A Review of Our Experience in Phonosurgery in Children

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Abstract

Introduction and objectives: Dysphonia is a common problem in children, especially those of school age. Exploration of vocal folds is often difficult and less accurate in children. The most frequent lesions found in children with chronic dysphonia are vocal nodules, followed by epidermoid cysts and other congenital lesions, such as sulci and mucosal bridges. The treatment is multidisciplinary and it is fundamentally based on vocal rehabilitation. We indicate surgical treatment in children older than 9 years of age for whom the problem persists after rehabilitation, especially if we suspect a congenital lesion of the vocal fold.

Methods: We present a retrospective study of paediatric phonosurgery performed by the Vocal Pathology Unit of our Hospital over a period of 9 years (2005–2013). Fifty-one children were included, ranging in age from 9 to 16 years old. We analysed the distribution of the different lesions, both congenital and acquired. We evaluated the results by subjective evaluation by the children’s relatives.

Results: We obtained a distribution of 76% (n=39) of congenital lesions and 24% (n=12) of acquired lesions. After surgery, there was a global percentage of improvement of 90%, with better results in cases of vocal nodules, without statistical significance.

Conclusions: The evaluation of the results of this surgery is controversial and in this study is done with a single question survey administered to relatives. We found an overall result of improvement in 90% of operated cases, without any complications. We obtained better results in vocal nodules, although not reaching statistical significance.

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**Introduction**

Dysphonia is common in children, with an incidence of between 6% and 9%, according to the majority of studies, although several authors state that it exists in up to 40% of school age children. The majority of patients we care for are of school age and usually present with dysphonia from some time ago, with the organic lesion being more common in adults. Dysphonia in pre-school age children presents with a differentiated aetiology and both diagnosis and treatment are different.

A child’s larynx presents with anatomical differences compared with that of the adult. In the newborn the membranous and cartilaginous parts of the vocal cord are similar in size. Later, the membranous part increases in size compared to the cartilaginous part, up to puberty, when a huge increase in size occurs in very limited time, especially in males. The internal structure of the vocal cord is also greatly transformed during the first years of life and it appears that up until 10 years of age there is no clear differentiation between the superficial and deep layers of the vocal folds.

Examination of the glottis is more complex in children than in adults, especially in those of a young age. Video stroboscopy is the examination method of choice, although if this is not possible fibroscopy would be used instead.

The most common glottic lesion in this pathology are the vocal cord nodules (from 50% to 70%) from chronic vocal abuse. Following this, epidermoid cyst is the most common lesion, followed by other congenital disorders (sulcus and mucosal bridge).

Treatment of this pathology is multi-disciplinary. Referral for surgery is more conservative than in the adult. We recommend it for patients when vocal rehabilitation has failed and especially if there is suspicion of a congenital lesion.

**Material and Methods**

We present a retrospective study of children who underwent phonosurgery between years 2005 and 2013 in the vocal pathology unit of the otorhinolaryngology unit in our hospital.

Our sample was of 51 patients, of whom 30 were males and 21 females, aged between 9 and 16 years, with a mean age of 12. Out of the 51 patients, 12 presented with vocal cord nodules. The remaining 39 presented with congenital lesions (epidermoid cyst, sulcus and mucosal bridge).

Out of the 39 patients with congenital lesions, 17 presented with epidermoid cysts, 14 with sulcus (8 of them bilateral) and one presented with a bilateral mucosal bridge. Furthermore, 5 cases presented with an epidermoid cyst with sulcus and 2 with epidermoid cysts with mucosal bridges.

Surgical treatment at paediatric age is governed by the same principles as that of adults. Complete excision was therefore made in cases of vocal cord nodules. Cordotomy was used for congenital lesions, with total removal of the capsule in the epidermoid cysts and
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Figure 1  Epidermoid cyst.

Figure 2  (a) Sulcus vocalis. (b) Sulcus vocalis after pulling with micro-forceps.

Figure 3  Mucosal bridge included in sulcus vocalis.

Table 1  Functional Subjective Evaluation After Surgical Intervention.

<table>
<thead>
<tr>
<th>Condition</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocal cord nodules</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyst</td>
<td>11</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulcus</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mucosal bridge</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyst+sulcus</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mucosal bridge+cyst</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a, greatly improved; b, not much improved; c, practically the same; d, slightly worse; e, greatly worse.

To assess the outcome of surgery, apart from stroboscopic or fibroscopic examination and perceptual assessment of the elimination of the epithelial invagination of the sulcus vocalis (Figs 1, 2a and b, and 3).

To assess the outcome of surgery, apart from stroboscopic or fibroscopic examination and perceptual assessment of the voice using the GRABS system, we asked family members for an assessment of outcome on the child’s voice with a single question which was asked 6 months after surgical intervention. To answer this question they had to choose one of 5 options (a: greatly improved, b: not much improved, c: practically the same, d: slightly worse, and e: greatly worse; Table 1). In this review we analysed the subjective assessment of surgical outcome according to this single question.

Results

As a whole, out of the 51 patients, 37 responded greatly improved (74%), 8 not much improved (16%) and 5 practically the same (10%). One patient did not attend check-ups.

Of the 12 patients with vocal cord nodules 10 responded greatly improved (83.3%), 1 not much improved (8.3%) and 1 practically the same (8.3%).

Of the 38 patients with congenital lesions who were monitored 27 responded greatly improved (71.05%), 7 not much improved (18.4%) and 4 practically the same (10.5%).

Of the patients with congenital lesions, out of the 17 who underwent surgery for cysts 11 (65%) responded to the option greatly improved, 3 (17%) the slightly improved option and 2 (11%) no change. One patient did not attend check-ups. Of the 14 who underwent surgery for sulcus, 12 (85%) responded to the option greatly improved, one (7%) responded not much improved and one (7%) practically the same. The patient who underwent surgery for a
bilateral mucosal bridge responded greatly improved. Of the 5 patients with cyst and sulcus, 3 (60%) responded greatly improved, one (20%) not much improved and one (20%) practically the same. The 2 patients who had sulcus and mucosal bridge chose the option not much improved.

Although the percentage of good outcome (option a) is greater in the vocal cord nodules (83.3%) than in the congenital lesions (71.05%), the difference is not statistically significant (P: .667). If we compare within the congenital lesions the two most common lesions, we find a major improvement in the 85.71% of sulcus compared with 68.75% of epidermoid cysts, although these differences are not statistically significant either (P: .536).

Discussion

Children who go to the surgery due to chronic dysphonia are usually of school age. The majority of patients are referred from family observation, although they are often advised to consult a physician by their teachers. Dysphonia frequently does not concern the family much, which delays diagnosis.

Chronic dysphonia is more common at this age in boys than in girls, whilst from puberty onwards it is more frequently seen in females.

In the newborn, the larynx is located at a high level of the neck (C3–C4), so that it may suckle and breathe at the same time. Later, it descends over the years until it is located at level C6–C7 at 15 years of age. The vocal tract is very short in the newborn and lengthens over time so that its structure is almost definitive at the age of five years.

In the newborn the vocal cord measures around 4 mm and the size of its membranous segment is similar to that of the cartilaginous. Later, it increases in size, especially at the expense of the membranous segment (which in the adults is 4 or 5 times greater than the bony part). This growth of the vocal cord is slow during the first years of life. Later (at 10 years of age it measures between 6 and 8 mm and is the same for both sexes) but in puberty it grows a great deal in a very short time (especially in males, where it reaches between 17 and 23 mm compared to 12–17 mm in females).

The histological structure of the vocal cord in the newborn is characterised by a thicker epithelium, an absence of structure by layers and non-existence of the vocal ligament.

It appears there is no clear differentiation up until the age of 10 years of the superficial layers and the deep layers of the lamina propria of the vocal cords. At the age of 12 the superficial layer of the lamina propria appears and at 17 the complete stratified structure of the adult vocal cord.

Although examination of the vocal cords is often difficult at this age, we always try to perform a stroboscopy in children with dysphonia (usually achieved from 10 years of age). When this cannot be performed we use fibroscopy. In all chronic cases of dysphonia we need to visually examine the larynx and the vocal cords to rule out organic pathology the study or treatment of which must be immediate (papillomatosis, recurrent paralysis, tumours, etc.).

On exception, we have to perform a direct laryngoscopy under general anaesthesia to view the vocal cords.

On occasions it may be difficult to differentiate between cystic vocal nodules and endochondral cysts since in both an enlargement of the middle third of both vocal cords is noted (it has been estimated that there is around 10% of doubtful cases).

Children with chronic dysphonia present more often with an organic lesion than adults. The most commonly reported lesion in this pathology are vocal cord nodules (from 50% to 70%). After these, come the epidermoid cysts (Fig. 1), as the most frequent, followed by other congenital lesions (sulcus (Fig. 2a and b) and mucosal bridge (Fig. 3)). It is notable that lesions very frequent in the adult, such as polyps or Reinke oedema are practically absent in children.

Another aetiology may also be found for dysphonia, such as paralysis of the vocal cord or papillomatosis.

Vocal cord nodules are essentially caused by vocal abuse. When they are associated with micro membranes (from 23% to 36% of cases), they respond more poorly to vocal rehabilitation.

Vocal nodules regress in the majority of male patients after puberty. In one study of 91 teenagers with vocal cord nodules dysphonia persisted after puberty in 37% of girls but only in 8% of boys.

Some personality traits have been associated with the development of vocal cord nodules, such as aggressive behaviour, hyperactive behaviour, immaturity and difficulties in social relationships. They have also been associated with emotional disorders within or outside of the family environment.

Apart from vocal abuse or congenital malformations of the vocal cord, there are other factors which may promote dysphonia at this age, such as allergy, gastro oesophageal reflux or recurrent respiratory infections. Other factors are also involved, such as hearing loss, neurological and endocrine changes, exposure to irritant agents, dehydration, chronic coughing, etc.

As with the adult, treatment has to be multi-disciplinary.

We would recommend vocal rehabilitation in all children with chronic dysphonia. We never indicate surgical treatment in these cases without have previously tried speech therapy. Many studies exist which show the efficacity of vocal rehabilitation, although the disparity of parameters used and the heterogeneity of samples impedes the obtainment of scientific evidence. The speech therapy has to be appropriate for this age, with shorter session and a more playful approach. Small children are usually less aware of their problem compared with older children, who usually collaborate more in rehabilitation. It is highly important at this age to involve the family in this therapeutic process.

After evaluating the outcome of rehabilitation, we recommend surgical treatment, especially in those cases where the problem persists, and we suspect the existence of congenital lesions (epidermoid cyst, sulcus or mucosal bridge).

Vocal cord nodules are essentially caused by vocal abuse and will mostly be treated with vocal rehabilitation. One has to be aware of emotional disorders often in the family environment or of the presence of hyperactivity in children with vocal cord nodules. We should be very conservative in surgical referral in these patients, especially in males.

Medical treatment does not play a major role in this pathology, although on occasions it may be helpful, such as in allergic patients or those with gastro-oesophageal reflux.

With regards to age, there is no unified criteria and several authors advise against surgery until the larynx has been fully developed. Like other authors, we did not perform
phonosurgery until the patient was 9, 2, 7 since no clear limit between deep and superficial layers of the vocal cord was present. 3

The principles guiding phonosurgery are the same for a child as an adult, but surgery is more delicate in children due to the size and less mature structure of the vocal cords. In contrast, exposure of the glottis through direct laryngoscopy is easier and presents with fewer complications in the adult. 7 In our series we found no complications in the cases which underwent surgery.

One controversial issue is how to assess the functional outcome of phonosurgery. Similarly to the adult, stroboscopic examination may be used, in addition to perceptual evaluation of the voice, aerodynamic values, acoustic analysis 17 or subjective evaluation of the patient (visual analogus scales, etc.). 18 In adults there is extensive use of the Voice Handicap Index as an assessment tool. This tool has been adapted to paediatric age and recently has been validated in Spanish, 19 but at the time of our study it was not yet available.

In our study we assessed the outcome with a single question to the family where they had to choose between 5 options. We have found no studies which analyse the functional outcome of this surgery in children.

In 90% of patients we obtained an improvement in the quality of the voice. Outcome is better in non-congenital lesions (91.66% of improvement) than in congenital ones (89.47%) although there is no statistical significance. Among the congenital lesions, in our series the sulcus (92%) was better than the epidermoid cysts (87%), although again no statistical significance was present.

Conflict of Interests

The authors have no conflict of interests to declare.

References


