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The developing role of a paediatric voice clinic: a review of our experience

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Abstract

Objective: We report our experience in developing a paediatric voice clinic within a tertiary otolaryngology department and describe the emerging role of this specialized clinic.

Materials: Currently our referral base is divided between other otolaryngologists within our department who require voice assessment as part of the pre- or post-operative management of laryngeal disorders (e.g. cysts, webs, vocal fold palsies, laryngo-tracheal reconstruction) and other professionals within our hospital who require characterisation of voice within the broader task of defining medical conditions in which voice abnormalities exist (e.g. mucopolysaccharidoses, functional dysphonias).

Methods: The patients were assessed by a team consisting of a paediatric laryngologist and a speech and language therapist. Each patient underwent a perceptual voice assessment and qualitative voice assessment using electrolaryngography. Direct visualisation was attempted and methods of and suitability for, such examination are discussed.

Results: Our experience is reviewed and guidelines for the establishment of a paediatric voice clinic are presented.

Key words: Voice; Child

Introduction

The otolaryngologist's interest in vocal pathology and the role of the larynx in phonation has developed recently owing to improved methods of direct examination and the expansion in the number of surgical options becoming available to treat benign disorders of the voice. In addition, the miniaturisation and improvement in optical quality of endoscopes has allowed evaluation of children to be performed on an ambulatory basis.

Abnormalities of the child's voice can be identified from the neonatal period. Changes in the voice can occur secondary to congenital or neurological deficits, metabolic insult, trauma or surgical misadventure (Cohen *et al.*, 1983; Maddern *et al.*, 1991). The departments of otolaryngology and speech and language therapy have developed a paediatric voice clinic at Great Ormond Street Hospital in an effort to integrate the assessment of paediatric voice problems, coordinate referral to local speech therapists and follow up the results of such therapy. Three groups of children were targeted by our programme as requiring specific care by a multi-disciplinary voice team. These included a) children in whom dysphonia had persisted despite speech and language therapy and possibly previous endoscopic evaluations, b) children in whom voice problems occurred after laryngeal or other airway surgery had been performed and c) children in whom the examination of voice might complete the description of a multi-systemic medical disorder (e.g. mucopolysaccharidoses). This report outlines our experience and the techniques we have adopted to examine young children's voices.

Subjects

At GOSH the voice clinic team consists of a speech and language therapist and an otolaryngologist. Two children are assessed per clinic and fifty assessments (48 children) are reviewed in this report. The two children assessed twice both underwent surgical procedures based on the findings in the voice clinic at their initial visit (anterior glottic web and prolapsing arytenoid causing dyspnoea).

There were 17 females and 31 males with a mean age of 9.2 ± 4.4 years (range from 0.08 to 17.9 years). The children were predominantly referred from the department of otolaryngology (31 children) but others came from speech and language therapy (11 children), medicine (five children) and surgery (one child). Forty-one children were referred from within

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GOSH. Of the seven referred from outside GOSH, all came via our speech and language therapist to whom the initial referral was made.

The children were all referred because of persistent dysphonia. Thirty-one complained predominantly of hoarseness, nine complained of dysphonia plus stridor and in eight, air escape and breathy voice accompanied the dysphonia. Other complaints included pitch breaking (two children), a weak cry (one child), a chronic cough (one child) and shortness of breath on exertion (two children). The dysphonia was longstanding in all the patients referred and it had been present since birth or since first vocalisation in 30 children. In nine children the dysphonia developed following a specific event, usually surgery. The remaining nine children had developed dysphonia over a number of years prior to being seen in the voice clinic but the parents reported that each had previously had a normal voice.

All patients were asked to describe any factors exacerbating their dysphonia and shouting was most commonly reported (16 children). Other factors included prolonged speaking (two children), exertion (four children), stress (two children) and fatigue (five children). Twenty-seven children had been intubated on at least one occasion and eight had previously been seen in the voice clinic prior to this audit.

Prior to assessment in the voice clinic all but nine children had undergone at least one surgical procedure. Twenty-four children had at least one procedure for laryngeal pathology which ranged from a diagnostic microlaryngoscopy and bronchoscopy (MLB) to laryngotracheal reconstruction (LTR). Figure 1 shows the type of operations on the airway performed in these children (all children undergoing laser resection or MLB in conjunction with LTR were counted as LTR only). All children undergoing LTR also had tracheostomies which are displayed separately in Figure 1. The number of operations performed in each child ranged from one to 47 in a child who required repeated laser resection of recurrent respiratory papillomatosis. Twenty-four children had been assessed and treated previously by a speech and language or voice therapist.

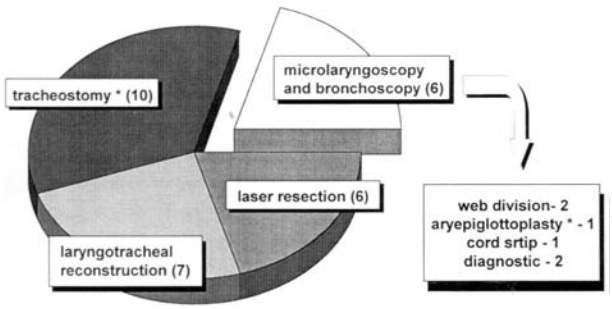

FIG. 1

The 24 surgical procedures on the airway carried out in children prior to attendance at the voice clinic is shown in this figure. This represents a higher percentage of cases than in other reported series of paediatric dysphonia. *One child underwent tracheostomy and aryepiglottoplasty.

Thirty-seven children underwent voice analysis and 49 endoscopic examinations were attempted. One child refused ambulatory examination but her symptoms were felt to be of sufficient significance (exertional dyspnoea) to warrant scheduling a microlaryngoscopy under general anaesthesia.

Method

Children are referred to the voice clinic via the department of speech and language therapy. One hour is allotted for each consultation and children are told in advance by mail, when their appointment is arranged, what they can expect in the clinic.

The child is seen by the speech and language therapist who performs a voice recording of the child counting in a soft, medium and loud voice, saying prolonged 'ah', 's' and 'z' sounds and retelling a standard story while being prompted with accompanying pictures. The recordings are made with a TEAC (DA-P20 digital audio tape recorder) and Sennheiser stereo condenser microphone (MKE 66). The voice is then rated using the Buffalo III voice profile (Wilson, 1987). Electrolaryngographic analysis is performed using a laryngograph personal computer display and analysis system (PCLX).

The child is next seen by the otolaryngologist, with the speech and language therapist in attendance, and an attempt is made to visualise the larynx (Figure 2). The equipment used includes a rigid laryngoscope (Storz 70° WQ 075) with a light source capable of performing stroboscopy (Bruel and Kjaer type 4914). Alternatively, a flexible fibreoptic nasoendoscope (Machida 3FL) is available for use in children unable to be examined satisfactorily with the rigid laryngoscope. When the flexible nasoendoscope is used, local anaesthetic (cocaine four per cent or lignocaine hydrochloride four per cent with 0.25 per cent phenylephrine hydrochloride) is applied topically to the nasal mucosa either with an insufflator or on cotton pledgets. A videocamera (R. Wolf 6251) is then attached to the eyepiece of the rigid or flexible endoscope, to allow projection of the laryngeal image on a monitor screen and simultaneous

FIG. 2

The examination of the child with the 70° rigid endoscope as shown in this picture is well tolerated in children above five years of age.

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TABLE I
CLASSIFICATION OF VOICE DISORDERS (WILSON 1987)

1. **Organic voice disorder**
   A. Structural abnormality (e.g. subglottic stenosis, vocal fold paralysis, webs)
   B. Laryngeal masses (e.g. recurrent respiratory papillomata)
   C. Others (e.g. velopharyngeal insufficiency, neurological deficit, hearing loss)
2. **Organic changes from voice abuse**
   A. Common (e.g. vocal fold nodules, inflammation)
   B. Uncommon (e.g. hyperkeratosis, ventricular band phonation)
3. **Functional voice disorder**
   A. Disturbed mutation (e.g. puberphonia, falsetto)
   B. Psychological (e.g. hysterical dysphonia)
   C. Imitation
   D. Faulty learning
   E. Functional (i.e. no demonstrable defect in vocal production mechanism)
4. **Voice disorder resulting from other factors**
   A. Allergy
   B. Upper respiratory tract conditions (e.g. kyphosis)

recording on a SONY videocassette recorder (Umatic VO-5800 PS) which allows subsequent frame by frame analysis of the laryngeal images.

Based on the severity of the dysphonia and the information gained at endoscopy, the voice is classified using the system described by Wilson (1987) which is outline in Table I. Data are collected and entered into a database.

Results

Of the 47 children (representing 49 examinations) in whom an examination was attempted, successful visualisation of the larynx was achieved in 43 (86 per cent), most commonly in the upright position (96 per cent) and using the rigid 70° telescope (71 per cent) rather than the flexible nasoendoscope (29 per cent). In three children both endoscopes were employed.

Findings at endoscopy are summarised in Table II. The Buffalo III voice profile scores for the group are summarised in Figure 3. Considering these two outcomes together, the final classification of the children by aetiology is shown in Figure 4. Thirty-four children were sent for further speech and language therapy and five were scheduled for surgery

TABLE II
FINDINGS AT THE 44 SUCCESSFUL ENDOSCOPIES

Cricoarytenoid joint fixation	6[a]
Vocal fold paralysis	3[b]
Glottic webs	2[a]
Scar (laryngocele, papilloma)	2
Vocal fold nodules	9
Hyperkeratosis	1
Supraventricular phonation	7
Mucopolysaccharidoses	3
Impaired posterior closure	2
Normal examination	9

[a]One patient was found at second examination to have developed a posterior glottic web after laser arytenoidectomy.
[b]One child was examined under a general anaesthetic.

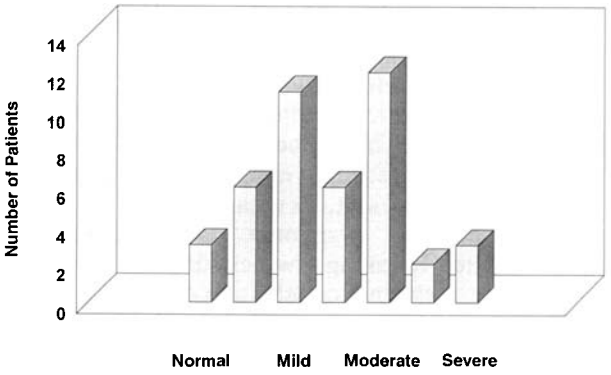

FIG. 3
The Buffalo III profile score for 43 children assessed in the voice clinic is shown in this figure (Wilson, 1987).

based on the results of assessment in the voice clinic. This group included two children in whom a microlaryngoscopy was felt to be required after failure to obtain a view in the voice clinic. One child had a bulbar palsy and the view in the voice clinic was completely obscured by secretions. The second child had dyspnoea on exertion and despite an earlier bronchoscopy at the referring institution, no cause could be found. She was subsequently found to have a unilateral vocal fold paralysis. Two children with dyspnoea on exertion and unilateral cricoarytenoid joint fixation with soft tissue prolapsed into the airway were scheduled for laser resection of the prolapsing tissue to improve the airway.

Unfortunately one of these children then developed a thin posterior glottic web which was subsequently successfully divided at two short secondary procedures. The final child undergoing surgery had a small anterior glottic web resected with the laser (Figure 5). Six children were discharged from further follow-up.

Thirty children were scheduled to return to the voice clinic to review their progress after surgery or a course of speech and language therapy. Review in the otolaryngology clinic was arranged for 18 children and in speech and language therapy for 25 children.

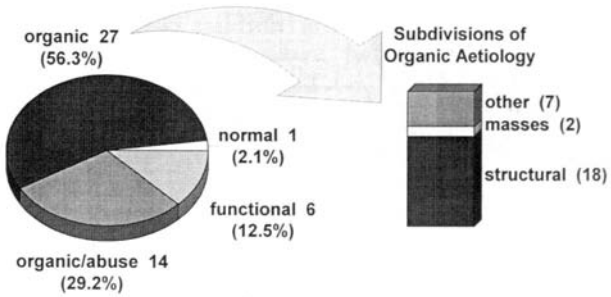

FIG. 4
After considering the findings at endoscopy and the voice profile, the children's dysphonia were classified according to aetiology as described by Wilson (1987). Note the high number of children in whom the dysphonia was due to organic causes.

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Discussion

Paediatric dysphonia is not uncommon and estimates of its incidence in school aged children range from 10 to 40 per cent (Yairi *et al.*, 1974; Silverman and Zimmer, 1975; Zajac *et al.*, 1993). Most commonly paediatric dysphonia is secondary to vocal abuse causing microtrauma to the vocal folds. There is evidence that the immaturity of children's vocal folds increases susceptibility to microtrauma and nodule formation (Schalen and Rydell, 1995). However, the tendency to adopt a 'wait and see' attitude based on the statistical likelihood of vocal abuse being the cause of a paediatric dysphonia is universally decried by clinicians and phoniatricians involved in children's care (Cohen *et al.*, 1983; Schalen and Rydell, 1995).

Dysphonia should be evaluated immediately if symptoms are progressive or accompanied by dyspnoea. Also evaluation with endoscopy should be considered in the case of dysphonia that persists without change after six months of speech and language therapy. One child assessed in the voice clinic had mild cerebral palsy and her hoarseness had previously been attributed to this condition but at endoscopy an anterior glottic web was identified as the cause (Figure 5). Patients with a history of previous intubation or airway surgery or those in whom there is an associated medical problem should be promptly evaluated in a voice clinic after the onset of dysphonia.

Preparation prior to arriving at the voice clinic is essential to inform the patient and parent of what can be expected during the assessment. We send out a leaflet at the time the appointment is booked which describes what will happen at the clinic and have found that this diminishes the anxiety of our patients considerably. The flexible nasoendoscope is widely reported to be the optimal tool for examining the child's upper respiratory tract, including the larynx (D'Antonio *et al.*, 1986). High degrees of success with this method have been reported and it offers the advantage of examining palatal function as well as giving a view of the larynx. In addition, phonation can be observed in an unaltered state and the technique can be used in infants and very young children (Lotz *et al.*, 1993). We initially used the flexible nasoendoscope but found that many children became distressed during the examination, often after the instillation of the topical anaesthetic. Reports of success with the 70° rigid endoscope cited benefits of the technique including the absence of the need for local anaesthetic and the possibility of performing stroboscopy even during the brief examination often obtained in the child (Cornut and Troillet-Cornut, 1995; Schalen and Rydell, 1995). We, therefore, changed our practice early in this series and preferentially use the rigid endoscope to examine all children over five years of age. At GOSH there is a dedicated clinic for children with suspected velopharyngeal insufficiency so palatal function is not routinely assessed in the voice clinic. We reserve the use of the nasoendoscope for children unable to tolerate the rigid endoscope or in whom the presence of a large tongue precludes an adequate view with the rigid endoscope. Our success rates at visualisation are comparable to programmes in which exclusively rigid (Cornut and Troillet-Cornut, 1995) and exclusively flexible (Lotz *et al.*, 1993) endoscopes have been used.

Our voice clinic does not reflect a usual speech and language therapy practice. The children we see have a significantly higher rate of organic causes of dysphonia than most programmes, in which organic dysphonia secondary to vocal abuse is more common (Cornut and Troillet-Cornut, 1995). As a result of this, our threshold for proceeding to the operating theatre for an examination under general anaesthetic, if ambulatory examination fails, is low. The number of children undergoing surgical intervention based on the findings at voice clinic (five in this series) is also higher than in other reports.

We identified two children with glottic scarring secondary to laser excision of a laryngocele and papillomata respectively. In six children cricoarytenoid joint fixation resulting from prior intubation or surgical reconstruction was identified at endoscopy. In these cases of dysphonia secondary to iatrogenic

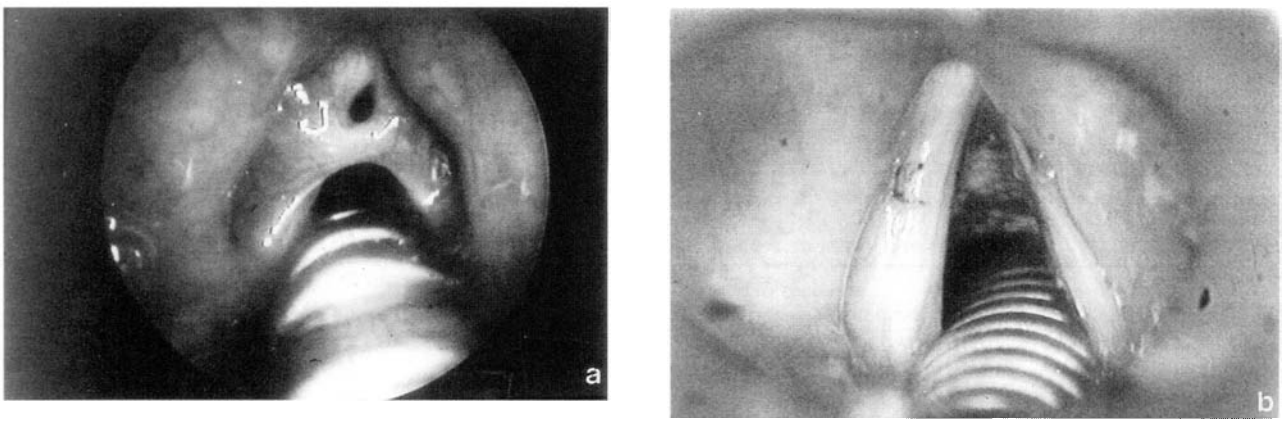

FIG. 5

This 10-year-old girl with mild cerebral palsy had dysphonia that persisted despite speech therapy. An endoscopy at age four was reported as normal. An anterior web was diagnosed in the voice clinic and laser resection carried out. The web was divided above the free edge of the vocal folds which were normal stroboscopically at follow-up. Her mother reports her self-esteem and confidence have improved now that she can communicate with diminished impediment.

laryngeal trauma our role is to both document the status of the larynx and also monitor the effects of speech and language therapy and further reconstructive surgery on phonation. An interesting subset of children seen in our clinic includes those in whom laryngotracheal reconstruction has been performed and voice outcome for these children is the subject of a separate report (Bailey *et al.*, 1995).

Even in the cases of organic dysphonia secondary to vocal abuse our population was exceptional for the small number of 'screamer's nodules'. Six children who had undergone cleft lip and palate repair presented with hoarseness; the relationship between organic dysphonia and velopharyngeal function has been well described (MacWilliams *et al.*, 1973), our experience confirms that this dysphonia is hard to treat successfully. Another interesting cause of organic dysphonia was hearing loss which occurred in one child with Stickler's syndrome, one with a cochlear implant and another with otitis media with effusion. The importance of this factor was confirmed by the resolution of dysphonia after grommet insertion and its reappearance after their extrusion and recurrence of the otitis media with effusion.

Summary

The assessment of the paediatric voice is possible in an ambulatory setting in the majority of children. The examination of the larynx is well tolerated, especially with the rigid 70° endoscope which offers the added ability to perform a stroboscopic examination. The importance of the team approach cannot be over emphasised as both the examination and the interpretation of the data collected for each child requires multi-disciplinary input to arrive at both a diagnosis and plan for treatment. In children with persistent dysphonia not responding to speech and language therapy, progressive dysphonia or dyspnoea, or medical diseases in which the voice is affected, referral to a voice clinic equipped to examine children is appropriate.

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