Comparing Videostroboscopy and Direct Microlaryngoscopy: An Argument for Flexible Consent and Operative Plan

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Summary: Introduction. Office-based evaluation of glottic lesions has progressed significantly, but there can still be discrepancies compared with direct microlaryngoscopy (DML) in the operating room. We performed a prospective evaluation comparing diagnosis of epithelial and lamina propria glottic lesions on rigid telescopic strobovideolaryngoscopy (RTS) with DML.

Methods. Fifty subjects were enrolled and underwent RTS followed by DML. We compared presence and extent (unilateral or bilateral) of lamina propria and epithelial lesions. Primary (diagnoses motivating an operation) and secondary (diagnoses not requiring an operation) were considered. Changes in diagnosis and operative plan based on DML findings were evaluated.

Results. Sixty-eight lesions were identified on RTS, including 53 primary (15 epithelial, 38 lamina propria) and 15 secondary diagnoses. RTS was accurate in only 36% of subjects. Ten subjects had a different primary pathology identified on DML. A change in surgical management occurred in 16% of subjects.

Conclusions. This is the first prospective study evaluating how both diagnosis and operative plan for epithelial and lamina propria glottic lesions differ based on RTS and DML. Despite significant advances in office-based diagnosis of glottic lesions, there are still notable limitations. Clinicians should consider these findings when counseling patients on interpretation and plan for findings based on RTS. Obtaining a flexible surgical consent and counseling patients on the potential for new diagnoses and interventions based on DML is warranted.

Key Words: Videostroboscopy–Direct microlaryngoscopy–Glottic lesion–Epithelial lesion–Lamina propria lesion.

INTRODUCTION

Office and operating room laryngeal evaluation of benign vocal fold lesions have undergone a progressive transformation and refinement. Through innovations such as Hopkins rod rigid telescopic laryngoscopy in the late 1960s, stroboscopy in the 1980s, and videography and photography in the 1980s, laryngeal examination has incorporated enhancing features of light delivery, magnification, and video recording into assessment.[1,2] These advances have significantly improved the clinician's diagnostic ability.

Although patients presenting for voice evaluation may demonstrate laryngeal pathology, assessing how these findings relate to the patient's concerns and goals for treatment is extremely important, especially when surgery is recommended. This preoperative dialogue is unfortunately limited by the extent of lesion assessment possible at the time of office-based evaluation. A change in severity, diagnosis, or additional pathology noted during surgery may ultimately change the focus of the surgery as well as the postoperative expectations. These abrupt changes present difficulties in the patient-physician relationship, especially when they negatively impact postoperative function and occupational potential.

Experience and training play important roles in the recognition of pathology, but there are key differences between the examinations achievable in the awake office setting and in the operating room under general anesthesia. Office-based rigid telescopic strobovideolaryngoscopy (RTS) is performed with an awake patient and assesses not only laryngeal surface lesions, but also glottic closure and mucosal pliability during phonation.[3,4] This dynamic examination allows for a detailed understanding of vibratory behaviors during sustained vowel production and provides more accurate diagnosis of laryngeal anomalies compared with exam under standard halogen illumination.[4–6] This has allowed RTS to become the gold standard for the clinical evaluation of dysphonia.[2,7] Despite the diagnostic power of RTS, there are limitations to the RTS examination. It can be difficult to see the medial and infraglottic surfaces of the vocal folds, subtle mobility alterations may be missed because of tongue extrusion, and intolerance can limit the ability to advance the endoscope close to the glottis or palpate a lesion. Another significant limitation is related to the nature of stroboscopy itself, which relies on periodic vocal fold oscillation. If oscillation is aperiodic, the stroboscope cannot track, thereby limiting image capture.[8] This requirement effectively limits laryngeal examination during connected speech tasks.[9]

In contrast to RTS, direct microlaryngoscopy (DML) allows for a detailed view of all surfaces of the vocal folds at very close proximity with different perspectives, particularly when using angled telescopes. This enhanced control provides a more detailed understanding of the vocal fold surface in areas that are not easily visible through the optical vector of awake rigid

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transoral endoscopy. It also allows for palpation of the vocal folds, which provides proprioceptive information that cannot be obtained in an office setting. These benefits are tempered by the required general anesthetic and the static nature of the exam, which limits evaluation of vocal fold vibratory dynamics and arytenoid mobility speed and range.

Because the laryngeal stroboscope's inherent limitations may, in some cases, produce an inaccurate or incomplete understanding of vocal fold pathology or function, it is important to understand the relationship between office-based and intraoperative laryngeal visualization procedures, their respective roles in laryngeal evaluation, and their potential limitations and benefits.[9]

Four previous studies have compared the diagnostic accuracy of RTS with intraoperative DML in the diagnosis of benign glottic lesions.[3,10–12] Poels et al performed a retrospective review and observed a 33% change in diagnosis after operative evaluation.[10] Dailey et al completed a retrospective chart review showing a 9% rate of intraoperative identification of an additional glottic lesion.[3] Of those participants for whom additional lesions were identified, an intraoperative management change occurred in 45%. Mendes Neto et al also conducted a retrospective review and reported a 23% rate of identifying additional lesions intraoperatively.[11] Akbulut et al performed the first prospective study comparing videostroboscopy and microlaryngoscopy.[12] Preoperative diagnosis was correct in only 34.2% of patients. Notably, they did not include epithelial lesions and did not report on how changes in diagnosis affected treatment plan. The existing literature does not offer a *prospective* comparison of the diagnostic accuracy of RTS and DML for both epithelial and lamina propria lesions, nor does it offer a prospective evaluation of how changes in diagnosis based on operative DML affect operative plan. Prospective studies on this topic are valuable as greater attention to detail would be paid to the stroboscopic assessment, thus providing a more accurate rate of intraoperative change in diagnosis and management.

We performed a prospective study examining the diagnostic accuracy of RTS compared with DML (via microscope and telescope). We specifically evaluated diagnoses driving performance of DML, change in diagnosis with DML, identification of more or fewer lesions during DML, and diagnoses driving an intraoperative change in management.

METHODS

This prospective, observational study was approved by the University of Wisconsin Health Sciences Institutional Review Board, with approval obtained before the start of participant enrollment. Participants were enrolled from an adult laryngology practice at a tertiary care referral center between 2006 and 2009. The article was finalized and submitted in 2017 following delays secondary to study team turnover. Inclusion criteria were adults who were examined via RTS with a diagnosis requiring operative intervention. Exclusion criteria were incomplete data collection or stroboscopic examination via flexible distal chip laryngoscopes. Prior laryngeal surgery was not an exclusion criterion.

Fifty subjects participated in the study (23 males, 27 females; average age 50.7 years, range: 19–82). Average time between RTS and DML was 26.6 days (range: 5–79 days).

All patients underwent a standard clinical dysphonia evaluation by otolaryngology and speech-language pathology consisting of history, physical exam, perceptual voice analysis (grade, roughness, breathiness, asthenia, strain scale), aerodynamic analysis, acoustic analysis, patient-reported questionnaire (voice handicap index), and RTS. The preoperative RTS diagnosis incorporates all these factors. RTS diagnoses were obtained during office videostroboscopy using a rigid glass rod peroral laryngoscope (Model 9106, KayPENTAX, Lincoln Park, NJ). We chose to focus on RTS rather than flexible fiberoptic or distal chip strobovideolaryngoscopy because of the desire to be the prospective correlate of prior retrospective studies.[3,10,11] All RTS examinations were performed by trained speech-language pathologists and reviewed in conjunction with a single laryngologist (SHD). RTS diagnoses were recorded by the senior author using a data sheet to record both diagnoses and geographic sites of pathology. DML was completed under general anesthesia using standard laryngoscopes, operative microscope (Model M 525 F40, Leica Microsystems Inc., Buffalo Grove, IL), and Hopkins rod telescopes (Models 8712CA and 27005AA, Karl Storz, El Segundo, CA). All DML procedures were performed by a single laryngologist (SHD). All findings were recorded at the time of DML, noting diagnosis and geographic sites of pathology.

Reinke's edema, polyps, pseudocysts, vascular ectasias, varices, nodules, reactive nodules, sulcus vocalis, scar, and mucosal cysts were classified as lamina propria pathologies, whereas leukoplakia, erythroplakia, carcinoma, and papilloma were classified as epithelial lesions. Lesions were classified as leukoplakia, erythroplakia, or carcinoma based on their appearance and apparent severity. At the time of RTS, erythroplakia was defined as a smooth, red, homogeneous, velvety plaque. Leukoplakia was defined as thickened white plaque. Carcinoma was defined as an exophytic, nodular, or ulcerative lesion. No biopsies were performed at the time of preoperative evaluation. Understanding that there may be some discrepancies in nomenclature between sulcus and scar, we chose to identify scar as a more diffuse lesion, with the term "sulcus" or "sulcus vocalis" referring to a classic type II (sulcus vergeture).[13,14]

If multiple diagnoses were identified in a single patient for either the RTS or the DML examination, the diagnoses were classified as being primary or secondary based on level of importance for clinical management. Lesions driving the decision to proceed to surgery for treatment were classified as primary lesions, whereas pathology noted that was not influencing surgical decision-making was classified as secondary. For both primary and secondary lesions, extent was noted by determining if the pathology was unilateral or bilateral. Increasing extent was noted if the lesion involved bilateral true vocal folds on the DML exam when unilateral extent was noted on RTS exam. Likewise, decreased extent was noted if a unilateral lesion was identified with DML, whereas a bilateral lesion was noted on RTS. A change to the point of lesion absence was classified as a misdiagnosis.

RESULTS

Among the 50 subjects, 68 diagnoses were identified on RTS examination. Fifty-three diagnoses drove the decision to operate

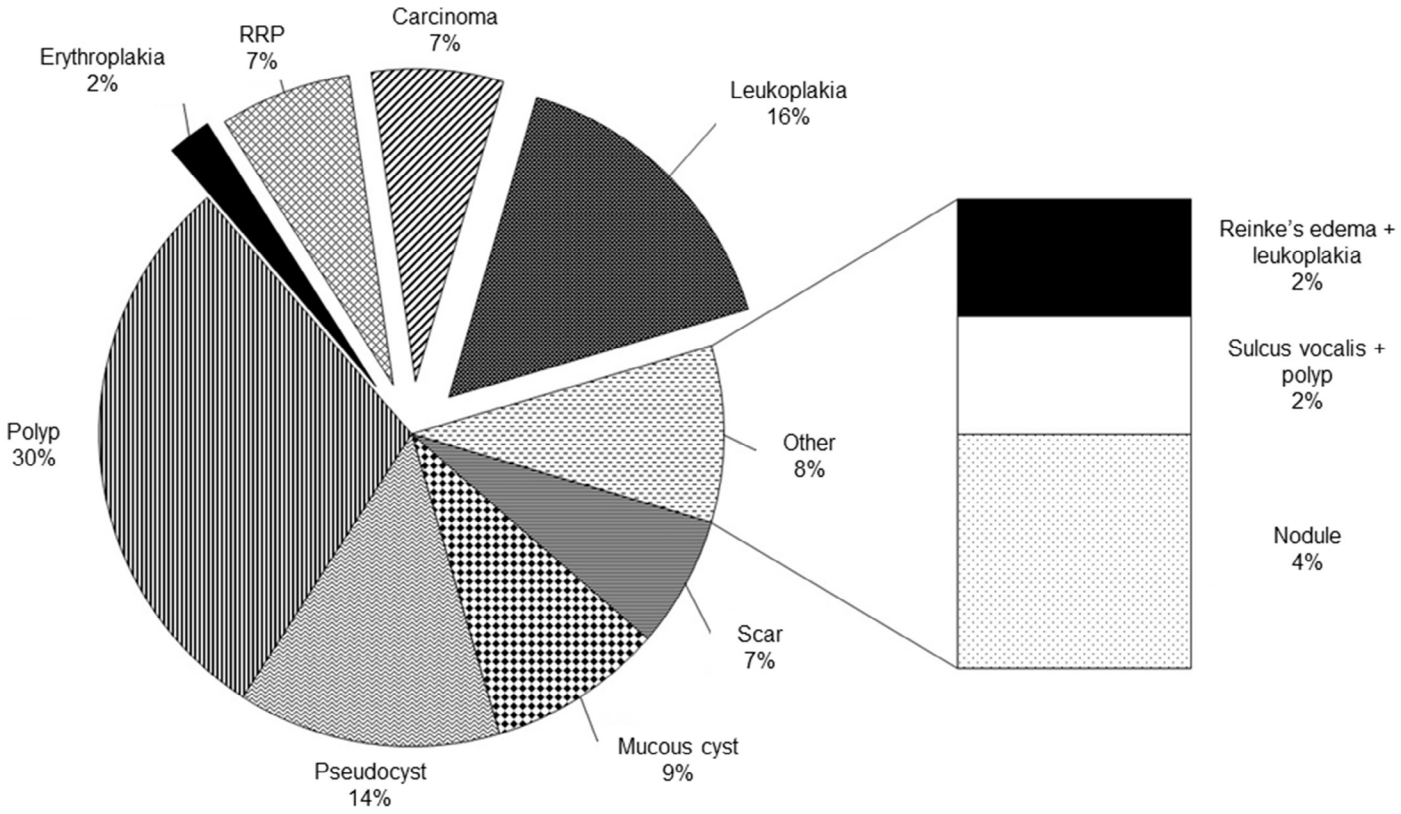

FIGURE 1. Pie chart showing primary diagnoses identified on rigid telescopic videostroboscopy.

(primary diagnoses), and 15 diagnoses were noted but did factor into the surgical plan (secondary diagnoses). There was an average of 1.1 primary diagnoses per RTS examination (range: 1–2). Of the 53 primary diagnoses, 15 (28%) were epithelial lesions and 38 (72%) were lamina propria lesions (Figure 1). Only one subject had concurrent epithelial and lamina propria lesions that drove surgical management via the RTS examination. Secondary diagnoses accompanied the primary RTS diagnoses 28% (n = 14) of the time, ranging from one to two diagnoses. These secondary diagnoses were exclusively lamina propria lesions. Primary lamina propria diagnoses were more frequently accompanied by secondary diagnoses (n = 12; 32%) compared with primary epithelial lesions (n = 2; 14%).

Only 18 subjects (36%) had an accurate RTS examination (Table 1). Of these patients, five (28%) had an epithelial diagnosis, whereas 13 (72%) had a lamina propria diagnosis. Accordingly, 32 subjects (64%) had a change in pathology or lesion extent with DML. Ten subjects (20%) had a different primary pathology identified via DML, and another three (6%) had a change in extent identified. Secondary diagnosis pathology or extent was changed in 19 subjects (38%).

Additional contralateral lesions were identified in 14 subjects (28%; range: 1–2 additional lesions), including nine lamina propria lesions and six epithelial lesions. As shown in Table 2, three subjects (6%) had fewer contralateral lesions on DML, all of which were lamina propria lesions diagnosed on RTS. Four subjects (8%) had additional ipsilateral lesions (range: 1–2) on DML, including four lamina propria lesions and one epithelial lesion. Two subjects (4%) had fewer ipsilateral lesions at the time of DML, including two lamina propria lesions.

In the setting of bilateral lesions, additional diagnoses (range: 1–3) were noted in five subjects (10%), including six lamina

TABLE 1.
Summary of Findings for the 18 Subjects in Whom Findings on Rigid Telescopic Strobovideolaryngoscopy (RTS) and Direct Microlaryngoscopy (DML) Were the Same

Diagnosis	Number of Subjects
Epithelial lesions	
Bilateral leukoplakia	2
Unilateral leukoplakia	2
Carcinoma	1
Lamina propria lesions	
Bilateral polyps	1
Unilateral polyp	1
Unilateral polyp, contralateral scar	1
Bilateral nodules	1
Unilateral nodule	1
Unilateral pseudocyst	3
Unilateral mucous cyst	2
Bilateral Reinke edema	1
Bilateral scar	1
Bilateral scar, unilateral sulcus vocalis	1
Total	18

Primary diagnosis motivating surgery is listed in bold.

TABLE 2.
Findings on Rigid Telescopic Strobovideolaryngoscopy (RTS) and Direct Microlaryngoscopy (DML) in Subjects With Differing Findings on the Exams

RTS Diagnosis	DML Diagnosis	Change
Left carcinoma	**Left erythroplakia**	Type of primary lesion
Right polyp	**Right pseudocyst**	Type of primary lesion
Bilateral Reinke's edema	**Bilateral leukoplakia**	Type of primary lesion
Left polyp; right scar	**Left mucous cyst; right scar**	Type of primary lesion
Right erythroplakia	**Right carcinoma; left leukoplakia**	Type of primary lesion; comorbid primary lesion
Right scar	**Left leukoplakia**	Type and location of primary lesion
Right pseudocyst	**Bilateral scar**	Type and extent of primary lesion
Left leukoplakia; bilateral sulcus vocalis	**Left carcinoma; right erythroplakia**; right sulcus vocalis	Type of primary lesion; additional primary lesion; extent of secondary lesion
Right polyp; bilateral scar	**Bilateral erythroplakia; right leukoplakia; right RRP;** bilateral sulcus vocalis	Type of primary lesion; additional primary lesion; additional secondary lesion
Left polyp, bilateral sulcus vocalis, right Reinke's edema	**Left polyp, right sulcus vocalis**	Extent of primary lesion; presence of secondary lesion
Unilateral RRP	**Bilateral RRP**	Extent of primary lesion
Unilateral RRP	**Bilateral RRP**	Extent of primary lesion
Bilateral Reinke's edema; right leukoplakia	**Bilateral Reinke's edema**; right scar; left sulcus vocalis; left erythroplakia	Presence of secondary lesions
Left polyp	**Left polyp**; right sulcus vocalis	Presence of secondary lesion
Right polyp	**Right polyp**; bilateral scar	Presence of secondary lesions
Left polyp	**Left polyp;** right nodule; right erythroplakia	Presence of secondary lesions
Right polyp	**Right polyp**; left scar	Presence of secondary lesion
Left polyp	**Left polyp;** bilateral sulcus vocalis; right scar; left erythroplakia	Presence of secondary lesions
Bilateral Reinke's edema	**Bilateral Reinke's edema; right leukoplakia**; left sulcus vocalis	Presence of secondary lesion
Right pseudocyst	**Right pseudocyst**; left nodule	Presence of secondary lesion
Bilateral leukoplakia	**Bilateral leukoplakia**; left sulcus vocalis	Presence of secondary lesion
Bilateral RRP	**Bilateral RRP;** right sulcus vocalis	Presence of secondary lesion
Bilateral leukoplakia	**Bilateral leukoplakia**; left sulcus vocalis	Presence of secondary lesion
Left polyp	**Left polyp**; left sulcus vocalis; right nodule	Presence of secondary lesions
Right Reinke's edema; right sulcus vocalis; right scar	**Right Reinke's edema**; bilateral scar	Type of secondary lesions
Bilateral Reinke's edema; bilateral sulcus vocalis	**Bilateral Reinke's edema**; bilateral scar	Type of secondary lesions
Left mucous cyst; left sulcus vocalis	**Left mucous cyst**; right scar	Type and location of secondary lesion
Right mucous cyst; bilateral nodules	**Right mucous cyst**; left reactive nodule	Extent of secondary lesion
Left carcinoma; right scar	**Left carcinoma**	Absence of secondary lesion
Right polyp; left sulcus vocalis	**Right polyp**	Absence of secondary lesion
Left pseudocyst; right erythroplakia	**Left pseudocyst**	Absence of secondary lesion
Bilateral Reinke's edema; bilateral scar	**Bilateral Reinke's edema**	Absence of secondary lesions

Each row represents a subject. Primary diagnosis is indicated with bold text.
Abbreviation: RRP, recurrent respiratory papillomatosis.

propria lesions and one epithelial lesion (Table 2). Fewer diagnoses (range: 1–2) were noted in four subjects (8%), including three lamina propria lesions and two epithelial lesions.

A change in surgical management occurred in eight subjects (16%). This included four epithelial lesions and four lamina propria lesions (Table 3). Changes included abortion of a procedure because of lack of previously identified pathology, longer surgery duration because of more extensive disease, or different surgical plan based on identification of other pathology (Table 3).

TABLE 3.
Subjects in Whom Findings on Direct Microlaryngoscopy Prompted a Change in Surgical Plan

RTS Diagnosis	DML Diagnosis	Change in Surgical Plan
Bilateral Reinke's edema; right leukoplakia	**Bilateral Reinke's edema**; right scar; left sulcus vocalis; left erythroplakia	No biopsy performed
Right RRP	**Bilateral RRP**	Additional laser treatment required
Right RRP	**Bilateral RRP**	Additional laser treatment required
Right polyp	**Right polyp**; bilateral scar	Scar lysis and dexamethasone injection added for scar
Right pseudocyst	**Bilateral scar**	No pseudocyst resection performed
Left polyp; right scar	**Left mucous cyst; right scar**	Deeper dissection required for cyst
Right scar	**Left leukoplakia**	Biopsy performed
Left polyp; bilateral sulcus vocalis; right Reinke's edema	**Left polyp; right sulcus vocalis**	Less dissection of scar as it was less deep

Primary diagnoses are in bold.

DISCUSSION

Clinical application of laryngoscopy has matured since its infancy. Technological advances have allowed an increasingly detailed examination of both the pathology and function of the larynx in the office setting. Because of this maturation, detailed examinations for diagnosis under anesthesia are not as heavily relied on. However, retrospective studies comparing the diagnostic reliability of RTS with DML have demonstrated the increased diagnostic yield that suspension laryngoscopy provides over RTS.[3,10,11] This study represents the second prospective investigation into this comparison, and the first to evaluate how changes in diagnosis affected surgical plan.

When comparing RTS and DML findings, a diagnostically accurate laryngeal examination can be defined in multiple ways. We chose to categorize an RTS examination as accurate if all the types and extent of pathology seen on the RTS exam were the same as those seen on the DML exam. With this definition, only 36% of subjects had an accurate RTS exam. Mendes Neto et al noted an RTS exam accuracy of 64.5%, but this was related only to the primary pathology driving the decision to proceed to surgery and did not take into consideration whether other types of pathology were identified on the subsequent DML.[11] There was also no comment on what type of pathology was driving surgery when additional pathology was identified during DML. Poels et al reported consistency of diagnosis, but the definition was not explicitly defined, especially when two different types of pathology were found on DML.[10] Unilateral *versus* bilateral extent of disease was noted, but not the progression of pathology between examinations. The Dailey et al study did not report on disease extent[3]; if our accuracy definition was applied to their study for pathology only, RTS accuracy would be 90%.

Although a few issues associated with light delivery, color representation, and display or camera resolution play into every telescopic laryngeal examination using video imaging, there are a few factors unique to RTS that may negatively influence lesion identification. Distance from the tip of the telescope to the vocal fold impacts image resolution. Newer distal chip technology, which incorporates the charge coupled device camera onto the tip of the flexible laryngoscope, attempts to ameliorate this factor, but was not included in this study. Other factors include patient compliance, degree of supraglottic hyperfunction, and the lack of palpation. Although palpation is indeed possible with adequate laryngeal topical anesthetic, the time needed to guide the patient through such a procedure is prohibitive in a typical clinic setting.

During our study, the most common change at the time of DML was the identification of additional pathology on the contralateral vocal fold in the setting of unilateral pathology identified on RTS. This occurred in 14 subjects. These changes were noted especially in the setting of a unilateral polyp where no other secondary pathology was noted. When we consider the additional contralateral lesions that were identified, many of these (scar, nodule, varix, ectasia, erythroplakia) were present in the setting of larger bulkier lesions such as a polyp or pseudocyst. Identification of the contralateral lesions via DML begs the question of which lesion begat the other, how that relates to their pathophysiology, and speaks to the nature of the visually obstructive anatomic hooding, or "umbrella," effect that the larger lesions can have over other subtle anomalies when viewed through the optical vector of RTS.[3,14] In contrast, the angled telescopes used during DML help to give visual access to these "hidden" lesions and also permit the inspection of portions of the glottis not easily seen on RTS, such as the infraglottic surface. Bulkier lesions also significantly impact the vibratory dynamics of the medial and infraglottic surfaces, making an interpretation of the quality of the superficial lamina propria in this region difficult even if visible.

The second most common change noted at the time of DML was identification of an additional lesion in the setting of a different bilateral pathology, occurring in five subjects. This included two patients with bilateral Reinke edema in whom a comorbid sulcus vocalis was found on DML. Although not demonstrated well by the limited number of patients with Reinke's edema (n = 7), Reinke's edema appeared to localize to the superior aspect of the true vocal folds, with the sulcus vocalis present on the medial surface inferior to the Reinke's edema. Although the umbrella effect can certainly account for the additional sulcus vocalis noted in the setting of papilloma, optical resolution, distance, and the lack of color contrast among leukoplakia, scar, and sulcus

vocalis likely played a role in the remainder of the intraoperative changes in this setting.

The third most common change noted at the time of DML was tied between the addition of lesions on the ipsilateral vocal fold in the setting of a unilateral polyp and the failure to identify certain lesions in the setting of bilateral pathology that were previously noted on RTS. Although the umbrella effect could also be in play here, other possibilities include spontaneous resolution of some of the leukoplakia anomalies or errors in image interpretation because of resolution or image artifact issues. Glare-related phenomenon is an important artifact to consider given its interruption of the contrast needed to discern the subtle surface differences between the lesion and surrounding tissue. The white discoloration seen with glare-related image artifacts are easily resolved using binocular microscopy and the use of angled telescopes during DML.

Twenty-one patients had a change in diagnosis related to scar or sulcus vocalis (ie, discordance between RTS and DML diagnosis where scar or sulcus vocalis was diagnosed on at least one exam) (Table 2). In four patients, this also led to a change in treatment (Table 3). Although reduced vibratory capacity on stroboscopy can be interpreted as scar, vibration can also be impaired by other pathology such as leukoplakia. Further, it can be difficult to distinguish between sulcus vocalis and scar without close microscopic visualization and palpation with manipulation of the affected vocal fold. This also allows for more thorough examination of the entire mucosal surface, which may uncover an area of scar not seen on the preoperative exam; this accounted for the majority of the changed diagnoses.

Although it is certainly valuable to evaluate changes in diagnosis based on operative exam, it is even more important to know how those changes affect operative plan. Twenty percent of patients in this study had a change with the DML exam in the primary pathology that was driving surgical management. Additionally, 16% of patients required a significant change in management; this is higher than the 4% noted by Dailey et al[3]; the other two retrospective studies and the one prospective study did not comment on this issue.[10–12] This is a clinically meaningful proportion of patients. This increased frequency may be secondary to differences in study exclusion criteria. Epithelial lesions were not considered in the studies by Dailey et al[3] or Akbulut et al[12] but accounted for four of the eight lesions in our cohort. Changes in diagnosis included both epithelial and lamina propria lesions, and even whether a given lesion was unilateral or bilateral. Thus, the diagnostic value of DML is real. This has important implications for preoperative counseling, surgical consent form, and equipment to have available in the operating room. Considering the technological advances that have led to modern videostroboscopy and the ability of both speech pathologists and laryngologists to review those exams together, we have become more confident in office-based diagnosis and the corresponding operative plan. Patient counseling and operative consent, then, may also be more specific or limited. However, this study demonstrates that a meaningful proportion of patients may require a change in operative plan, which can range from increased extent of a planned treatment (eg, amount of laser energy applied) to addition of an unplanned treatment (eg, injection of therapeutic agent, lysis of scar, performance of a biopsy). This mandates that preoperative counseling should include a flexible consent and emphasize the potential for new diagnoses or alternative operative plan. Further, appropriate equipment should be readily available in case operative plan is indeed modified.

This study has limitations. First, the diagnoses were made by a single surgeon at a single institution. There is also a lack of uniformity for nomenclature of benign vocal fold lesions.[15] The wide variety of pathology makes it difficult to make inferences on the diagnostic accuracy of the RTS *versus* DML with types of pathology that were not well represented in our patient population. Lastly, some diagnoses (eg, carcinoma, leukoplakia) are ultimately a pathologic diagnosis, and surgical management is particularly susceptible to intraoperative modification if preoperative exam identifies such a lesion. The prospective nature of the study may help to more carefully characterize the RTS examination and point out weaknesses that can help guide preoperative discussions with the patient.

CONCLUSIONS

Diagnostic change at the time of DML was common, as was change in intraoperative management. Both scenarios often involved lesions of the lamina propria. To address these common issues, distal chip visualization may be helpful in reducing the rate of error before the patient heads to the operating room. The use of additional technologies such as narrow band imaging may highlight lesions too light or too small to be seen reliably on standard rigid stroboscopy.

A flexible consent should be obtained, and preoperative counseling should emphasize the potential for alternative surgical procedures. This study provides relevant quantitative information that can be used to guide that discussion.

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