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OVERVIEW OF DIAGNOSIS,
TREATMENT AND PREVENTION

LARYNGOSCOPY / STROBOSCOPY

Laryngoscopy/Stroboscopy: Highlights

In Brief

Since many voice disorders are caused by problems in the voice box and/or throat, a careful and detailed examination of the voice box and throat is key to the identification of the cause or causes of voice disorders. Several methods can be used to examine the throat and voice box.

Viewing the Voice Box Through Specialized Tube (Endoscope)

Rigid laryngoscopy: This examination provides the clearest magnified view of the voice box. A rigid telescope-tube is passed through the patient's mouth. The examiner then holds the patient's tongue while viewing the voice box. Images are usually recorded on video.

- Also called: telescopic laryngoscopy, transoral laryngoscopy

Flexible laryngoscopy: This examination allows for viewing the voice box in action. Flexible laryngoscopy provides a magnified view of the voice box while the patient produces sound (speaking, singing, etc.). Viewing is done through a flexible viewing-tube passed through the patient's nose to the back of the throat, thus allowing the examiner to view the voice box while the patient speaks, sings, coughs, sniffs, etc. Images are usually recorded on video.

- Also called: fiberoptic laryngoscopy, fiberoptic flexible endoscopy, nasopharyngoscopy, transnasal laryngoscopy

Laryngeal stroboscopy: This examination is a specialized viewing of vocal fold vibration. Laryngeal stroboscopy involves controlled high-speed flashes of light timed to the frequency of the patient's voice. Images acquired during these flashes provide a slow motion-like view of vocal fold vibration during sound production.

- Also called: videostroboscopy, laryngostroboscopy, laryngo-videostroboscopy, stroboscopic laryngoscopy, strobolaryngoscopy

Advantages

These technologies provide valuable practitioner and patient information. They allow images to be recorded on video or other media formats, permitting examiners to review the images of the voice box frame by frame, capture still and close-up images, and re-review images with members of the voice care team. Patients can also view the recorded images and see the reason(s) for their voice problems. *(For more information, see Voice Care Team.)*

Who performs laryngoscopy and stroboscopy?

- An otolaryngologist or speech-language pathologist typically performs laryngoscopy and/or stroboscopy. The examiner's training and background experience is critical in performing and evaluating laryngoscopy and stroboscopy findings.
- In certain situations, stroboscopy may be performed by a nurse practitioner or a physician assistant under the supervision of a physician.

Recording Laryngoscopy and Stroboscopy Findings

Flexible laryngoscopy, rigid laryngoscopy, and stroboscopy are frequently recorded on some type of playback media: videotape or DVD. The reasons for this are:

- **"Instant replay" review of examinations critical:** The recorded images allow the clinician to review the examination repeatedly, often for a frame by frame analysis. This review of the examination of the voice box, vocal fold structure, vibration, and closure is analogous to the instant replay method used in televised sporting events. Playback media recording is

especially important in stroboscopy because of the intricacy and rapid speed of vocal fold vibration.

- **Records for comparison over time:** Recording the laryngeal examination on video allows comparison of voice box structure and function over time. By comparing old examinations of the voice box with a current examination, the voice care team can monitor the success or failure of various treatments and also observe any changes over time.

Understanding Laryngoscopy

Viewing the Voice Box

Laryngoscopy means, literally, throat viewing (laryngo = throat; scopy = viewing). Three methods of laryngoscopy are used to examine the voice box and its surrounding areas.

1. Mirror laryngoscopy
2. Flexible laryngoscopy
3. Rigid laryngoscopy

1. Mirror Laryngoscopy

- During a mirror laryngoscopy, the examiner views the voice box by placing a mirror in the back of the patient's mouth at an angle such that light can be directed to the voice box area.
- This allows a view of the voice box – much like a car's rear-view mirror does of the area in back of a car.
- Prior to the exam, the patient is usually given surface anesthesia (topical anesthesia) to numb the back part of the throat and reduce the gag reflex.

2. Rigid Laryngoscopy

- Rigid laryngoscopy provides the clearest magnified view of the voice box.
- This exam is done through a specialized telescope that has a light source and a magnified viewer contained within a rigid tube. This tube is passed through the patient's mouth with the patient's tongue protruded and held by the examiner.
- Because the tongue is protruded, the patient is not able to speak or sing, but is able to make sound such as "eee."

3. Flexible Laryngoscopy

- Flexible laryngoscopy provides a view of the voice box while allowing the patient to perform voice functions such as speaking, singing, producing different vowel sounds, etc. It is also used to examine the space joining the throat and nasal cavity (nasopharynx), the soft palate, the throat and the back of the tongue.
- Flexible laryngoscopy is done through a specialized scope that has fiberoptic light and a magnified viewer contained within a flexible tube.
- Prior to the exam, the patient is usually given surface anesthesia (topical anesthesia) to numb the nasal passage through which the tube is passed. This surface anesthesia is delivered in a mist or spray. It can also be combined with another medication that shrinks the lining of the nose, making it easier to pass the flexible scope through the nasal passage.

Do patients undergoing laryngoscopy have to sit in a special position?

Mirror Laryngoscopy and Rigid Telescopic Laryngoscopy: Specific Posture with Tongue Protruded

- For a mirror laryngoscopy or a rigid telescopic laryngoscopy, the patient is usually placed in the sitting position, leaning forward from the waist, often with hands on the knees. The patient's head is kept in a neutral position, and the chin and tongue are protruded.
- The examiner will gently hold the patient's tongue with one hand, and the other hand will then pass the mirror or rigid telescope toward the back part of the mouth and throat region.
- This examination is done while the patient breathes through the mouth (or pants) and then makes sound of sustained "eee."

Flexible Laryngoscopy: No Need for Specific Patient Position

- Flexible laryngoscopy does not require a specific posture or head and neck position. It and can usually be done in the patient's most natural sitting position.
- During the examination the patient performs a variety of throat-related and voice-related tasks, including speaking, singing, breathing, laughing, whistling, coughing, and sniffing. These different voice and non-voice tasks allow the laryngologist to look for a variety of possible abnormalities in the throat region during each task.
- Because the transnasal flexible laryngoscope is placed through the patient's nose and does not require a restricted posture or position, most patients tolerate this procedure extremely well.

Laryngoscopy/Stroboscopy: Comparing Exams

What are the advantages and limitations of each voice box viewing technique?

Pros and Cons of Each Examination Technique

Type of Viewing	Advantages	Limitations
Mirror examination	• Inexpensive • No need for specialized equipment • Performed by all otolaryngologists	• Limited viewing of the voice box • Images not recorded
Rigid laryngoscopy	• Magnified viewing with clearest detail • Images recorded on video or DVD, allowing review and frame-by-frame analysis	• Done with tongue protruded and held by examiner; as a result, examination of voice box function is limited • Expensive equipment
Flexible laryngoscopy	• Magnified viewing of the voice box while allowing patient to sing, speak, etc. • Images recorded on video or DVD, allowing reviews and frame-by-frame analysis	• Image not as clear as rigid laryngoscopy • Expensive equipment

Mirror Examination

Advantages

The mirror examination is inexpensive, does not require specialized equipment, and can be performed by all otolaryngologists.

Limitations

Mirror laryngoscopy provides a limited examination of the voice box, and does not allow images to be recorded. The medical record of a mirror exam is simply the verbal description of the examiner's findings.

Rigid Laryngoscopy

Advantages

Rigid laryngoscopy provides the clearest and most magnified view of the voice box and vocal folds. It is the best viewing technique to investigate voice disorders caused by structural abnormalities of the vocal folds, such as vocal fold cysts, polyps, nodules, granuloma, scars, etc. It is also the most commonly used viewing technique for stroboscopy.

Limitations

Because the tongue is protruded and held by the examiner, viewing the voice box "in action" is limited to simple sound production, such as "eee".

Flexible Laryngoscopy

Advantages

A key advantage of flexible laryngoscopy is that the patient can be examined in a natural posture, and the voice box and vocal folds can be viewed while the patient performs different voice tasks, such as speaking and singing. This assists the clinician in

determining if the voice problem comes from specific activities of the larynx during these various tasks. It is also extremely helpful in determining whether a patient's voice disorder is caused by a "functional problem" such as muscle tension dysphonia or spasmodic dysphonia. *(For more information, see Spasmodic Dysphonia.)*

Disadvantages

The main downside to this examination technique is that the clarity of the image is not as good as rigid telescopic laryngoscopy.

Understanding Laryngeal Stroboscopy

Examining Vocal Fold Vibration

Stroboscopy in Brief – Slow Motion Picture of Vocal Fold Vibration

- Vocal folds vibrate so fast during sound production that this vibration is impossible to see with the naked eye, similar to the wings of a hummingbird.
- Stroboscopy is a special method used to visualize vocal fold vibration. It uses a synchronized, flashing light passed through a flexible or rigid telescope to visualize vocal fold vibration. The flashes of light from the stroboscope are synchronized to the vocal fold vibration at a slightly slower speed, allowing the examiner to observe vocal fold vibration during sound production in what appears to be slow motion. This "slow motion picture" is an illusion, as the speed of actual vocal fold vibration is not changed by stroboscopy.
- This special viewing allows the voice care team to evaluate each vocal fold's vibration properties during the different phases of the vocal fold's vibration cycle. Because vocal fold vibration is so fast, the "slow motion" view is actually derived from many successive vibration cycles. *(For more information, see Anatomy & Physiology of Voice Production.)*
- Stroboscopy also provides detailed information regarding the pattern and duration of vocal fold closure during sound production.
- The stroboscopy light can be used with a flexible laryngoscope or a rigid laryngoscope.

What kinds of information are obtained with stroboscopy?

Critical Component of Investigation of Voice Disorders

Stroboscopy provides key information needed in the investigation of voice disorders. It allows the examiner to evaluate two key components of sound production.

1. **Vocal fold vibration:** Stroboscopy provides detailed and often essential information on the nature, degree, and quality of vocal fold vibration.

   How regular is it? Normal vocal fold vibration is regular and periodic.

   How wide do the vocal folds open during vibration?

   Are the left and right vocal folds "balanced" during vibration? Normal vocal folds are "balanced" or symmetrical.

   How pliable are the vocal folds? Normal vocal folds are pliable (i.e., not stiff) hence demonstrate a normal "mucosal wave."

Key Information

Mucosal Wave

Stroboscopy allows the examiner to assess the mucosal wave. The "mucosal wave" is the term used to refer to the pattern of light traveling on the top surface of the vocal folds during vibration – seen on stroboscopy.

Mucosal wave is the wave-like movement of the vocal fold cover (epithelium + superficial lamina propria) over the vocal fold body (vocalis muscle).

How Assessing Mucosal Wave Helps in Diagnosis of Voice Disorders

How dynamic this mucosal wave is reflects how pliable the vocal fold covering is, hence how efficiently the folds vibrate.

Decreased mucosal wave reflects stiffness of vocal fold which can be caused by swelling, scarring, etc.

Areas or spots with mucosal wave abnormality signal where lesions on or within the vocal fold most likely are.

2. **Vocal fold closure:** Stroboscopy provides information about the nature, degree and quality of vocal fold closure.
   How well do the vocal folds close? *Normal vocal folds can achieve complete closure during the vibratory cycle.*

Need to Investigate Vocal Fold Vibration and Closure

Vocal fold vibration and closure are essential for normal sound production. Even minor abnormalities of vocal fold vibration or closure can account for significant voice problems. Changes in vocal fold vibration detected by stroboscopy provide important clues to the cause or causes of the voice problem.

What are the advantages and limitations of stroboscopy?

Advantages

- Stroboscopy is essential when a voice disorder is due to abnormalities that affect vocal fold vibration. These abnormalities span a spectrum of disorders, such as:
  Vocal fold scarring
  A mass (e.g., cyst, polyp, nodule)
  Incomplete closure of vocal folds
  Abnormal vocal fold vibration
- Stroboscopy is often required to identify the causes of voice disorders. It can pinpoint the underlying problem or problems with vocal fold vibration so treatment can be directed appropriately.

Limitations

- Stroboscopy can only be used when the patient's voice is fairly stable. Thus stroboscopy is not possible for patients with severe voice loss or hoarseness.
- Stroboscopy provides a view of vocal fold vibration from the top (a two-dimensional image). Although this view is clearly informative, it cannot evaluate the region of the vibrating vocal folds below (a three-dimensional image).
- Investigation of certain voice disorders (e.g., vocal fold scarring, sulcus vocalis, etc.) needs to include both three-dimensional views of the vocal folds and tactile assessment of the vocal folds, as can be done using microlaryngoscopy.

Laryngoscopy/Stroboscopy: Vocabulary

Rigid Laryngoscopy
An examination of the voice box in which a rigid telescope is used; this examination provides the clearest magnified detail of the voice box, but the patient is unable to speak or sing during the exam

Flexible Laryngoscopy
An examination of the voice box in which a flexible fiberoptic scope is used; this examination allows the physician to view the voice box in action (i.e., while the patient is producing sound)

Stroboscopy
An examination in which a strobe light is combined with rigid or flexible laryngoscopy, allowing an examination of vocal fold vibration and vocal fold closure