst, glottic sulcus, and mucosal bridge are three benign laryngeal pathologies relatively commonly seen in that they represented approximately 4% of all voice cases seen in phoniatric consultation and approximately 15% of microlaryngoscopic cases seen in the total reported caseload from Lyon, France.

These pathologies are rarely evident on indirect

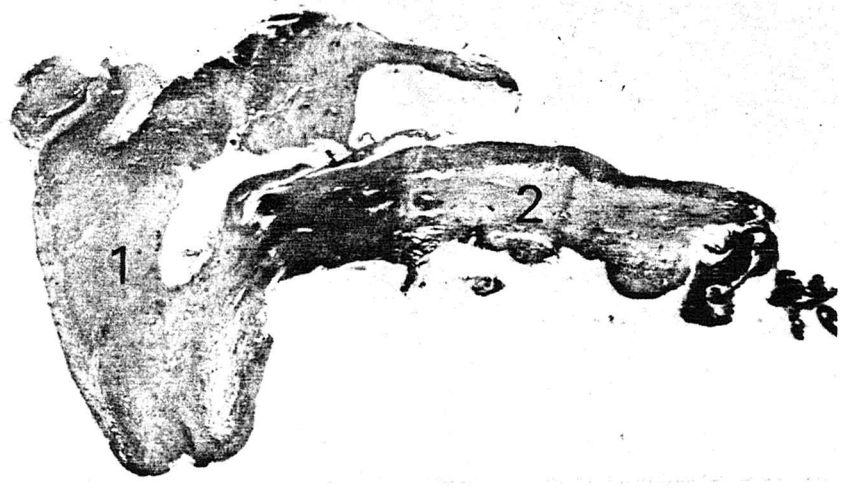



Fig. 15. Excised sulcus. The walls of the cul-de-sac are of a stratified squamous epithelium of variable thickness. Hyperkeratosis of this lining epithelium becomes more marked as one approaches the depth of the pocket (1). Also visible is a fragment of connective tissue (2). No. 1959/82.

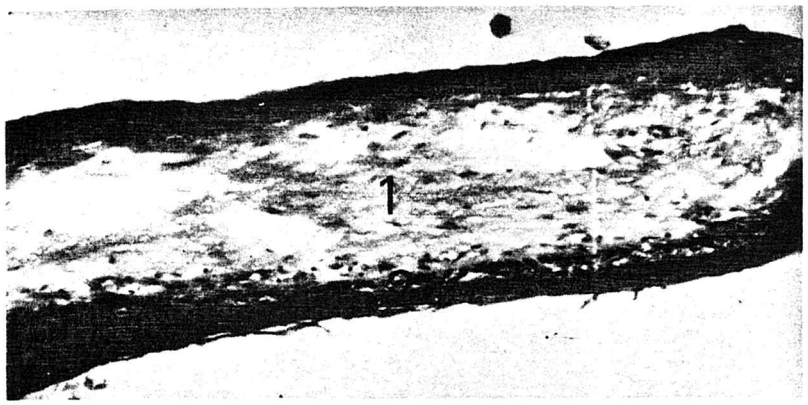



Fig. 16. Mucosal bridge in 20-year-old woman consisting of central axis of connective tissue (1) bordered by a stratified epithelium (2) growing in centrifugal manner.

laryngoscopy alone and will often be suspected at the time of the clinical examination with the aid of not only indirect signs but also vibratory changes seen under stroboscopic illumination and the perceptual analysis of the sound of the voice.

The most effective treatment for these disorders in our clinic was the combination of microsurgery and vocal reeducation. The visible anatomic and functional results confirmed this. Visible and audible improvement was seen in approximately 95% of cases. We conclude that, given a vocal cord cyst or sulcus, though one cannot always return the voice to perfect normalcy, he can obtain great improvement in vocal quality.

TABLE V.

| Result of Overall Assessment | Number of Patients |
|---|---|
| Very good | 15 |
| Good | 63 |
| Fair | 61 |
| Poor | 8 |
| Bad | 1 |
| Total | 148 |

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