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Vocal fold scars: a common classification proposal by the American Laryngological Association and European Laryngological Society

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Abstract

Purpose Vocal fold scar is one the most challenging benign laryngeal pathologies. The purpose of this paper is to propose a classification that will allow for a common description of this entity between laryngologists, prevent discrepancies in interpretation, allow for comparison of related studies, and offer a training tool for young laryngologists.

Methods/Results Based on the depth and laterality of scarring, we propose 4 types: type I, characterized by atrophy of lamina propria with/without affected epithelium; type II, where the epithelium, lamina propria, and muscle are affected; type III, where the scar is located on the anterior commissure; type IV, which includes extended scar formation in both anteroposterior and rostro-caudal axis with significant loss of vocal fold mass.

Conclusion We believe that our proposal is comprehensive and encompasses all existing iatrogenic and non-iatrogenic etiologies in a simple and concise manner. It also serves its purpose as a descriptive, comparative, and training tool.

Keywords Vocal fold scar · Classification proposal · European Laryngological Society · American Laryngological Association · Benign laryngeal pathology

Need for harmonization

Vocal fold scar is a pathologic entity that is characterized by reduced pliability of the mucosal vocal fold. It is seen as reduced mucosal wave and, occasionally, incomplete glottic closure on laryngeal stroboscopy. However, although the diagnosis is apparent on appropriate investigation and laryngeal visualization, the treatment varies largely and is one of the most challenging conditions for the laryngologist. In its broader spectrum, vocal fold scarring condition may include vocal fold atrophy, congenital or acquired sulcus vocalis, iatrogenic or postsurgical scarring, phonotrauma, direct trauma, i.e., after prolonged intubation, or as a result of radiation or chronic irritation on reflux disease. This wide variety of different pathologies under the same term has caused discrepancy between the authors in the international literature. Although different in origin, the phonatory outcome is similar. Pathophysiology of phonation from scar is due to some degree of mucosal wave impairment with loss of mucosal pliability. A classification of vocal fold scar

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is currently not addressed in the English literature. Such a classification system would help in the nomenclature currently used to describe this disparate group of conditions that results in vocal fold stiffness. The need for harmonization by developing a classification on vocal fold scars is, therefore, deemed necessary to use a common language when addressing this condition. It will also help to develop treatment strategies for each suggested type and allow for comparison of investigations and studies from different centers around the world. Lastly, it may be a useful tool for training purposes.

Prior authors have proposed different classifications systems for diseases of the larynx. These include the classification system used to describe sulcus vocalis and the ELS classification system used to describe endoscopic cordectomy [1–4]. Both have been adopted with regularity in the literature and have facilitated communication. We believe that a classification of vocal fold scar may be similarly helpful in describing the scar condition. The desire for formulation of such a classification have prompted the authors to have an online and personal discussions and the proposal is being submitted for consideration with input from members of the European Laryngological Association and the American Laryngological Association.

Proposed classification

We propose four types of vocal fold scar, based on the depth and location (Fig. 1). Where applicable, these are subclassified according to laterality.

Type I: atrophy of lamina propria with/without affected epithelium

This category includes conditions in which there is pliability of the vocal fold. These are characterized of incomplete glottic closure with bowing of the vocal fold on stroboscopic evaluation. These conditions are the various types of atrophy of the lamina propria, as these have been described by others [1, 2], and age-related vocal fold atrophy (presbylarynx). These include superficial sulcus, sulcus vergeture, sulcus vocalis, and mucosal bridge with/without sulcus.

Type Ia: unilateral.

Type Ib: bilateral.

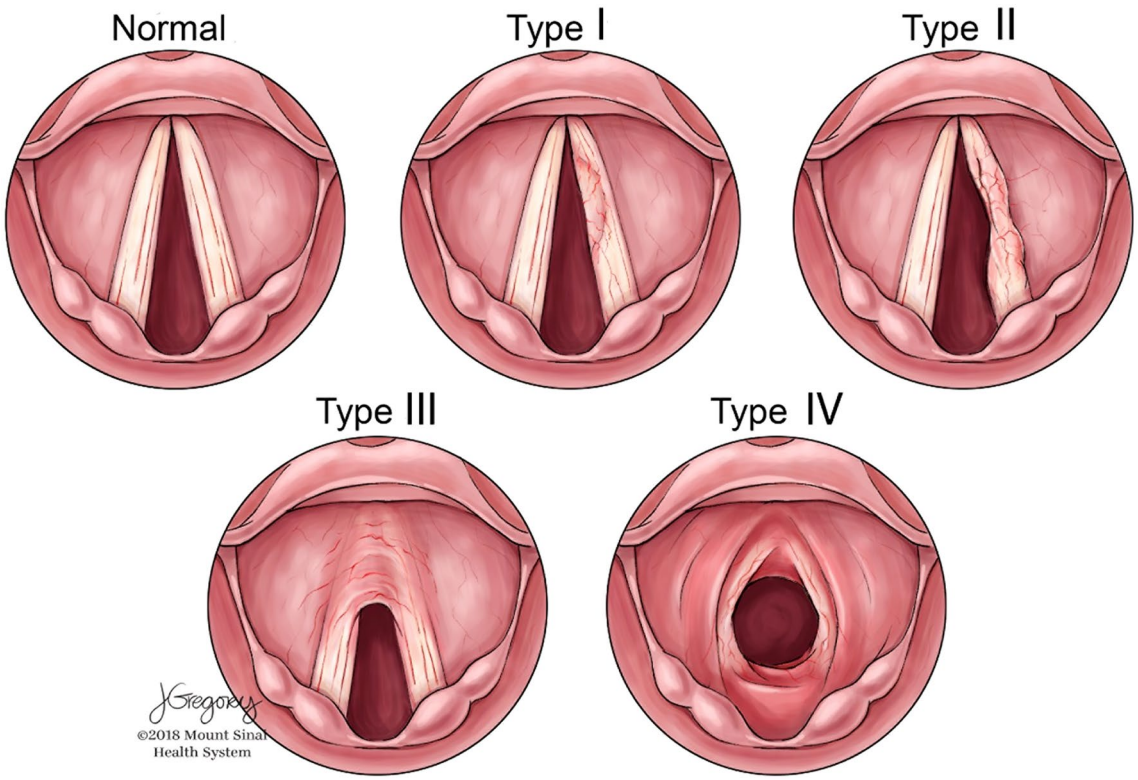

Fig. 1 Illustration of the proposed types of vocal fold scars in comparison to normal morphology

Type II: the epithelium, lamina propria, and muscle are affected

This category includes conditions that alter the pliability of the vocal folds. They result in stiffening of the mucosal wave, which may be secondary to phonotrauma, direct trauma, iatrogenic, postradiation, and chronic chemical irritation (smoking, reflux). These may vary from minimal changes noted on the epithelium and lamina propria with simple stiffening of the free vocal fold edge and minimal reduction of the mucosal wave, to partial or complete removal of the thyroarytenoid muscle, extension of scar formation throughout the hemilarynx and severe impairment of the mucosal wave with incomplete glottic closure. Typical causes may range from phonotrauma, intubation trauma, smoking, reflux (GERD/LPR), to types I, II, III and IV cordectomies and open partial laryngectomy.

Type IIa: unilateral.

Type IIb: bilateral.

Type III: scar located on the anterior commissure

Resulting in anterior glottal incompetence with or without affecting the mucosal wave on stroboscopy. Includes congenital or acquired laryngeal web, and types Va and VI cordectomies. Results in anterior involvement.

Type IV: this category includes extended scar formation in both anteroposterior and rostro-caudal axis, with significant loss of vocal fold mass

It includes ELS type Vb–d cordotomies, as well as patients with voice deficiency after open vertical partial laryngectomy with extended vertical partial laryngectomy. This category also includes open subtotal partial laryngectomy with arytenoidectomy with contra-lateral cordectomy.

Type IVa: unilateral or bilateral vocal fold cover and body involvement with posterior stenosis and unilateral or bilateral fixation.

Type IVb: any of the above, with associated supraglottic and/or subglottic stenosis.

Discussion

In 1974, Hirano proposed his theory of voice production that is now known as the cover-body theory [5]. This has been the basis for understanding vocal fold mechanics and benign vocal fold pathology ever since. The location, extent, and depth of damage on each layer, therefore, alters the vocal fold vibration and determines the phonatory outcome. These changes can range from an intact epithelium with loss of Reinke's space, such as in vocal fold atrophy, to alterations on any or all layers.

In 1983, Monday et al. [1] addressed the problem of sulcus vocalis with the theory that this pathologic entity represents different stages in the natural course of an epidermoid cyst of the vocal fold. They came up with a simple classification in two types: true sulcus, which represents an open epidermoid cyst with thickened epithelium, adherent to the vocal ligament, and sulcus vergeture, which corresponds to atrophy of the mucosa covering the ligament. This classification was extended in 1996 by Ford et al. [2] who described a slightly more detailed classification. In this, he described a non-pathologic superficial Type I sulcus that is limited to the superficial lamina propria and has no functional impact, and a pathologic type II with two subdivisions. Type IIa sulcus has a similar description and origin to sulcus vergeture, is described by atrophic epithelium and causes moderate dysphonia with involvement or loss of the superficial lamina propria, with possible involvement of the vocal ligament and intact vocalis muscle. A deeper Type IIb "true sulcus" or "pouch" type causes severe dysphonia with involvement or loss of the superficial lamina propria, as well as involvement of the vocal ligament and, possibly, the vocalis muscle.

In 2000, the European Laryngological Society (ELS) proposed a classification for endoscopic cordectomy [3], which was later revised in 2007 [4]. It was based on the extent of tissue removal from the vocal fold in regards to depth (from superficial to lateral) and location (rostral to caudal, anterior to posterior, right to left) and is widely accepted in the international literature. Each of the described types of cordectomies results in different extent and location of iatrogenic scar. It may, therefore, be used as a framework for vocal fold scar classification.

Scarring is the single greatest cause of poor voice after vocal fold surgery [6]. The best management is prevention of scarring with appropriate microsurgical techniques and careful use of the laser for laryngeal surgery [7]. The proposed classification is the result of a systematic approach to vocal fold scar, which remains one of the most challenging pathologic conditions for the laryngologist. We believe that it covers the full spectrum of this condition and may serve as a guide for more accurate description and treatment proposals.

In 2013, the Phonosurgery Committee of the European Laryngological Society published a consensus report on vocal fold scars [8]. This paper lists several treatment options currently available in our armamentarium for vocal fold scar treatment: medialization techniques for the treatment of glottic gap, or epithelium freeing techniques for improvement of vibration characteristics often combined with injection, augmentation or implantation, free mucosal grafting for severe cases, as well as new developments, with angiolytic lasers, laser technology with ultrafine excision/ablation properties avoiding coagulation (picosecond infrared laser, PIRL), or techniques of tissue engineering. We believe that our classification allows for a better description of vocal fold scars that helps communication among colleagues and, eventually, fosters scientific collaboration and implementation of all available treatments, enabling comparison of treatment results.

The proposed classification is simple, including four types with four different subtypes for each type. It is not too intricate to memorize, therefore, allowing for easier application. It is comprehensive and covers all aspects of vocal fold pathology leading to scarring. It incorporates past descriptions and classifications for vocal fold atrophy, such as these by Monday and Ford, as well as iatrogenic scars from the various types of cordectomies, as these were classified by the ELS. It is also flexible, allowing for separate description of different coexisting degrees of scarring in both vocal folds, i.e., type Ib for a sulcus for a sulcus vergeture for the right vocal fold with a type IIb after a cordotomy on the left vocal fold.

The classification addresses the depth of scarring, which affects vibratory and phonatory outcome, as this is reflected by scar involvement of the epithelium, lamina propria, vocal ligament and vocalis muscle. It also addresses the anterior and posterior extension of the scar by incorporating supraglottic and subglottic stenosis resulting from extensive tissue loss.

Conclusion

There is a need for a universal agreement for vocal fold scarring, to allow for better communication between otolaryngologists for a more accurate description of the various pathologies. We believe that our proposal incorporates all existing iatrogenic and non-iatrogenic etiologies in a simple and concise manner and serves as a tool for development and comparison of treatment strategies.

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