

Hoarseness of voice in the pediatric age group: Our experiences at an Indian teaching hospital

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Received - 18 January 2019

Initial Review - 05 February 2019

Accepted - 14 February 2019

ABSTRACT

Background: Hoarseness of the voice or dysphonia is a commonly encountered vocal symptom among children. The etiological profiles of dysphonia among children are variable, and laryngoscopic examination is required for identification of the lesions. **Objective:** The objective of the study was to study the etiology, clinical presentations, and diagnosis of the hoarseness of voice among children. **Materials and Methods:** The children aged from 3 to 16 years presenting with dysphonia/hoarseness, were included in this study from October 2015 to September 2018. All the 132 children presented with hoarseness of voice were subjected to video laryngoscopy for voice assessment. **Results:** The majority of this study was male children (59.09%). Vocal fold nodules (36.36%) were the major cause for dysphonia. Other attributing causes include vocal fold polyp, vocal fold cyst, laryngopharyngeal reflux, hemorrhagic vocal fold polyp, laryngeal papilloma, vocal fold sulcus, and vocal fold paralysis. Voice abuse was an important cause for dysphonia and history of vocal abuse was reported among 61 children (46.21%). The duration of hoarseness ranged from 1 month to 2 years with a mean duration of 3.63±2.31 months. The larynx was examined by laryngeal mirror alone in 23 children (17.42%), fiber-optic laryngoscopy in 88 children (66.66%), and direct laryngoscopy under general anesthesia in 21 cases (15.90%). Voice therapy was done in all children along with vocal hygiene care and micro-laryngeal surgery in 64 cases. **Conclusion:** Pediatric dysphonia is a common cause for referral to pediatric otolaryngologists and management sometimes variable. Flexible nasopharyngolaryngoscopy is suitable for making an accurate diagnosis.

Key words: *Dysphonia, Hoarseness of voice, Pediatric age, Vocal fold*

Communication or speech of children plays a greater role in everyday life. Dysphonia and hoarseness are the terminology used for altered voice quality. Dysphonia is commonly encountered as a clinical problem in pediatric otolaryngology practice. Hoarseness or dysphonia is around 6–9% of all childhood voice problems [1]. Pediatric dysphonia represents a broad-spectrum disorder ranging from hoarseness to inability to communicate. Hoarseness (often seen in all age groups) or dysphonia is a disorder characterized by the altered quality of voice, loudness, pitch or vocal effort which reduces the voice quality so impairs the communication [2]. The incidence of hoarse voice in the school-going children was reported as 2–23% [3]. Dysphonia has a negative effect on the health of the child, communication, social and educational development, self-image, and self-esteem.

The etiologies of pediatric dysphonia are classified into infectious, inflammatory, traumatic, iatrogenic, congenital, and functional [4]. The functional causes for voice changes in children are emotional or psychological problems such as personality disorders, adjustment problems, or anxiety. While the organic causes are the laryngeal papilloma, laryngeal web,

stenosis, malignant lesions, polyp, cysts and nodules, allergic or infectious laryngitis and laryngitis due to gastroesophageal reflux are other common causes for hoarseness of voice in children [5]. Endolaryngeal microlaryngoscopic excision by minimal stripping or CO₂ laser is helpful for vocal fold lesions such as nodules and polyps. The variable causes and its effects on the social, educational, and emotional part of life prompted us to carry out such study.

MATERIALS AND METHODS

This was a prospective study where the vocal symptoms were analyzed along with laryngoscopic findings of the dysphonic children between the age group of 3 and 16 years, at a tertiary care teaching hospital, from October 2015 to September 2018. After the Ethical Committee Approval and getting the consent from the respective parents, we included a total of 132 children. All the pediatric patients presenting with hoarseness of voice were included in this study. Exclusion criteria were a history of previous laryngeal surgery, history of radiotherapy of head and neck region and child not cooperative for examination. Children

presenting with stridor or dyspnea, acute hoarseness during upper airway infections, genetic syndromes with craniofacial malformations, were also excluded from this study.

The predominant presenting symptoms of the children were hoarseness of voice. The parents of the children answered the questionnaire such as age, gender, vocal symptom, history of voice abuse, nasal symptoms, and gastroesophageal reflux symptoms. All the children with dysphonia had undergone a careful and detailed history, general and physical examination, and systemic examinations such as ear, nose, and throat. All the children presented with hoarseness had undergone proper clinical assessment, investigations, and treatment. All the selected children were examined by the video laryngoscopy for examination of the larynx. Investigations such as routine blood tests, sputum for acid-fast bacilli, urine microscopy, and imaging (X-ray chest, X-ray paranasal sinuses, and X-ray neck-lateral view) were done in all cases. All the children underwent speech therapy after proper medical and surgical treatment.

RESULTS

There were a total of 132 children with 78 male (59.09%) and 54 female (40.90%) presented with hoarseness of voice during the study period, with a male to female ratio of 1.4:1. The youngest patient in our study was 3-year-old boy and oldest was 16 years old with the mean age of 10.34 year. Among the children above 11 years, there were more girls than the boys (Table 1).

History of vocal abuse was reported among 61 children (46.21%). The duration of hoarseness ranged from 1 month to 2 years with a mean duration 3.63 ± 2.31 months. The larynx was examined by laryngeal mirror alone in 23 children (17.42%), fiber-optic laryngoscopy in 88 children (66.66%), and direct laryngoscopy under general anesthesia in 21 cases (15.90%). Vocal fold nodules (Fig. 1) were found in 48 children (36.36%), vocal fold polyp (Fig. 2) in 23 cases (17.42%), and vocal fold cyst (Fig. 3) in 19 cases (14.39%).

Further, laryngopharyngeal reflux was found in 18 cases (13.63%), hemorrhagic vocal fold polyp (Fig. 4) in 7 children (5.30%), laryngeal papilloma (Fig. 5) in 6 cases (4.54%), vocal fold sulcus in 5 cases (3.78%), vocal fold paralysis in 4 children (3.03%), laryngeal carcinoma in one case (0.75%), and spasmodic dysphonia in 1 case (0.75%) (Table 2).

Seven children (5.30%) had a history of sudden phonotrauma followed by the development of large hemorrhagic vocal fold cyst. Out of 48 children with vocal fold nodules, 19 cases presented with an early stage of nodules. Out of 23 cases of vocal fold polyp, 11 cases were in early stages whereas 9 cases of vocal fold cysts were

in early stages. Early stages of vocal fold nodules and polyps were treated conservatively along with speech therapy. Microlaryngeal surgery was performed among 29 cases of vocal fold nodules, 12 cases of vocal fold polyp, 10 cases of vocal fold cysts, 7 cases of hemorrhagic vocal fold cysts, and 6 cases of laryngeal papilloma. Voice therapy was done by speech and language therapist in all cases along with vocal hygiene care. A case of pediatric glottic carcinoma was sent for radiotherapy, and a case of spasmodic dysphonia was treated with Botulinum toxin injection.

DISCUSSION

Hoarseness of voice is a common clinical symptom seen among children of all age groups. The prevalence of hoarseness in the children of age group between 8 and 14 years varies from 3.9% to 23.4% [2]. Dysphonia has a negative impact on effective communication, general health, educational development, self-image, self-esteem, and participating in a social environment. Parents of the children and peers often judge the dysphonia among children more negatively than other child of healthy voices [6]. The characteristic head and neck anatomy in children has an impact on voice production and dysphonia. The newborn baby has a small mandible, small mouth, large head, and more

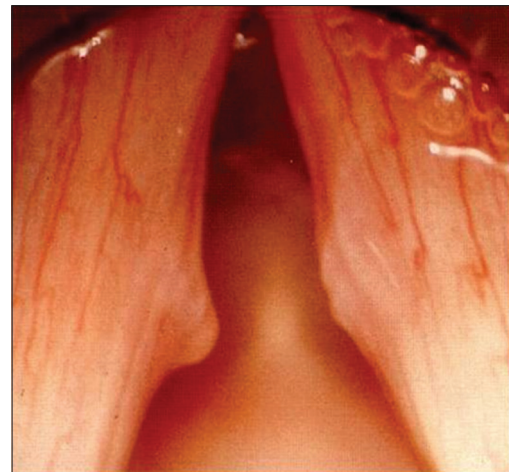


Figure 1: Vocal fold nodules

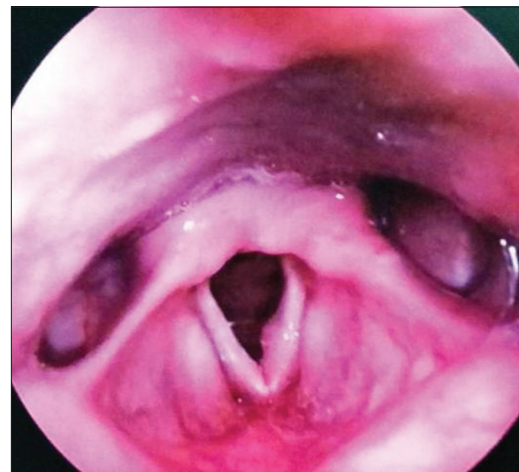


Figure 2: Left vocal fold polyp

Table 1: Correlation between age and sex of children with hoarseness of voice

Age	3–6 years	6–10 years	11–16 years
	n (%)	n (%)	n (%)
Sex			
Girl	16 (12.12)	22 (16.66)	27 (20.45)
Boy	21 (15.90)	26 (19.69)	20 (15.15)

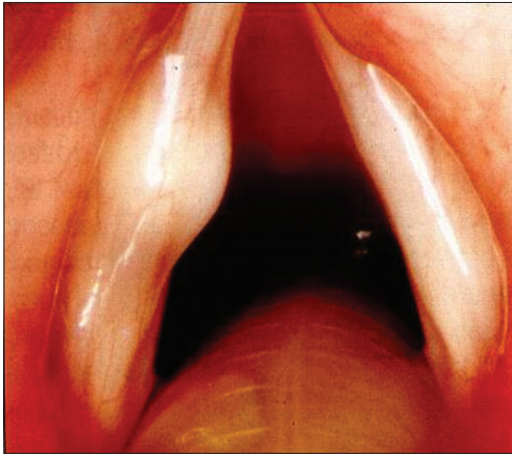


Figure 3: Left vocal fold cyst



Figure 4: Right vocal fold hemorrhagic polyp

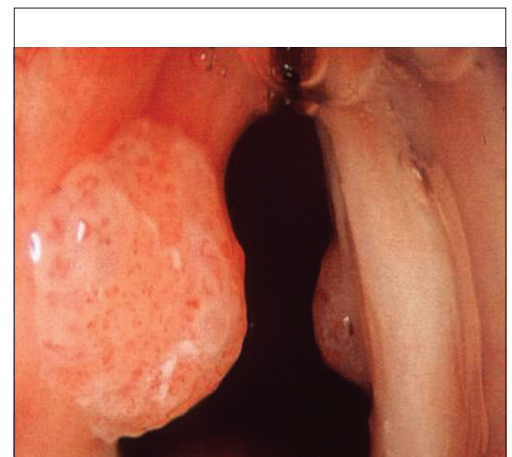


Figure 5: Papillomas over both vocal folds

fat pads at the cheeks and tongue filling the entire oral cavity. All these anatomical characteristics have an impact on the speech of the child.

The larynx of the child is present high in the neck in relation vertebra of the neck and cricoid cartilage at the fourth cervical vertebra (C4), in comparison to C6–C7 vertebra in adults. There is also a closer relationship between the epiglottis and soft palate and a shorter length vocal tract than adults. The laryngeal cartilages and vocal folds of the larynx changes as the child grow or mature.

Table 2: Distribution of vocal fold pathologies

Vocal fold pathologies	Number of children (%)
Vocal fold nodule	48 (36.36)
Vocal fold polyp	23 (17.42)
Vocal fold cyst	19 (14.39)
Laryngopharyngeal reflux	18 (13.63)
Vocal fold hemorrhagic polyp	7 (5.30)
Laryngeal papilloma	6 (4.54)
Vocal fold sulcus	5 (3.78)
Vocal cord paralysis	4 (3.03)
Glottic carcinoma	1 (0.75)
Spasmodic dysphonia	1 (0.75)

The higher position of the larynx makes a tighter oral seal and helps the infants to breathe while feeding. The connective tissue layers of the lamina propria in vocal folds are not well delineated or not well defined and vocal ligament not fully developed in children. In growing infant, the functions of the larynx evolve from primary airway protection to complex phonatory function along with airway protection.

According to Hirano's cover-body theory of the vocal fold vibration, the epithelium and superficial layer of the lamina propria forms the "cover," the vocalis muscle forms the body, and the intermediate and deep layers of the lamina propria constitute the vocal ligament, are the "transition" layer [7]. The cover layer is often involved in the mucosal wave vibration of the vocal folds. The basement membrane zone (BMZ) consists of extracellular matrix which attaches and secures the overlying epithelium of the vocal fold. The BMZ is divided into two layers, the superficial lamina lucida and deep lamina densa which are joined by anchoring filaments consisting of collagen type IV and fibronectin [8].

Hemorrhagic polyps in the vocal fold are usually due to phonotrauma such as voice abuse or misuse. Trauma to larynx either external (blunt) or internal as in endotracheal intubation or prolonged nasogastric tube injury, cause injury to vocal fold and lead to change in voice or dysphonia. Vocal fold nodules are a common cause of dysphonia during childhood. Vocal fold nodules are seen in 40% of the cases suffering from voice disturbances [9]. In this study, vocal fold nodules are seen in 36.36% cases. Vocal fold nodules have a strong relationship with allergic rhinitis; upper respiratory tract infections and gastroesophageal reflux are the major predisposing factors [10]. Laryngopharyngeal reflux was seen in 18 children (13.63%). Children with chromosomal defects cause dysphonia as in case of cri du chat syndrome.

In the pediatric age group, the behaviors of the male child are more impulsive and aggressive than a female child and are allied to anxiety, spirit of leadership, and excessive hyperactivity. These profiles of a male child directly reflect in phonatory mechanisms, leading to vocal abuse [11]. As age increases in childhood, the larynx undergoes structural changes due to masculine hormones in adolescence, leading to enlargement of laryngeal dimension. In male adolescent, the new glottic configuration is characterized by

longer vocal folds along with the acute angle of thyroid cartilage approximately 90°. During the adolescent period of a male child, symptoms of dysphonia tend to decrease and vocal nodules begin an involution process. Such types of changes are not seen in adolescent girls. In adolescent girls, the vocal folds elongate 3–4 mm whereas in boys, it increases by 1 cm [12]. Children in a family with siblings are often prone to dysphonia [13]. One study showed that 65% of the children suffering from dysphonia belonged to large families, i.e. >2 children, 30% of the children had a family history of dysphonia out of which 57% were male child [14].

Outcomes of this study suggest that noisy surroundings need excessive demand for loud talking which makes the risk for formation of vocal nodules and dysphonia [14]. Phonotrauma in a noisy environment is an important risk factor for causing dysphonia among children [15]. The most common etiology for hoarseness of voice among children is vocal fold nodules, which have been seen in 38–78% of the pediatric patients evaluated for dysphonia [1]. Other vocal fold lesions such as localized edema and irregular surface at the junction of the anterior and middle third of the vocal fold are found in 13.3% children of those evaluated for dysphonia [12].

In this study, vocal abuse was a major cause for dysphonia among children (46.21%). There were equivalent results documented by other studies such as Connelly *et al.* (45.2%) [16] and Angelillo *et al.* (90.3%) [15]. Vocal fold polyps occur mainly among children those use their voices very intensively and develop at the site of maximum muscular and aerodynamic forces exerted during phonation, and it is considered as the squeal of phonotrauma. In this study, vocal fold polyp was seen in 17.42% cases. The metabolic or endocrinal causes may lead to dysphonia in children by metabolic errors which cause disruption of normal enzymatic activity and cause abnormal infiltration or faulty muscle and nerve function.

In Urbach-Wiethe's disease or mucopolysaccharidosis, dysphonia occurs by laryngeal involvement. In a hypothyroid child, there is generalized hypotonia and myxoedematous infiltrations in the vocal folds. Extrinsic administration or abnormal secretion of testosterone or estrogen interfere with normal laryngeal function and often lead to dysphonia. Recurrent respiratory papillomatosis is common during childhood. It is common in a first born child, young primigravida mothers and low socioeconomic groups [12]. In this study, laryngeal papilloma was seen in 6 cases (4.54%).

Psychogenic causes such as emotional disturbances, psychic trauma, and disturbed parent-child relationship are sometimes counts as the cause for dysphonia among children. Psychogenic causes such as family conflict and exacerbated expectations are a major cause for dysphonia in children [17]. In the case of psychogenic dysphonia, vocal strain is usually not seen, and vocal folds are normal. The cough sounds and laugh of the children are usually normal whereas, disturbed mutation often associated with psychogenic dysphonia.

Congenital lesions of the pediatric larynx are webs and cysts whereas neoplastic lesions of the vocal folds help for visualization of the larynx. One of the congenital etiology is vocal fold sulcus

where vocal fold shows a furrow on the medial edge. The common symptom of vocal fold sulcus is a hoarse and breathy voice. Persistent pediatric dysphonia is sometimes associated with airway obstruction, dysphasia or pain, which should be investigated promptly.

Endoscopy with trans-nasal flexible scope is often useful in all the cases of pediatric dysphonia for identifying the morphodynamic alterations. Stroboscopy is carried out only in the older age group of children. Video laryngoscopy examination gives a better view of the larynx and particularly vocal fold as compared to indirect laryngoscopy. Video laryngoscopy examination gives large magnification, better angle of visualization, better illumination, and resolution. Computed tomography (CT) and magnetic resonance imaging are usually advised for any neoplastic assessment in the larynx. Any laryngeal stenosis is assessed by CT scan. Virtual endoscopy has been advised and nowadays used as a replacement for classical laryngeal endoscopy during follow-up. It is often helpful for assessing the topography of stenosis and tumors. Diagnostic biopsy of the tumor or papillomatosis lesions is done to find out the pathological diagnosis. The differential diagnosis of pediatric dysphonia is broad. A thorough and careful evaluation is essential for the exact diagnosis of the etiology.

The treatments of pediatric dysphonia need individual basis. The therapeutic options available are counseling, voice re-education, medical treatment, psychotherapy, and surgical intervention. CO₂ laser is quite effective for treatment of vocal fold polyp and nodules. It will completely excise the polyp without injuring adjacent tissue and bleeding. A combination of vocal hygiene and CO₂ laser is highly effective treatment for vocal fold lesions such as polyp and nodules. In the case of spasmodic dysphonia, there is focal dystonia affecting the laryngeal muscles during speech. It may be adductor spasmodic dysphonia (common) or abductor one (rare) [18]. In this study, one child presented with adductor spasmodic dysphonia those often presenting with voice breaks and was treated with Botulinum toxin. In our study, one case of pediatric glottic carcinoma was diagnosed in the early stage which was treated by radiation therapy.

CONCLUSION

Hoarseness of voice among the children is not an uncommon clinical entity. Pediatric dysphonia accounts for a good number of referrals. There are variations in the protocol of management among different centers. A structures protocol is needed for the diagnosis and managing the pediatric dysphonia.

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Funding: None; Conflict of Interest: None Stated.

How to cite this article: Swain SK, Behera IC, Sahoo L. Hoarseness of voice in pediatric age group: Our experiences at an Indian teaching hospital. *Indian J Child Health*. 2019; 6(2):74-78.

Doi: 10.32677/IJCH.2019.v06.i02.006