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ORIGINAL REPORT

A Retrospective Multicenter Analysis of Vocal Fold Sulcus Disorders

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ABSTRACT

Background: Vocal fold sulci are depressions that may be linear; sulcus vergeture (SVE) or like a pit; sulcus vocalis (SVO). The occurrence of SVE in family groups and the preponderance of reports from specific geographical areas suggest a hereditary etiology. Our objectives are to audit the possibility of a geographical variability between SVE and SVO and to study the patterns of presentation and treatment.

Methods: Following ethics clearance, a 3-year retrospective case-series review of the demographics of vocal fold sulcus was conducted at voice centers in India, USA, Germany, and Australia. Sulcus cases were noted with details of associated lesions, sex, performers, age, and treatment given. The denominator was benign mucosal glottic lesions such as cysts and polyps.

Results: Of a total of 351 cases of sulcus, 239 were SVE, with associated lesions in 56% (47% in SVO). A total of 50/239 SVE and 56/112 SVO were found in vocal performers ($p < 0.00001$). A total of 160/239 SVE and 64/112 SVO were found in men. Sulcus of both types made up 20% of benign lesions in Sydney, 17% in Mumbai, which were significantly higher than New York (4%) and Germany (3.5%). SVE comprised 82% of cases (Mumbai), 72% (Sydney), 70% (New York) and 8.5% (Germany) with a significantly higher geographical variability than SVO.

Conclusion: Both SVO and SVE were found predominantly in men. SVO was significantly more prevalent in performers, suggesting phonotrauma in its formation. SVE showed significant geographical variation, suggesting regional variation in its prevalence, supporting heredity in its formation, unlike SVO.

Level of Evidence: 4

1 | Introduction

Vocal fold sulcus was first described by [1] Giacomini in 1892. In laryngology, sulcus describes an invagination of vocal fold epithelium, with consequences to phonatory mucosal dynamics that result in dysphonia [2]. Vocal fold sulci remain a diagnostic challenge despite advances in technological tools, such as high-definition laryngoscopy and chip-on-tip laryngostroboscopies, with the more superficial sulci often being missed in office procedures. The absence of a variable amount of superficial lamina propria has an impact on both the quality of the mucosal waves as well as the presence of glottic incompetence with consequent often severe effects on the voice of the patient. Depth of invagination generally correlates with the symptom severity, as well as the prognosis for successful treatment outcome. Bouchayer [3] in 1987

described both sulcus vocalis (SVO) and sulcus vergeture (SVE) (Figure 1). SVE is a longitudinal depression of epithelium into the superficial lamina propria (SLP), reaching up to or beyond the vocal ligament. SVO refers to a more localized area of depression. One of the popular classifications of vocal fold sulcus is that by Ford et al. as Type 1 or Physiological Sulcus, Type 2 or SVE, and Type 3 or SVO [4]. Both SVE and SVO may be acquired or from childhood, and both may be superficial or deep.

The occurrence of SVE in family groups and preponderance of reports from specific geographical areas suggests a hereditary/genetic etiology. In their study "Geography is a better determinant of human genetic differentiation than ethnicity", Manica et al. [5] concluded that a more powerful approach when considering the host's genetic background in medicine might be to use individual geographical locations as a continuous variable, or even better, use both geography and ethnicity together.

The primary objective of our study is to audit the possibility of a geographical variability in the demographics of SVE in comparison to SVO. The secondary objective is to study the patterns of presentation and variability in treatment.

2 | Methods

Following ethics clearance, a 3-year retrospective case-series review from January 2021 to December 2023 was conducted of the demographics of vocal fold sulcus at voice centers in India, USA, Germany, and Australia. The inclusion criteria were new patients visiting the voice clinic with a history of hoarseness of voice/vocal fatigue/odynophonia. The presence of sulcus was detected as an office procedure during laryngovideostroboscopy or during microlaryngeal surgery. Being a retrospective study, the sulcus diagnosis was determined by the treating laryngologist at the time of the initial evaluation and confirmed upon review of examination for this paper. Patients in all four centers were included consecutively, thus minimizing selection bias. SVE and SVO cases were noted with details of associated lesions, sex, vocal performers (singers of all genres), age, and treatment given. The denominator was the number of first-time patients during this period with benign mucosal glottic lesions, which included polyps, cysts, pseudocysts, vocal fold bumps, nodules, varix, subepithelial hemorrhage, and leukoplakia besides sulcus. The presence of sulcus with or without concurrent lesions was noted. Pearson's Chi-Square Test was used to compare differences between patient groups, and statistical significance was set at the $p < 0.05$ level.

FIGURE 1 | Right SVO and left SVE in an adult male who is a non-performer.

Exclusion criteria were patients with precancerous and cancerous lesions, amyloidosis, granulomatous voice disorders, lipoma, laryngocele, neurological voice disorders, puberphonia, presbyphonia, primary muscle tension dysphonia, and functional voice disorders. A tabulation explaining patient selection with inclusion and exclusion criteria and associated lesions criteria is given in Figure 2. The senior laryngologists in all four centers standardized the definitions of all lesions to minimize reporting variability.

3 | Results

A total of 4494 patients were reviewed across four centers: Mumbai ($N = 1007$), New York ($N = 1867$), Hamburg ($N = 1330$) and Sydney ($N = 278$). Sulcus of both types made up 20% of benign lesions in Sydney and 17% in Mumbai, which were significantly higher ($p < 0.00001$) (C.I. = 6.77–12.52) than New York (4%) and Germany (3.5%).

Of a total of 351 cases of sulcus, 239 (68%) were SVE and 112 (32%) were SVO. SVE was seen in 141/1007 (14%) benign lesions in Mumbai, 52/1867 (2.8%) benign lesions in New York, 4/1330 (0.3%) benign lesions in Hamburg, and 42/290 (14.5%) benign lesions in Sydney. The geographical distribution of SVE was significantly higher in Mumbai and Sydney compared to New York and Hamburg ($X2 = 279.84$; $p < 0.0001$; OR = 9.21) (C.I. = 6.77–12.52).

SVO was seen in 31/1007 benign lesions in Mumbai (3%), 22/1867 benign lesions in New York (1%), 43/1330 benign lesions in Hamburg (3%) and 16/290 benign lesions in Sydney (5.5%) revealing no significant geographical variability (Chi-square = 2.75; $p = 0.43$).

SVE comprised 82% of total sulcus cases (Mumbai), 72% (Sydney), 70% (New York), and 8.5% (Germany).

The details of associated lesions is tabulated in Figure 3 and revealed a highly significant difference between the institutions of the prevalence of SVE with and without concurrent lesions, unlike in the case of SVO. A comparison of associated lesions in the total SVE and SVO of all four centers did not reveal any statistical significance [$p = 0.12$] (56.067% VS 47.32%); $X2 = 2.35$.

SVE was found bilaterally in 167/239 (70%) total cases with 107 bilateral SVE out of 141 SVE in Mumbai (76%), 42/52 in New York (80%), 4/4 in Hamburg (100%), and 14/42 in Sydney (33%). SVO was found bilaterally in 39/112 (35%) total cases

Retrospective review of 3 years from January 2021 to December 2023 of all cases of sulcus vergeture and vocalis

Inclusion criteria for study

- New patient with hoarseness of voice/vocal fatigue/odynophonia
- Presence of sulcus detected by scopy or during surgery
- Vocalis/Vergeture with number and laterality
- Sulcus with or without concurrent lesions (concurrent lesions may be polyp, cyst, pseudocyst, bump, varix, subepithelial haemorrhage, leukoplakia, paresis, tremor, SD, Laryngocele)
- Detailed notes available and ideally video /image available
- Gender, Age, Profession
- Treatment given- none, medication, therapy, augmentation, surgery

Denominator – mucosal benign glottic lesions

Inclusion criteria
vocalis, vergeture, polyp, cyst, pseudocyst, bump, varix, subepithelial haemorrhage, leukoplakia

Exclusion criteria
RRP
Precancerous and cancerous lesions
Amyloidosis
Granulomatous disorders
lipoma
laryngocele
Neurological voice disorders
Puberphonia
Presbyphonia
Muscle Tension Dysphonia
Functional Voice Disorders

FIGURE 2 | A tabulation explaining patient selection with inclusion and exclusion criteria and associated lesions used for all four centers.

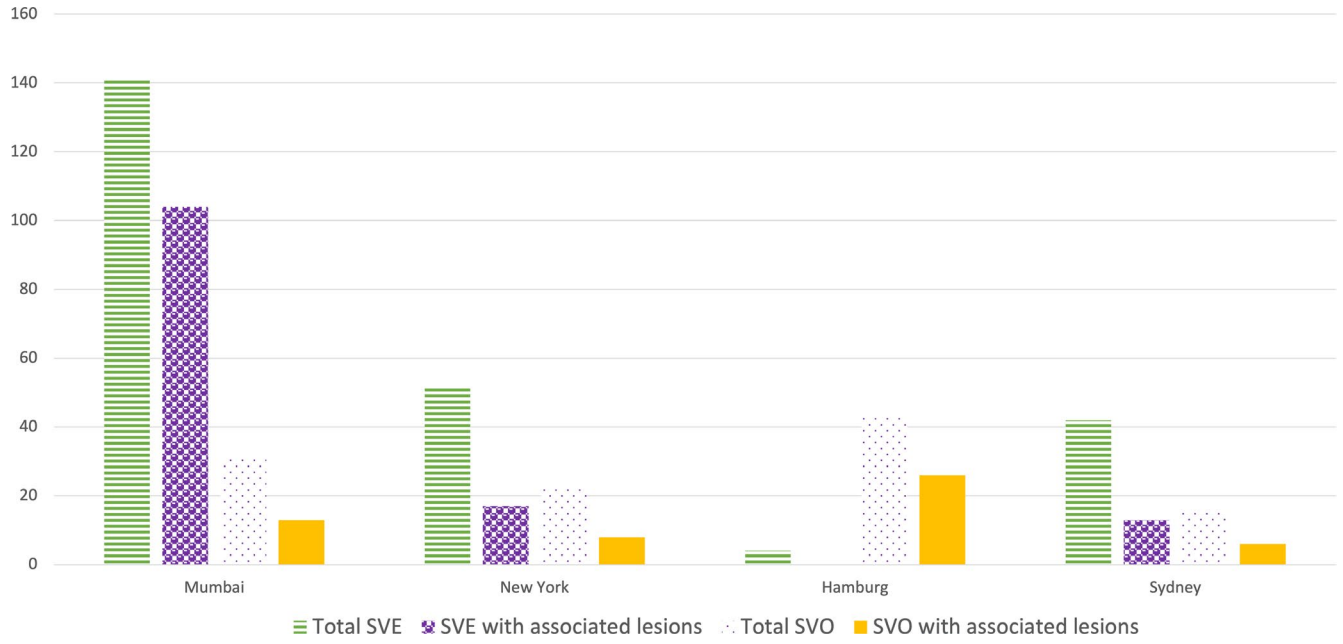

FIGURE 3 | A graphical representation of the total number of SVE and SVO and the number of SVE and SVO with associated lesions in Mumbai, New York, Hamburg and Sydney.

with four bilateral SVO out of a total of 31 SVO in Mumbai (13%), 7/22 in New York (32%), 20/43 in Hamburg (47%), and 8/16 in Sydney (50%). Thus, bilateral SVE was significantly higher than bilateral SVO ($p < 0.0001$) X2 = 35.65; OR = 4.34 (C.I. = 2.69–6.99).

In Hamburg there were 0/4 SVE in performers and 25/43 SVO in performers, New York had 16/52 SVE in performers and 17/22 SVO in performers, Mumbai had 29/141 SVE in performers and 13/31 SVO in performers, and Sydney had 5/42 SVE in performers and 1/16 SVO in performers. A total of 50/239 SVE and 56/112 SVO were found in vocal performers showing a significant difference between the two groups ($p < 0.00001$) (C.I. = 2.32–6.13). A diagrammatic representation of the percentages is shown in Figure 4.

A total of 160/239 SVE and 64/112 SVO were found in men, which was not found to be significant.

The minimum age of patients ranged from 12 in Mumbai to 21 in New York, 19 in Sydney, and 22 in Hamburg. The maximum age ranged from 80 in Mumbai to 79 in New York, 82 in Sydney, and 54 in Hamburg. The mean age was 48 in Mumbai, 51 in New York, 43 in Sydney, and 38 in Hamburg.

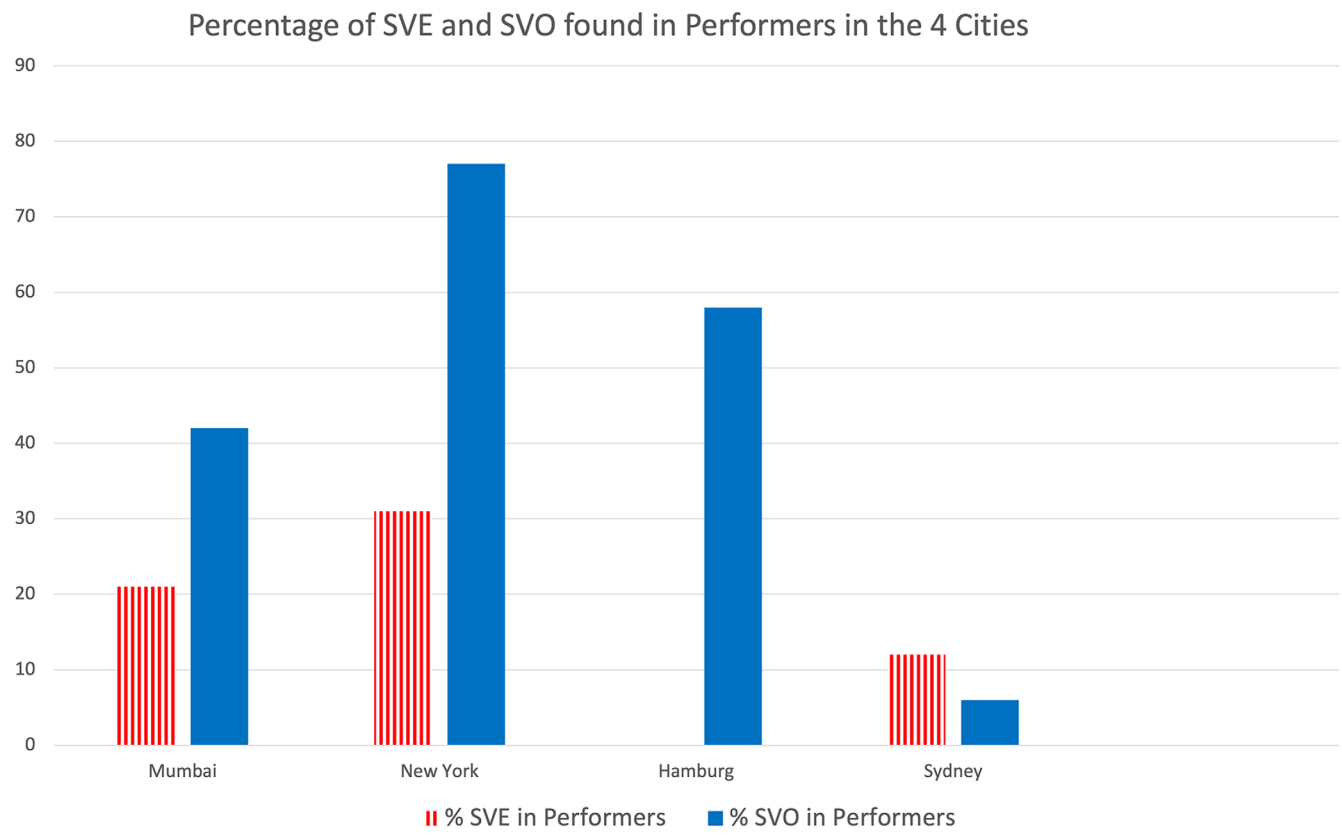

FIGURE 4 | A graphical representation of percentage of SVE and SVO found in performers in the four cities.

Voice therapy was most frequently employed as a primary line of management in Mumbai, with 133/172 patients receiving it as compared to 27/58 patients in Sydney, 20/74 patients in New York, and 12/47 patients in Hamburg.

Laser Assisted Sulcus Release (LASR) surgery was performed in 39 patients in Mumbai (31 SVE and 8 SVO). Surgery was performed in 24/43 patients of SVO in Hamburg and 0 patients of SVE. Surgery was performed in 13 patients in Sydney (10/42 SVE, 3/16 SVO) and 1 patient of SVO in NY.

Augmentation procedure was performed in 9/52 SVE patients in New York, 7/42 SVE and 1/16 SVO patients in Sydney, 4/4 SVE and 8/43 SVO patients in Hamburg, and 0 patients in Mumbai. Figure 5 is a summary table of the total number of SVE and SVO in all four centers with denominators, associated lesions, laterality, age, sex, and treatment modalities used by each center.

4 | Discussion

Sulcus is a Latin term meaning depression, furrow, or groove. In laryngology, sulcus refers to an invagination of the epithelium of the membranous vocal fold into or beyond the superficial layer of the lamina propria. By itself, it does not constitute a diagnosis, but refers to an architectural feature common to more than one pathologic process. Sulcus was first described on the vocal fold by Giacomini in 1892 [1]. The renowned Lyonnais laryngologist Garel added the term "vergeture," meaning "stretch mark," to describe one type of characteristic appearance in 1921 [6]. Bouchayer and colleagues, also from Lyon, distinguished sulcus vergeture from sulcus vocalis in 1985 and proposed the latter is a consequence of a ruptured cyst [7] This led to the development of the most widely used clinical classification of vocal fold sulcus by Ford and colleagues [4]. In this scheme, type 1 sulcus represents physiologic sulcus, a form in which the mucosal wave is preserved and consequently has no effect on voice quality. Type 2 corresponds to Garel's sulcus vergeture, a linear band of contracted epithelium extending along the medial margin of the vocal fold. Type 3 is a focal pit corresponding to Bouchayer's notion of sulcus vocalis as an open cyst. It is worth noting that Ford's classification is descriptive and not related to the severity of disease or voice dysfunction. The hallmark of Type 2 and 3 sulcus is mucosal stiffness in the area of the abnormality resulting in dysphonia.

Several familial reports of cases of sulcus vergeture suggest that sulcus vergeture (Ford Type 2) has a genetic, congenital, or developmental, noninflammatory basis, in contrast to sulcus vocalis (Ford type 3), for which no such cases exist. A 1977 report presented a mother and two daughters, all with dysphonia since at least childhood and sulcus vergeture [8]. A 2007 report presented four familial cases of sulcus vergeture, all with lifelong hoarseness [9]. The same group reported a different series of four patients across three generations with similar features, and proposed autosomal dominant inheritance [10]. Cakir et al. reported sulcus vergeture in monozygotic twins, and Husain and Sulica reported a father-daughter pair, all with dysphonia since birth [11, 12].

The primary objective of our transcontinental study of the demographics of vocal fold sulcus cases was to audit the

CITY	Total Cases	Denominator	Associated lesions	Laterality	Mean Age	Sex	Performers	Voice therapy	Augmentation	Pharmacological	Surgery
Mumbai	172	1007									
SVE	141		104	107 BL 34 UL	48	37 F 104 M	29	110	0	0	31
SVO	31		13	4 BL 27 UL	38	9 F 22 M	13	23	0	0	8
New York	74	1867				25F 49 M					
SVE	52		17	10 UL 42 BL	51	16 F 36 M	16	15	9	9	0
SVO	22		8	15 UL 7 BL	37	9 F 13 M	17	5	0	6	1
Hamburg	47	1330									
SVE	4		0	4 BL,0 UL	38	1F, 3M	0	0	4 (with therapy)	0	0
SVO	43		26	20 BL 23 UL	38	18F 25M	25	0	8(with therapy)	0	24
Sydney	58	290									
SVE	42		13	14 BL 28 UL	43	16 F 26 M	5	21	7	0	10
SVO	16		6	8 BL, 8 UL	35	9 F 7 M	1	4	1 (with therapy)	8 (1 with therapy)	3

FIGURE 5 | A summary table of the total number of SVE and SVO in all four centers along with denominators, associated lesions, laterality, age, sex and treatment modalities used by each center.

possibility of geographical variability in the demographics of SVE (Ford 2) in comparison to SVO (Ford 3), as another aspect of a genetic origin of SVE. This hypothesis arose from our informal observations regarding an apparent concentration of SVE in certain populations and ethnic groups. All four study centers are voice clinics that primarily treat patients with all types of voice disorders, not specifically targeting sulcus patients.

Our study revealed that SVE made up 14.5% of benign lesions in Sydney, 14% of benign lesions in Mumbai, which was statistically higher ($p < 0.0001$) than the 2.8% in New York and 0.3% in Hamburg, thus confirming a significant geographical variation in SVE. In contrast to this, SVO was seen in 3% of benign lesions in Mumbai, 1% in New York, 3% in Hamburg, and 5.5% in Sydney, revealing no significant geographical variability ($p = 0.43$). This suggests that SVE may be found in certain geographical distributions—and by extrapolation, that the incidence may vary between populations—reinforcing the notion that this entity may be due to a hereditary or congenital etiology in distinction from SVO.

Furthermore, SVE was found bilaterally in 70% of total cases in this study as compared to 35% of cases of SVO, another statistically significant difference suggesting the possibility of a developmental process affecting the larynx as a whole rather than a focal phonotraumatic phenomenon. Our findings were similar to those of Ahmet et al. and Byeon et al. in which more than a half of the SVO were found to be unilateral [13, 14].

Our study revealed that 21% SVE and 50% SVO were found in vocal performers, again a significant difference between the two groups ($p < 0.00001$) highlighting the role of increased vocal use and phonotrauma in the etiology of SVO. Literature data also support the possibility that SVO may be an acquired problem [15]. Lee et al.'s paper revealed that in a review of histology from excised lesions in sulcus vocalis (Ford type 3), an important and perhaps dominant element of inflammation was present in the epithelium. This inflammation probably represents an acquired phonotraumatic process [16].

The presence of associated or concurrent lesions such as polyps, cysts, mucosal bridges, varices, and so on. showed a significant difference between the four centers for SVE but not for SVO. A comparison of the total associated lesions in SVE as compared to the total associated lesions in SVO was not statistically significant ($p = 0.12$).

Vocal fold sulcus is an anatomic deviation of the vocal fold rendering it more susceptible to phonotrauma and polyp/lesion formations. The incidence of concomitant lesions in sulcus cases is reported to be 6.4% to 64% as per various studies [14, 17–21]. Byeon et al. [14] reported a prevalence of 6.4% sulcus vocalis among Korean patients with polyp, and Eckley et al. reported a much higher rate (25.9%) [22]. Therefore, whenever managing patients who have been diagnosed as vocal fold polyps, the possibility of a coexisting SVE and SVO should be considered, and efforts should be made to carefully examine the vocal folds before or during the operation (Figures 6 and 7). The added

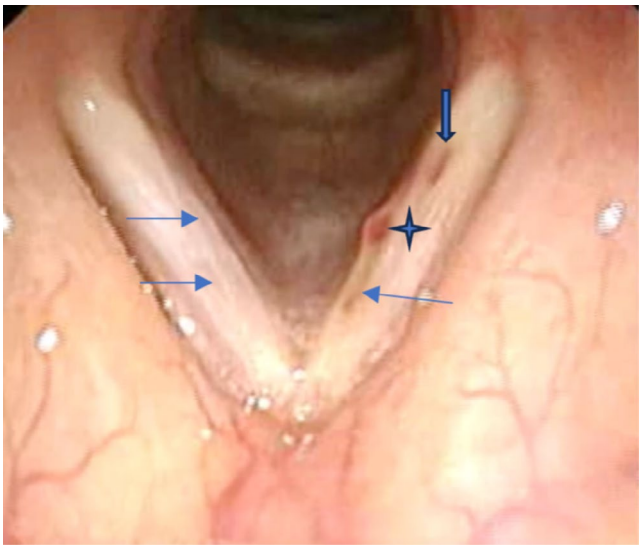

FIGURE 6 | A laryngostroboscopy picture of patient X revealing the presence of a haemorrhagic striking zone lesion of the left vocal fold (4-point star) with possible hemorrhage anterior and posterior to this (downward and left pointing arrow). The right vocal fold is suspicious for multiple SVO (right pointing arrows).

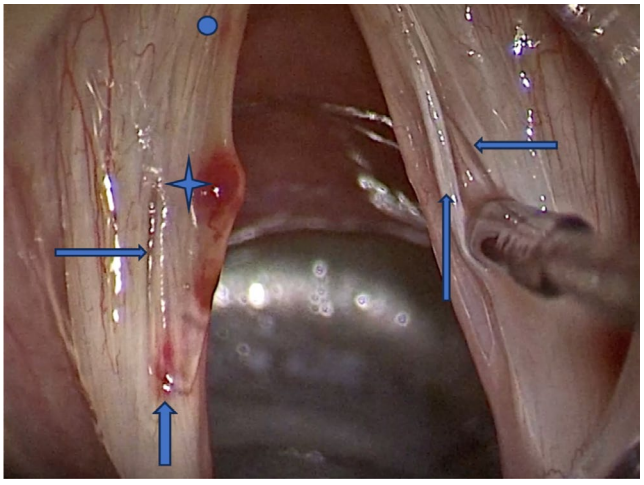

FIGURE 7 | The microlaryngoscopy picture of patient X confirms the presence of one SVO on the right vocal fold (left arrow), however a thin epithelial mucosal bridge is identified (up arrow) as an associated lesion which was not picked up on laryngostroboscopy. Furthermore, besides the striking zone haemorrhagic lesion of the left vocal fold (4-point star) and the anterior (dot) and posterior mild hemorrhage (upward arrow) a SVO is identified near the left striking zone (right arrow) which had been missed on laryngostroboscopy.

armamentarium during surgery is the ability to palpate the vocal folds under high magnification and perform subepithelial infiltration. In our study, associated lesions were seen in 134 SVE out of the total 239 SVE (56%) cases and in 53 SVO out of the total 112 SVO (47%) cases, with a total of 53% sulcus of both types with associated lesions.

Both SVO and SVE were seen predominantly in males with a total of 160/239 (67%) SVE and 64/112 (57%) SVO found in men. Literature review reveals a similar higher incidence of vocal fold sulcus in males. In a previous study by Selleck and Sataloff [23], males were significantly more likely to have sulcus vocalis than females. Itoh found the ratio was 2.58 times higher in males than in females [17]. Both these studies were in accordance with our findings where males showed a preponderance for both SVE and SVO.

In our study, age of the patients ranged from 12 years to 80 years as minimum and maximum respectively. The mean age was 48 years which is somewhat similar to a study done by Byeon et al. where 18 of a total of 280 patients had vocal fold sulcus and the mean age was found to be 46.5 years [14]. Another study by Morgan et al. revealed a comparable mean age of 42.3 ± 17.2 years [23]. A study based on 36 patients with diagnosis of pathological sulcus consisted of 23 women and 13 men aged from 22 to 70 years. Women were aged from 32 to 70 years ($M = 43.91$, SD = 10.88), and men were aged from 22 to 67 years ($M = 44.62$, SD = 14.12) [24].

Making a diagnosis of vocal fold sulcus is rather challenging and it remains one of the most commonly missed glottic pathologies. In our study, the diagnosis of vocal fold sulcus was made independently at the four centers participating in this study, which may have generated some interobserver variability.

In a study performed in 2020, 339 patients were operated on for benign glottic lesions over 30 months, and a total of 47 vocal folds with sulci in 36 patients (10.61% patients) were identified. Of note was that only 18 (38%) vocal folds with sulci were diagnosed by preoperative stroboscopy, and 29 (62%) vocal folds with sulci were incidentally diagnosed during surgery [25].

Brito has included vocal fold sulcus in minor structural alterations of the vocal fold cover and reiterated that sometimes diagnosis can be obtained only through surgical evaluation.

They state that the low occurrence of MSAC can be justified by the fact that the diagnosis was made through videolaryngoscopy and possibly the frequency of detection would have increased had patients been submitted to surgical evaluation, which is the gold standard examination for this evaluation. The utility of stroboscopy over laryngoscopy in the diagnosis of such lesions should be kept in mind [26] and was used in all four centers in the current study.

Literature is replete with studies indicating that sulcus may be detected or confirmed in approximately 30%–40% of patients undergoing surgery for various vocal fold lesions, thus confirming that sulcus is not easy to diagnose during stroboscopy [7, 14, 17].

Though anatomical minor structural alterations of the vocal folds are ideally confirmed under anesthesia, the functionality of the vocal folds is best understood by high definition videostroboscopy which may reveal a spindle-shaped phonatory gap during phonation, aperiodic mucosal waves with reduced amplitude and loss of symmetry [27] with bowing of the medial edge of the vocal fold, increased stiffness and compensatory hyper function [28]. Therefore the information provided with stroboscopy complements that obtained under anesthesia and magnification and this aids in planning the treatment for the symptomatic patient. Recreating the lamina propria remains the

most challenging problem among phonomicrosurgery and multiple surgical procedures described till date are a testament to the fact that no one surgery is as yet the gold standard. Welham et al. described vocal fold sulcus as "a persistent challenge as there is no evidence-based decision algorithm for its treatment" [29].

In our study, 55% of the patients received voice therapy alone as a mainstay treatment, which was similar to the study done by Rosen et al., wherein it was concluded that maximum conservative therapy in the form of voice therapy should be tried before surgery [30]. In the study done by Rajasudhakar [31], sulcus patients treated by voice therapy were found to have prominent positive changes in the voice parameters, such as reduction in F0, jitter, shimmer, and the VHI scores, showing overall grade and strain in voice reduced post therapy.

Injection augmentation procedures may be performed in patients with vocal fold sulcus not only to provide temporary benefit but occasionally to test the vocal response to it. In our study, augmentation was performed in 0%–26% of patients with vocal fold sulcus across the four centers.

Surgical treatment may be considered when there is no response to conservative measures such as voice therapy, and the frequency of surgery in our study varied from 1% to 56% across the four centers. The principles of the surgical treatment of sulcus are focused on restoring normal anatomy, freeing epithelium from deeper attachments, and occasionally interspersing material to prevent re-adhesion [4, 32].

The large variability in the percentage of patients opting for various treatments across the centers may be a consequence of the inability to quantify the expected vocal improvement outcomes in this challenging benign glottic pathology. Besides voice therapy, augmentation, and surgery, some patients were offered pharmacological treatments including but not limited to proton pump inhibitors, alginates, anti-inflammatory medication, and laryngeal hydration.

Treatment decisions were made according to options selected by patients and also seem to have been based on center-dependent factors rather than standardized protocols, and this reiterates the need to develop standardized care in the management of this challenging voice disorder.

The surgery performed at the Mumbai center was laser-assisted sulcus release (LASR) using an Acublade CO_2 laser (Figure 8) for both SVE and SVO, and the patients received voice therapy pre-and postoperatively. The details of this surgery are available in a previous publication by the first author [33].

The surgery performed at the NY center was complete epithelial excision of the vocal fold sulcus, and the details are available in a previous publication [16].

Treatment differences between the four centers may be variations in clinical practice patterns, resource availability, or patient preference, limiting the ability to compare outcomes.

In a study done by Remacle, bilateral lesions should be treated in separate stages, and surgical treatment for SVE is more difficult due to the extremely thin mucosa; hence, laser microdissection is ideal [18]. Autologous transplantation of temporalis fascia into the vocal fold (ATFV) was used for vocal fold sulcus by Pitman in 2014, with consequent improvement in the voice and correction of both glottal insufficiency and the lack of mucosal wave [34]. In a study conducted by William et al., there was significant improvement in phonatory function that persisted over time, as evidenced by the fact that 89% of patients in the study would recommend the surgery to others [35].

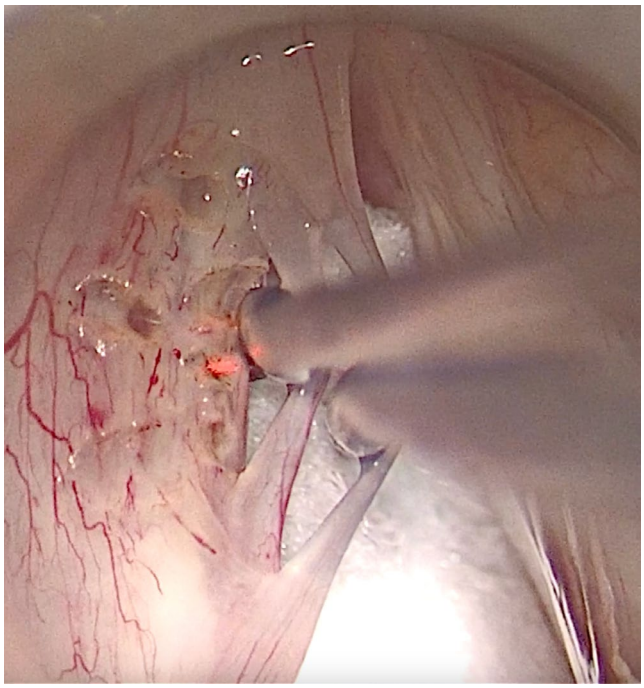

FIGURE 8 | Laser assisted sulcus release (LASR) performed for a left SVE where two thin overlying epithelial mucosal bridges were the associated lesions. These mucosal bridges were left untouched.

There are various other treatment modalities for improving the voice quality of patients with sulcus, such as medialization thyroplasty. Medialization thyroplasty was popularized by Isshiki for unilateral vocal fold paralysis but may be performed for vocal fold sulcus, unilaterally or bilaterally in mobile vocal folds. The main advantage is to achieve spatial reorganization of the glottic framework by bringing the vocal folds closer together without any trauma, as seen in injection of augmentation materials [36, 37]. Zeitels proposed Gore-Tex medialization laryngoplasty for management of both paralytic dysphonia and glottic incompetence due to deterioration of vocal fold mucosa [38].

5 | Conclusion

Both SVO and SVE were found predominantly in men. SVO was significantly more prevalent in performers, suggesting phonotrauma in its formation.

SVE presence bilaterally was significantly higher as compared to bilateral SVO. Unlike SVO, SVE showed significant geographical variation, suggesting regional variation in its prevalence, supporting a hereditary component in its formation. However,

there is a need for prospective studies and genetic analyses to establish causality.

A large variability in treatment modalities suggests the absence of a "gold standard" of treatment currently. There is a need for unified diagnostic criteria and an international consensus on management. Possibly the way forward for this is in maintaining multicentre registries, genetic screening, and standardized post-treatment vocal outcome reporting.

Acknowledgments

The authors have nothing to report.

Disclosure

This study has been presented as a poster at the ALA COSM meeting held in New Orleans in May 2025.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data available on request from the authors.

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