Dysphonias in Childhood

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With new diagnostic tools and a sub-specialization in laryngology, almost all pediatric patients with dysphonia can have a more certain diagnosis. Yet, mistakes in diagnosis and treatment are still very common. What can we learn by sharing the mistakes and lessons learned?

The goals for this chapter will be:

a) To highlight differences and similarities in diagnosis and treatment of dysphonia in the pediatric population compared with those in adults;
b) To describe how technology developed for diagnosis of adults may be applied reliably in the pediatric population;
c) To detail how to differentiate pediatric patients with dysphonia who should be considered for surgical intervention from the pediatric population with medical and behavioral disorders of the voice and,
d) To present a protocol for systematic evaluation of pediatric dysphonia.

We all know that children can be cruel. We often see children who have been hoarse and, because of their vocal disturbance, have been ostracized. The "stigma of the child with a poor voice" is much worse than for an adult with a poor voice. In Western civilization, a bad voice is actually quite widely tolerated among adults. A good example is patients who have had a partial laryngectomy. They have a poor voice but that does not impact their quality of life. But a child with mild dysphonia may be brought to the physician with the parents saying that the child is not doing well in school because he is withdrawn and self-conscious due to the vocal disturbance. This scenario is frequently seen in the premature child who has had laryngeal stenosis corrected and now is free from the original problem but, nevertheless, suffers from many years of social stigma due to having had a vocal disturbance.

The child with a hoarse voice presents with a symptom much like the complaint of vertigo. Unlike vertigo, the hoarse voice can be examined visually and reliably, examined anatomically to arrive at an anatomical diagnosis. To arrive at an accurate diagnosis, the clinician should take a positive mental attitude towards the work-up of the child who presents with a hoarse voice. One should approach pediatric dysphonia by committing to understanding the dysphonia by taking a careful history, physical examination, and endoscopic examination, and making an interdisciplinary evaluation.

Surprisingly, reports of dysphonia in children are sparse. There is a very good study by Dejonckere, 1984, where he catalogs the various causes of dysphonias, covering everything: chromosomal defects, congenital deformities, mass laryngeal lesions, inflammations and infections, trauma, disorders of musculoskeletal tension, neurological disorders, metabolic and endocrine disorders, deafness, velo-pharyngeal insufficiency, adolescent voice change, vocal abuse and misuse.[1] In that survey, it was Dejonckere's impression that 6% to 9% of children in the general population in schools had dysphonia.

Maddern and colleagues state that vocal disorders are very common among children (which are consistent with the previous study), and they estimated the incidence at from 6% to 23% in school-aged children.[2] They go on to make a very important point: that physicians should not be the only people involved in the evaluation and management of these patients. Multidisciplinary assessment and management should be the norm.

A study by Boltezar and coworkers of 51 children from 10 to 17 years of age concluded that subjects with mutational disorders of the voice are only a small minority, and that, in fact, during adolescence there are some normal variations during maturation into adults.[3] These are the five types of patients brought for evaluation: (a) those who were having singing lessons and just wanted to have it looked at; (b) subjects with mutational disorders of the voice; (c) subjects with true functional dysphonia (they did not specify whether these were muscle-tension dysphonias or conversion-disorders, or secondary groups); (d) nodules on vocal cords; and (e) normal variations found during maturation into adulthood.

Gray and Smith, in 1996, also stated that pediatric vocal disorders should receive assessment by a team, and they stressed the importance of communication among the pediatrician or primary care physician, the otolaryngologist, and the speech pathologist.[4] Although problems with speech or voice may prompt an otolaryngologic evaluation, the problem may simply be a manifestation or symptom of a larger or more complex disease- process. That might be the case with hypernasal speech eventually leading to a diagnosis of velocardiofacial syndrome, or bilateral paralysis of the vocal folds eventually leading to a diagnosis of hydrocephalus. The study by Gray and Smith also stressed the point that in diagnosis of vocal disorders, hoarseness is only a symptom and not a medical diagnosis. Therefore, causes of dysphonia in children can be localized, such as in the edge of the vocal cord, or can be part of a much more systemic issue.

Another issue that often comes up is in children who sing or act.[5] There is always a lot of controversy on whether it is safe to allow a child to perform in a very vigorous way. In a survey that Reilly conducted in 1995 from otolaryngologists, the incidence of vocal disorders was actually very, very low. Especially in a child who is a performer, disorders due only to singing were very, very low. Reilly discussed both the role of stroboscopy and the potential added value of vocal therapy and evaluation.[5]

The use of endoscopic equipment in the assessment of pediatric dysphonia is also controversial. A small study was done out of Boston with 25 children.[6] The mean age was seven years. Hartnick and Zeitels used flexible laryngoscopy,

either with a fiber-optic scope or with a scope with a video-chip at the tip. What was interesting is that in this study, multiple diagnoses could be made in the same child that would contribute to dysphonia. Although most had vocal nodules with vocal strain, there was one case of a cyst on a vocal fold, laryngeal stenosis, respiratory papilloma and laryngeal pharyngeal reflux. So, at least in this small study, they were able to examine all these patients with a mean age of seven years using a fiber-optic system.

In terms of rigid stroboscopy, Wolf and colleagues, in a study of 42 children with pediatric dysphonia, attempted rigid stroboscopy in the office. Of the 42 children, 31 had an adequate examination.[7] All these children were older than six years. The diagnostic findings were: nodule (10), cyst (8), polyp (6), sulcus (4), edema (3), mutation (2), web (2), mono-chorditis (1), and papillomatosis (1). Multiple diagnoses in the same patients may contribute to dysphonia. They cited as causes of failure inability to tolerate the rigid endoscope, short phonation-time, gag reflex, and sometimes impaired view of the glottis because the child's epiglottis went down. The authors concluded that if the child is older than ten years, rigid stroboscopy can be performed reliably.

By combining use of endoscopes, one should be able to evaluate all children with dysphonia using both rigid and fiber-optic endoscopes with the stroboscope.

I will comment briefly on a survey of other diagnostic tests.A study out of Mexico by Ysunza evaluated the role of laryngeal electromyography (EMG) in diagnosing immobility of vocal folds in children [8]. Their criteria for paralysis of a vocal fold were based solely on flexible laryngoscopy. If the vocal fold was immobile, then these patients went on to a laryngeal EMG. What is remarkable is that the median age was 12.5 years. So, they were able to stick a needle in a child held in the mother's arms and get an adequate diagnosis. In a study of 25 children, and 25 children studied as controls who had vocal abuse, the authors were able to differentiate every one of the patients who had paralysis of the vocal cords and obtain some sort of useful information. The authors used information from the laryngeal EMG to separate neurogenic problems from traumatic problems that would cause immobility of the vocal folds. Furthermore, information based on electrical activity from the recruitment-pattern and the signature of the motor unit was used to obtain some sort of prognostic information for this group of children.

Certainly, published reports suggest that dysphonia in children can be managed using techniques developed for adults. But what is the reality? The reality is that at this time, stroboscopy and video-stroboscopy have been available for 30 years, fiber-optics have been available for 30 years, yet we still see some very common errors made in the vocal diagnosis of children.

These are some common phrases used by healthcare providers to parents of children presenting for evaluation of dysphonia. For example: "Oh, your child has a virus" or "it must be allergy." Certainly when the finding is subtle, it is very easy to attribute dysphonia to swelling, chorditis, or allergy. But in general, dysphonia that lasts longer than two weeks is not based on a viral or allergic

etiologic factor. When the finding is subtle, as in paresis of the vocal folds instead of paralysis, one cannot make a diagnosis of paralysis of the vocal folds. But more commonly, subtle edema or a mass effect can be mistaken for inflammation, as is the case in unilateral Reinke's edema or allergic laryngitis.

Another common explanation given to parents is "it is how your child is using his/her voice." Although functional dysphonia may occur in children, the likelihood is low, in the absence of other functional or organic disorders. However, it is not uncommon to see children who are fairly reticent with use of their voice who have vocal disorders. Therefore a patient with such a condition, such as stenosis after anterior and posterior cricoid split, does not have dysphonia secondary to how he/she is using his/her voice. The hyperfunctional quality of the voice is secondary to an organic basis. This is called secondary muscle-tension dysphonia. In other cases, for example scarring after surgery, and also in certain types of neurogenic disorders, especially developmental disorders in children, that is the best voice that can be obtained. Another excuse that is often used is "There is nothing that can be done for your child." While it has been believed in the past that surgical manipulation of the vocal folds may worsen dysphonia, modern phonosurgical procedures can restore vibratory function and closure, with good results.

Another type of excuse given is: "Your child has laryngitis." Unfortunately laryngitis is another waste-paper-basket term. It does not help your patient to understand the cause of their dysphonia. And more recently, at least in the U.S., especially in the adult population, everybody is given a diagnosis of reflux. I submit to you that certainly pediatric reflux disease is under-recognized. However it is not the only cause for inflammatory disorders of the larynx. And it is your duty, as both pediatrician and otolaryngologist, to try to differentiate among these various components. Especially among the pediatric population, the possibility of rhinogenic laryngitis as well as chronic non-specific laryngitis from environmental issues should be taken into account, as part of the work-up. To distinguish among various possible causes of chronic laryngitis, a careful history and examination followed by a careful endoscopic examination, with examination of vibratory function of the vocal folds, is recommended for all pediatric patients who have prolonged dysphonia.

The last excuse is: "He/she will outgrow this problem." Often the approach is watchful waiting. The parent is told: "just be patient; when that boy/girl reaches puberty, this will disappear." Perhaps this is true for nodules of the vocal fold, because of the drop in frequency of speech in boys at puberty, there is less collision, less force affecting the vocal folds, as the frequency of the boy's voice drops in puberty. There is some reduction in the incidence of vocal nodules in boys after puberty. However, if the situation does not fit, one must be prompted to be more aggressive in evaluation.

Certainly some children are very difficult to examine. And if the situation warrants it, including when the clinical scenario does not fit a functional disorder of the voice and good endoscopy cannot be performed in the office, these patients are appropriate patients to undergo general anesthesia and exploratory examination

of the larynx. A good example is an adolescent with a sulcus vergeture involving the vocal fold. Formation of a sulcus and scarring conditions of the vocal fold may be difficult to visualize by endoscopy alone, and palpation may be necessary. This requires a trip to the operating room. In situations that are not clear, the patient need not be given a diagnosis of functional or psychogenic vocal disorder.

The very last excuse that should not be accepted is: "It is nodules." Most otolaryngologists do not use rigid endoscopy or a scope with chip-tip technology; they use fiber-optic technology. And fiber-optic technology is unable to separate asymmetric lesions from symmetric lesions. Because contralateral reactive lesions are the norm in patients with polyps, patients with polyps who are surgical candidates are often misdiagnosed as having nodules. Only by using high-quality videostroboscopy with a chip-tip scope or rigid endoscopy will the asymmetry become obvious. Patients with polyps are more likely to respond to surgery than to therapy. Other lesions that have been wrongly attributed to nodules include polyps, cysts, and papillomas. As a general rule, asymmetric lesions are not nodules, hence the need for visualization using high-quality endoscopy in the office setting.

There is another response: the pediatrician or the speech pathologist or the otolaryngologist throws up his or her hands and says: "I don't know what your child has, but it is nothing serious." Otolaryngologic training and training in speech pathology may not be adequate to address purely functional disorders of the voice. These patients need a multidisciplinary approach. That is because purely functional disorders are not in the realm of our training in ORL. A singer with vocal complaints, a patient with psychogenic dysphonia, children with dysphonia for secondary gain, and children with breathing abnormalities due to paradoxical adduction and fictitious asthma fall into this group of patients with functional disturbances that require specialized diagnosis and treatment.

The five main reasons why we see difficult problems are:

1- Atypical presentation: At least with children one is not so worried about progressive neurogenic disorders, but mild allergic edema or food allergy can be causes, and these patients will usually have fluctuant symptoms.

2- Rare cases will show up in the ear-nose-throat arena, and rare things are rare. These include unusual tumors, sarcoids, tuberculous rheumatoid nodules, and spontaneous arytenoid dislocations.

3- Another reason is subtle findings. One example is the patient who was diagnosed to have vocal nodules but in fact had unilateral Reinke's edema. This patient had what is called a pseudo-cyst. Also acute vs. chronic laryngitis, especially in earlier forms without the erythema, can be quite confusing.

4- Multiple findings and issues: In vocal disorders, the interaction among functional and organic components is completely intertwined. And because they are intertwined, very often it is very easy to assign the main problem to a functional problem when it is more likely due to an organic component. The cause is not clearly one or the other.

5- But perhaps the biggest mistake and difficulty in diagnosis of the correct cause of dysphonia is failure to correlate the history, signs, symptoms, and objective findings into a cogent synthesis of the problem. Even when findings of laryngeal inflammation are found, if the correct cause of the inflammation is not addressed, the diagnosis is incomplete and the patient will continue to suffer from prolonged morbidity.

Why is the child hoarse?

The assessment of the child with dysphonia will start, obviously, with the history. The history must be comprehensive If you, as a physician, don't have the time or whatever, then I would use a good form for taking histories, along with a medical assistant with good ear. But the history should be not only a medical history but also a social history and history of use of the voice. And that is where we find using our speech pathologist to obtain a history for one portion is helpful.

The history should include information on what are the child's **vocal habits**? In New York, where we have many young men starting religious studies at a very young age, they often spend seven or eight hours in a religious school using verbal arguments as a method of learning. We would never think about that as being important, because we think about religious learning as being quiet, as it may be in traditional Western schools. But in other traditions, use and abuse of the voice can result in significant vocal injury.

The physical examination incorporates the standard tools for evaluation of the ear, nose and throat. It should also incorporate your most unused tool in the diagnosis of a vocal disorder, a trained ear. You have to train the ear to differentiate between the main types of dysphonia. Voices are rated as to grade of strain, roughness, breathiness, and other types. Beyond the quality of the voice, the ear must also listen for articulation and breathing co-ordination.

It is important to listen to the prosody of the voice and the structures of resonance. A child with large tonsils will sound muffled. A child with large adenoids may sound hyponasal. A child with developmental delay may have excessive strain during talking. Is there a tone-focus problem? Terms such as "the voice is bright, nasal, dark or poorly supported" are terms used by singing teachers to assess voices and may apply to the office evaluation of a child with dysphonia.

As part of the examination of the phonatory apparatus, three substructures must be examined. These are the power, the source, and the filter. The power is the lung power driving the voice. The source is the larynx, and the filter is the upper airway tract. A simple checklist can help. With a trained ear, one can quickly stratify the types of voice and differentiate them from issues of articulation or breath-support.

In terms of using the **eyes**, we will comment later about visualization. And lastly, the ability to **palpate** the larynx is important. Palpation should search not just for masses but also for function. Is the child moving the larynx excessively during phonation? Is there excessive tongue-based tension? As part

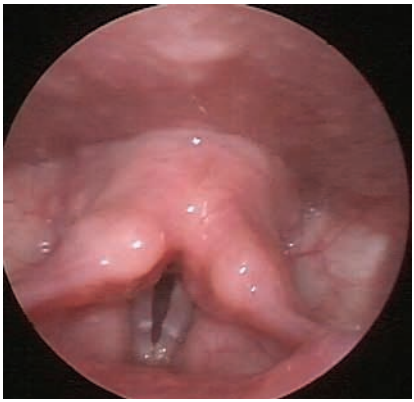
of the functional assessment, is there adequate range of movement of the larynx, pharynx, and oral articulators?.

We will comment next on visual examination in the office. Visual diagnosis is the basis for anatomical evaluation of the vocal folds for pathologic conditions and function. Rigid endoscopy, flexible endoscopy with video, and video-strobosocopy are all easily applied to the child. Careful endoscopy can separate lesions that are organic from functional disorders of the voice and can determine the best course of treatment. Stroboscopy can identify stiffness and scarring, differentiating them from other masses of the vocal folds. Flexible laryngoscopy allows examination of vocal gestures in an unrestricted manner through the nose. In some patients, both rigid endoscopy for a magnified view of vibrations of the vocal folds may need to be combined with a flexible examination through the nose of the nasal pharynx, palate, and larynx.

To illustrate this, we present several sample cases. These are all patients who had been evaluated by previous otolaryngologists, and these are all children. All had prolonged courses of dysphonia.

The first case is a six-year-old girl with dysphonia for nine months. She was having therapy for a mild articulation disorder. She was sent in by a speech pathologist after he heard persistent hoarseness. This child had already had an ENT examination which did not include fiber-optic or rigid-scope examination but the physician made the diagnosis of adenotonsillitis with laryngitis. This child is the tenth of fifteen children, from a large Jewish family. Rigid endoscopy showed classic nodules of the vocal folds with symmetric swelling. There was scant evidence of diffuse laryngitis. (**Figure 1**)

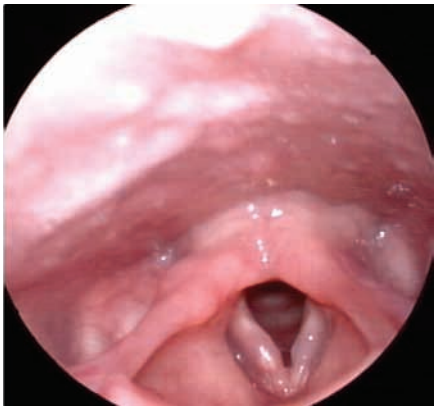
Figure 1: Case 1, nodules of the vocal fold.



By a simple thirty-second examination in a cooperative child you can easily tell this patient's family that this is not laryngitis. This child has very classic nodular swelling. There is no need to consider tonsillectomy in this child. Behavioral modification, re-education of the voice, even modification of familial behavior could be the key. And that will save a lot of healthcare dollars down the road.

The second case was vocal nodules diagnosed in a nine-year-old girl with a three-year history of progressive dysphonia. The voice was getting worse. This is a very well-adjusted child, but now it is getting harder for her to participate in class. She had a previous examination by fiber-optic nasolaryngoscopy, and the parents were told the child had nodules. In fact, vocal therapy was instituted, but she had progressive dysphonia. At examination in the office we could clearly see that if one were to use a fiber-optic scope the diagnosis of vocal nodule would be rather straightforward. However, even in rigid endoscopy without stroboscopy one can appreciate that there is a mass on one vocal fold. (**Figure 2**), and that is accentuated on stroboscopy by a mass effect on this side.

Figure 2. Case 2, right vocal fold cyst.



So, this child has a very clear diagnosis: intra-cordal keratin-type cyst. The treatment should be surgical exploration. Surgical exploration required a cordotomy, followed by resection of the mass. And because we also had to resect the sulcus, we used a microsuture to repair. Even after one week the child already had a mucosal wave, and the quality of the voice was already improving. Subsequently she did quite well.

So, the lesson from these two cases is that children can be examined, you can use a 70-degree scope to look at these patients, and they will give superior magnification compared to that seen with fiber-optic technology. Small 4 mm 70-degree rigid endoscopes may be used in children, starting at age five. In anyone under age five it may be more challenging to get full cooperation for rigid endoscopy, so we may use nasal anesthesia and fiberoptic laryngoscopy with stroboscopy. Because visualization may be brief, video recording and playback is essential to achieve accurate diagnosis.

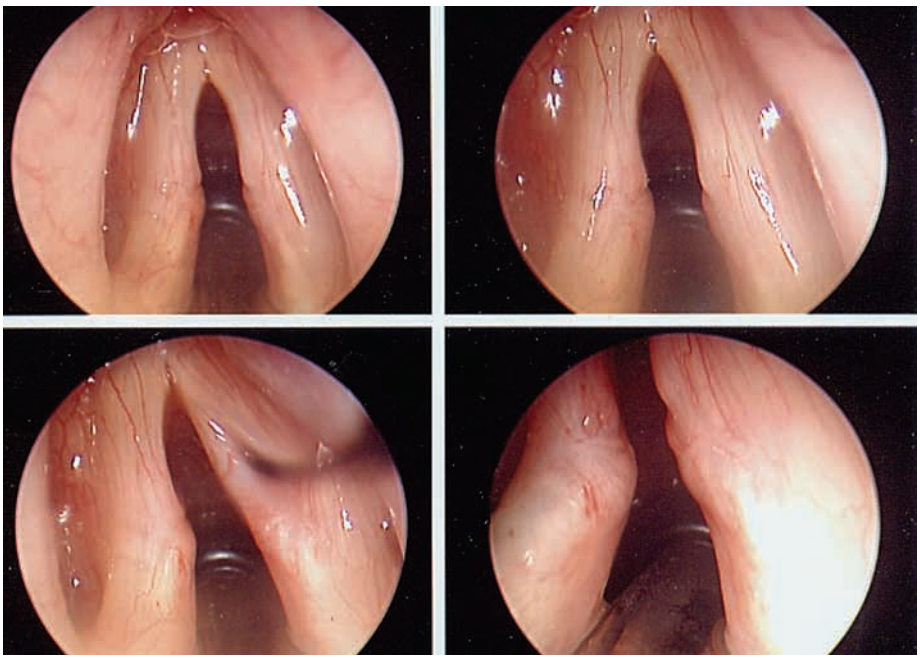
The third case refers to a boy who was sent to me with profound dysphonia. Fourteen years old, one of the best students in his class, with a more than four-year history of dysphonia. As a child he had mild dysphonia. He had had surgery for a polyp one year before, and the voice never got better. The voice was very breathy and rough. He underwent four months of vocal therapy on a regular basis.

In his video-scope we saw that he had an open gap. Certainly an ear-nose-

and-throat doctor could say it must be functional dysphonia. There was a gap, but there was a lot of super-glottic tension. We noticed a strained quality of voice and lots of super-glottic squeezing. But the important thing, which is unfortunate, was that his vocal fold membrane was completely stiff. There was reduced amplitude and mucosal wave.

Our conclusion was that although he had evidence of muscle-tension-dysphonia (MTD), this was probably secondary to vocal fold stiffness with notching. The impression was that this was secondary MTD. We suspected either scarring or bilateral congenital sulcus. At the time of surgical exploration, there was a lot of scarring (**Figure 3**). Steroid injection was performed with some improvement, and what we did with him was steroid injection in the operating room twice. However, the gap remained. We took him into the operating room for a third steroid injection, and we did an augmentation injection of the laryngoplasty, using a micronized dermis, and his voice was much better. Time will tell if this will be adequate.

Figure 3. Case 3, scarring on bilateral vocal fold causing dysphonia



The fourth case: DC is an eighteen-year-old, so we can say he is an adult. But this person was injured as a child, had a motor-vehicle accident with closed head injury with a fracture of the cervical spine. He was intubated for four weeks, underwent surgery on the right cervical disc. Post- rehabilitation, he has aphonia.

This child was sent in with a diagnosis of bilateral paralysis of the vocal fold. The history certainly fits. Closed head injury, intubation, and surgery on the cervical disk are all associated with the diagnosis of paralysis of the vocal

fold. But the findings do not support it. He presented aphonia or severe breathing dysphonia with a large gap. On careful laryngoscopy, this patient was seen to have an intubation groove, which was described by Benjamin, from long-term intubation. During phonation, the gap is virtually obliterated, and the patient has, nevertheless, bilateral ankylosis. (**Figure 4**). Laryngeal electromyography was normal, indicating arytenoid ankylosis without paralysis of the vocal fold.

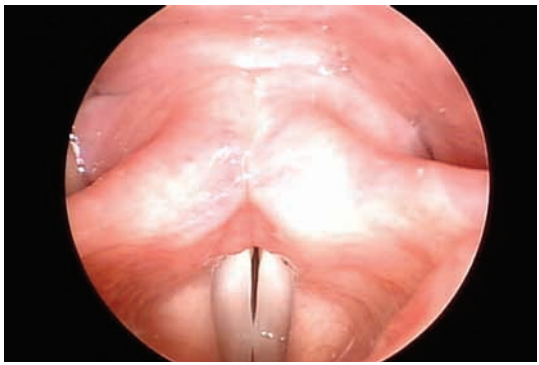
Figure 4. Case 4 Anklyosis of the larynx with intubation groove after closed head trauma.

This is a very challenging problem. Injection of the vocal folds would not have been able to improve the voice. He was managed using laryngoplasty, anterior laryngeal split, laryngeal fissure, and laryngeal stenting with a buccal graft for augmentation of the posterior glottis. The purpose here is not to describe surgical techniques but to concentrate on the diagnosis. An intubation defect and arytenoid ankylosis differs from bilateral ankylosis in presentation, diagnosis, and subsequent treatment.

The fifth case is a seventeen-year-old boy who had dysphonia characterized by excessive high pitch with a strained voice. He was very conscious of his high feminine voice. Multiple examinations showed normal anatomy, and yet he was told that there was nothing wrong and that he would outgrow it. This person has puberphonia and was easily converted with vocal therapy in two sessions. The reason why he was poorly understood was that it is just not common.

Case number six: Z.S. is a sixteen-year-old Broadway singer. One week before the opening she became dysphonic and was told that she had vocal nodules. She was very distraught psychologically, almost destroyed, because a nodule for a singer is considered the kiss of death. It took a lot of effort to reverse the condition. She did have some mild swelling of the vocal fold edge (**Figure 5**).

Figure 5. Case 6. Nodular swelling with vocal fold edema



This was in the background of vocal fold edema. She was told she had swelling from excessive use of the voice and does not have nodules. Singers often have vocal nodular swelling, which is what she had. It is present in about 20 to 30% of all singers. Mild nodular swelling has no pathological implications other than the need for a brief period of resting the voice. The reason this person was getting into trouble is not because of the presence of these vocal fold swellings but probably because of anxiety, excessive practice, MTD, with nerves and anxiety. So this person was put on 48 hours of resting the voice and reassurance. She sang well.

Our own data on the role of stroboscopy have been published.[9] Eighty patients identified with prolonged dysphonia, age three to 17 years, were examined by stroboscopy. The mean age was 11 years. All patients were examined using rigid endoscopy, or stroboscopy, or flexible laryngoscopy.

A variety of scopes should be considered for endsocopy. We have the 70-degree 10 mm rigid scope, the 70-degree 5 mm rigid, the 90-degree 10 mm rigid scope; we have the chip-tip scope - flexible fiber laryngoscope with 3.5 mm outer diameter (OD), and we also have a new, high-definition-view chip-tip scope and a fiber-optic scope. I think in children, primarily, we are limited to the 70-degree 5 mm rigid endoscope or the fiber-optic chip-tip scope. In small children, the later generations of chip-tip scopes have diameters similar to that of a small fiber-optic laryngoscope. The Olympus P4 fiber-optic endoscope has a 3.5 mm outer diameter and is most useful for young children. A 5 mm 70-degree scope is very helpful, because it is much smaller than the adult-sized rigid 70-degree endoscope. It is especially helpful for children who have large tonsils. Because a child's larynx is higher, the smaller 5 mm rigid scope throws enough light into the larynx for stroboscopic examination.

Our data support previous data from other investigators, which is that for about 30% of people you have to use a flexible approach, because a rigid approach is not adequate. Of 80 patients, though, about 66% underwent rigid endoscopy alone, and two were too uncooperative to get an adequate examination. After the stroboscopic examination, a total of 131 diagnoses were made in these 80 children. Therefore, many patients have multiple diagnoses.

In our series, only 51% of our children had nodules. Laryngeal reflux disease was significant in 23% of the cases. In the children we studied, 15% had polyps misdiagnosed as nodules. A significant number of patients had inflammatory, what I call rhinogenic, laryingitis contributing to vocal fold nodules and functional dysphonia. The diagnosis of sinusitis, adenoiditis, and some had non-specific laryngitis contributed to the diagnosis of non-specific laryngitis with vocal fold nodules. This is a larger number than in a similar study done on adults. While we had some patients with dysphonia due to congenital sulcus, laryngeal paralysis, trauma from intubation, and previous laryngeal surgery, the majority had benign mucosal lesions and inflammatory conditions affecting vocal fold function. Psychogenic disorders and purely functional vocal disorders were rare.

The inflammatory component constituted 50% of our diagnosis, with reflux, rhinitis, adenotonsillar hypertrophy, and non-specific laryngitis. And the number of diagnoses was actually 1.5 diagnoses per child, because multiple etiologies were found in 44 patients, with inflammatory co-factors being very significant. None of our patients actually had papilloma or cancer.

In terms of therapy, the tabulation of treatments shows that 50 of our patients were referred for evaluation by a speech therapist. These were the patients with vocal fold nodules. Anti-acid therapy with PPI treatments were given in patients suspected of reflux laryngitis (27/80). Sixteen of our cases went to microsurgery. Allergy, mucolytics, and nebulized steroids were used for management of rhinitis. Three patients were recommended to have adenotonsillectomy. Those were patients with adenoiditis and tonsillitis with chronic tonsillar hypertrophy or adenoiditis thought to cause chronic laryngitis with mouth-breathing. The average intervention per child was 1.5. Often, they had speech therapy plus PPI treatment. And about 40% underwent multidimensional, multispecialty evaluation.

Sixteen patients (20%) underwent endscopic microsurgery. Mucous cyst, keratin cyst, polyps, and firm nodules refractory to therapy were the main indicators for surgery. In children, the indications for surgical intervention are lower than in adults. This is attributed to the lower rates of malignancy and to a concomitant higher incidence of inflammatory disorders of the unified airway.

In patients with asymmetric lesions seen on stroboscopy, surgery should be considered over prolonged vocal therapy. Asymmetric lesions that cause mass or stiffness of the vocal folds can be effectively treated by surgical intervention. A typical child with asymmetric lesions will be referred for short-term therapy and then be reevaluated at three months. If they do not respond, then we may consider them for microlaryngoscopic examination, both for exploration and for definitive treatment. Post-surgical vocal therapy will be initiated after surgery.

The children-compared-to-adults issue

In general, in children you must be much more concerned with inflammation and metaplastic changes, and not so much about tumors and lesions of uncertain behavior. There is also much more of a behavioral issue, especially with boys, that can sometimes be resolved at puberty, while in adults vocal disturbance is more common in women. In fact in adults we see a 2/1 ratio of women with vocal disorders compared to boys, and in children it is

more equal or slightly more in the boys. Second, in consideration of vocal therapy, children's environmental and voice-use patterns must be integrated into a useful program of behavioral modification to ensure adequate carry-over. Vocal therapy must be integrated with behavioral and familial modification of vocal culture. In adults, vocal therapy alone is usually adequate.

Summary

A pediatric patient with a vocal disorder comes to the attention of the healthcare system in well-defined patterns. Below is a summary of indications for examination of pediatric patients with dysphonia.

- At birth, when their voice is poor.
- During childhood, when a new dysphonia is present with or without associated issues of speech/language articulation or prosody.
- After correction of laryngeal stenosis.
- After correction of laryngeal stenosis when the voice is poor for school.
- At puberty, due to abnormalities of pitch or loudness.
- After puberty, due to vocal dysfunction.
- Dysphonia in childhood of uncertain etiology.

Diagnosis of medical versus functional issues may be separated into those most likely to succeed with surgery versus those that should be treated by medical means or vocal rehabilitation of speech/language. Surgical cases include those with: Vocal fold cysts, mucous and keratin types; laryngeal papilloma, mature polyps and nodules that have failed therapy, disabling dysphonia after paralysis of the vocal cords, and stenosis and web after injury due to intubation and correction of stenosis. Medical and behavioral therapy should be considered in the patient with: inflammation of the upper aero- digestive tract including adenotonsilitis, allergic rhinitis, reactive airway disease, side-effects of medication, reflux laryngitis, abuse and overuse of the voice, puberphonia, conversion disorder, vocal fold nodules and early polyps.

Using such an approach that includes careful history and examination, endoscopy, and a multi-disciplinary evaluation, the paradigm for evaluation and management of the child with dysphonia has changed from "there is nothing to do" to "yes, we can."

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