Current trends in practices in the treatment of pediatric unilateral vocal fold immobility: A survey on injections, thyroplasty and nerve reinnervation

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Abstract

Introduction: The objective of this study was to poll pediatric otolaryngologists with a special interest in pediatric laryngology on their experience with injection medialization laryngoplasty (IML), thyroplasty, and reinnervation procedures in order to reflect on changing clinical practices.

Method: A 10-items questionnaire was designed to inquire about current management practices in the treatment of symptomatic UVFP. The 59 members of an ASPO pediatric laryngology working group received the anonymous online survey. A 47% (28/59) response rate was obtained over a 2 weeks period.

Results: Carboxymethylcellulose gel (Prolaryn) is the most popular injectable material used in the setting of IMLs (preferred by 46%; 13 respondents). Most clinicians perform IMLs in the operating room. However, 14% (4/28) of respondents currently perform office-based injections on older patients. When faced with the case of a young child with longstanding iatrogenic VFP, most respondents (41%; 11/27) would perform an IML alone as a first step for management. 37% (10/27) of respondents would inject and perform a laryngeal EMG while 22% (6/27) would offer reinnervation and concomitant IML. When faced with the case of a teenager with long-standing VFP, the polled physicians’ opinions were divided: 37% (10/27) favored reinnervation and concomitant IML, while 26% (7/27) would proceed to an IML only. The remaining 37% (10/27) would first assess for vocal atrophy through LEMG or visual inspection.

Conclusions: Two significant shifts in practice seem to have occurred. First, ansa-RLN reinnervation procedures are now being considered as a first line treatment for a subset of patients in whom only IML was considered in the past. In fact, more than 20% of respondents did consider this route of management. Second, there is an increased use of in-office augmentations for older pediatric patients.

1. Introduction

The management of unilateral vocal fold paralysis (UVFP) in the pediatric population can be challenging. Multiple treatment options are currently available, with the 3 most common medialization procedures being injection medialization laryngoplasty (IML), thyroplasty and ansa to recurrent laryngeal nerve (RLN) reinnervation procedures [1]. The different techniques and indications have evolved over the past decade.

In regards to injection medialization laryngoplasty (IML), multiple injection products have made their way onto clinical practice within the recent years. Pediatric otolaryngologist can now choose between over 6 types of frequently used products [2,3]. Our survey aimed to look into the current choices and to establish if one injectable was most commonly used. Furthermore, there has recently been an increase in office-based procedures in the adult laryngology world [4]. In fact, given that more and more pediatric otolaryngologists are double-certified in adult laryngology and in pediatric otolaryngology, our survey aimed to identify whether practice patterns were changing according to the marriage of these two skill sets and training and whether office-based diagnostic and therapeutic procedures in children were becoming more standard.

Thyroplasty procedures are not generally considered as first-line treatment in the very young patients anymore, although previously described for aspiration cases in this subset of patients [5]. In the well-chosen, appropriate adolescent, thyroplasty may be possible in the awake but sedated patient. Reinnervation procedures are also an option, with or without simultaneous IML. This technique has shown the positive long term outcomes and we wanted to objectify to know the extent of its current application [6–9].

The objective of this study was to poll pediatric otolaryngologists...
with an interest in pediatric laryngology regarding their experience with injection medialization laryngoplasty (IML), thyroplasty, and reinnervation procedures to highlight the currently provided care and to reflect on changing clinical practices. Due to the recently mentioned changes and development in the past decade, we were curious to assess the presence of any changes and shifts in the current pediatric otolaryngology practices.

2. Methods

2.1. Survey description

An online survey was developed to determine the current practices of pediatric otolaryngologists in the management of unilateral vocal fold paralysis. A 10-questions survey was formatted for a web-based administration using Survey Monkey Inc. [10]. The survey consisted of 2 set of questions. Section A focused on the practice habits and different treatment selections (See Table 1). Section B was composed of 3 case scenarios with multiple choice answers (See Table 2).

2.2. Survey administration

Online distribution of the survey was done by email to members of ASPO previously involved in a laryngology working group (2014; 2015). A total of 59 pediatric otolaryngologists received the anonymous online survey. The senior author (CJH) addressed the objective of the survey in the invitation email, in September 2017. Respondents were assured that their answers would remain confidential. All data was kept in a secured, password protected computer. After a week, a reminder email was sent to increase the number of responses. A two weeks’ time window from the initial send out was allocated for completion.

### Table 1
Survey questions.

Section A: Current practice questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the substance that you are currently using for injection medialization laryngoplasty (IML) the one that you have been trained to inject?</td>
<td><em>Y</em></td>
<td><em>N</em></td>
</tr>
<tr>
<td>2. What substance do you currently use for your injections?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Juvederm</td>
<td>Prolaryn</td>
</tr>
<tr>
<td>3. For your given injectable, how long do you quote parents that it lasts for before another injection is necessary?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1–3 months</td>
<td>3–4 months</td>
</tr>
<tr>
<td>4. What is the quantity that you inject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Y</em></td>
<td><em>Y</em></td>
</tr>
<tr>
<td></td>
<td>1–2 cc</td>
<td>more than 2 cc</td>
</tr>
<tr>
<td>5. Do you alternate between different substances in your current day to day practice?</td>
<td><em>Y</em></td>
<td><em>N</em></td>
</tr>
<tr>
<td>6. Do you perform pediatric thyroplasties in your practice?</td>
<td><em>Y</em></td>
<td><em>N</em></td>
</tr>
<tr>
<td>7. In what setting do you perform your injections?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating room (OR)</td>
<td>Office and OR</td>
</tr>
</tbody>
</table>

### Table 2
Survey questions.

Section B: Clinical scenarios

<table>
<thead>
<tr>
<th>Case scenario</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A 2 yo child presents to you with a history of aspiration with a LVFI secondary to PDA ligation a few years ago. What would be your first line of treatment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Injection and Laryngeal EMG</td>
<td>Injection and ansa-RLN reanastomosis</td>
</tr>
<tr>
<td>2. You did an injection only on the previous patient. He is now 3 years old and aspirating again. What treatment would you chose at this point?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Injection only</td>
<td>Injection &amp; ansa-RLN reanastomosis</td>
</tr>
<tr>
<td>3. A 16 yo teenager presents to your office with dysphonia and VF paralysis from a remote cardiac procedure when he was younger. What is your next step of action?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Injection only</td>
<td>Injection &amp; ansa-RLN reanastomosis</td>
</tr>
<tr>
<td></td>
<td>Assess VF atrophy first</td>
<td>If so, please indicate what means you would use: LEMG, visual examination, etc.</td>
</tr>
</tbody>
</table>

3. Results

A total of 28 respondents reached out with their answers, corresponding to a 47% response rate. For unknown reasons, 1 respondent out of 28 did not respond to Clinical cases number 1 and 3, explaining the total number of 27 responses in the result reporting.

3.1. Section A: current practice questions

3.1.1. Injection medialization laryngoplasty (IML)

3.1.1.1. Injectable: choice of material, injected amount. A good proportion of respondents still use the injectable substances that they were trained with (57%; 16/28 respondents) while 43% (12/28) currently opt for a different material once in practice. The purported reason was mainly because new products were developed since the physicians completed their training. Only one physician mentioned that the reports of adverse events with Calcium hydroxyapatite made him or her change from the material used during training.

Most pediatric otolaryngologists (43%; 12/28) currently use carboxymethylcellulose gel (Prolaryn) as an injectable substance, followed by Calcium hydroxyapatite in the form of (Radiose) in 14% (4/28) and in the form of Prolaryn Plus in 7% (2/28) of respondents. Nine (9) clinicians mentioned using different substances from the ones previously mentioned. These are: Cymetra, Restylane and Prolaryn gel. Most respondents (79%; 22/28) do not alternate between substances in their daily practice.

A good proportion of pediatric otolaryngologists (54%; 15/28) use visual cues obtained in the OR to determine the injected amount, while others (37%; 10/28) consistently inject less than 1 cc in total.

3.1.1.2. Setting. The vast majority of respondents perform their IMLs in an OR setting (86%; 24/28). Four (4) responders (14%) perform office-based IMLs, on older patients (representing a shift from traditional teaching, see Discussion).

3.1.2. Thyroplasty procedures

Sixty-four percent (64%; 18/28) of respondents do not perform thyroplasties in their current practices. The ones who did intervened when the patients were teenagers, after puberty. One physician mentioned offering these procedures to young patients with VFI and aspiration only when reinnervation procedures are not an option. Respondents reported indications to proceed to this surgery were if patients had long term RLN injury, or when the patients desired a long term solution.
3.1.3. Ansa-RLN reinnervation procedures

In teenagers, there continues to be concerns in regards to attempted characterization of possible vocal fold atrophy, as well as preoperative use of laryngeal EMG for prognostic information. Nevertheless, thirty-seven percent (37%; 10/28) of those polled proceed to reinnervation as a primary option in this subset of patients.

3.2. Section B: clinical scenarios

3.2.1. Clinical scenarios and management practice algorithms

3.2.1.1. Clinical case 1. Twenty-two percent (22%; 6/27) of respondents offer ansa-RLN reinnervation as a first line treatment on younger patients (with concomitant IML), reflecting another shift in practice (See Discussion). Thirty-seven percent (37%; 10/27) of respondents would inject and perform a laryngeal EMG while forty-one percent (41%; 11/27) would perform an injection alone. When this was favored, most physicians would offer ansa-RLN reinnervation procedure mainly based on the clinical course of the patient and symptomatology, if patients did not wish to pursue repeated injections. Two respondents mentioned they would wait a certain period of time before considering it: “12-24 months for one”, and “a couple of years” for the other.

3.2.1.2. Clinical case 2. After a period of time, if young patients are still aspirating, most surveyed physicians would proceed to an ansa-RLN reinnervation procedure, with a concomitant injection (71%; 20/28). 14% (4/28) would have done an injection only, while 14% (4/28) would have performed an injection and a laryngeal EMG.

3.2.1.3. Clinical case 3. In the case of the teenager case with remote cardiac surgery, opinions on management seemed to be divided amongst physicians: 37% (10/27) favored injection and reinnervation, and 26% (7/27) would only proceed to an IML. 37% (10/27) would want to assess the vocal fold mobility first, and the respondents replied they would do so by doing a LEMG or by visual inspection.

4. Discussion

After analysis of our results, we are able to conclude that two significant shifts in practice seem to appear according to those polled. These shifts in practice are extremely interesting and demonstrate the acquisition of new skills and procedures in the management and treatment of vocal fold paralysis by the pediatric otolaryngologists.

First of all, laryngeal reinnervation procedures have gained tremendous popularity amongst the subspecialty in the past decade. In fact, greater than 20% of first time injection medialization laryngoplasty (IML) procedures are now accompanied by ansa-RLN nerve reinnervation for a small subset of the affected patients. This trend is likely secondary to an increased comfort level with the positive outcomes. Indeed, this procedure has shown promising results in the pediatric population. In fact, multiple series were published recently demonstrating GRBAS (Grade, Roughness, Breathiness, Asthenia and Strain) scores improvements as well as improved long term acoustic and perceptual results and patient outcome measure questionnaires [6,7,9,11]. The survey results also demonstrate that there seem to be a lack of standardization in the workup and management of young patients with vocal fold paralysis. Perhaps this is due to the facts that multiple options can be performed with positive results and that the treatment is usually tailored to each specific patient. However, not all interventions can provide long term positive outcomes and we believe it calls for a serious conversation about creating management algorithms for these patients.

A second shift is that pediatric otolaryngologists perform more outpatient office procedures, which is a change from the traditional teachings. In the survey results, 7 respondents would have done an IML only for the teenager presented in Case 3. From the answers we obtained in section A, it is safe to say that 4 clinicians out of the 7 would have done it as an outpatient procedure, which is an interesting shift in practice. The number of outpatient procedures in adult laryngology has been increasing over the past 20 years [4]. This is understandable, as office-based procedures have multiple advantages such as the avoidance of general anesthesia. The lack of suspension micro-laryngoscopy also reduces the risk for dental injuries [4]. The acquisition of real time and physiological feedback when performing IML is also a major benefit. However, in the pediatric population, the clinician will face challenging situations as the patient’s cooperation is key and may be extremely poor in the younger subjects. In fact, more and more pediatric otolaryngologists are double-certified in adult laryngology and in pediatric otolaryngology. To our knowledge, at least 6 tertiary care centers in the country have members with this double expertise. This could explain the increase seen in the survey results as we can assume the skills are translated from one population to another.

In terms of the chosen injectable material, Prolaryn (carboxymethylcellulose gel) is the most popular product at this time. However, a multitude of products are currently being used, without proof of clear superiority from one another. Calcium hydroxyapatite (Radiesse) is still used in the practice of 14% of the polled physicians, although there has been concerns raised in the literature about alteration of the mucosal wave and foreign body reactions [3,12,13].

Finally, many pediatric otolaryngologists do have a concern for vocal fold atrophy when treating older patients as most take into account a potential impact of prolonged denervation duration time frame in teenagers. Concerns of older age and vocal atrophy have indeed aroused in the literature. No consistent way of assessing this feature has been evoked in our survey results: physicians either proceed to laryngeal EMG or to direct inspection for signs of vocal atrophy. Smith et al. [14] obtained positive outcomes on a series of patients specifically targeting ages between 12 and 21 years old. In the senior author’s (CJH) clinical experience, vocal atrophy is seldom really seen and appreciated on examination. Thus, we believe that laryngeal reinnervation can be done with good results in adolescent patients but that given the importance of having a viable muscle for the success of the procedure; a standardized assessment should be done by all and for all older patients. This may include a trial of documentation of vocal atrophy but most importantly a LEMG testing.

4.1. Limitations

The first limitation to our survey resides in the survey participant’s choice. In fact, it is possible that we introduced a selection bias by sending the survey to pediatric otolaryngologists already interested in laryngology. This may have skewed our respondents group with the introduction of the double board certified otolaryngologists, but also with physicians that would be more prone to be up to date with the newer techniques available.

The second main limitation of the survey is that we presented cases pertaining to the management of the very young child and the older child, without inquiring about the current management of the middle aged group. Questions remain about their management as this group is challenging in terms of timing of the interventions. Their clinical picture is also not as clear as the dichotomy we see in the very young (more aspiration symptoms) versus in the older patient (more hoarseness symptoms). This would have been a clinically relevant scenario to present and should be investigated in further studies.

5. Conclusion

Two significant shifts in practice seem to appear according to those polled. First, ansa-RLN procedures are becoming more and more prevalent. Second, there is an increased use of office-based augmentation procedures in the treatment of pediatric VFP. Carboxymethylcellulose
seems to be the most popular chosen material for IMLs. The variation of responses in management of VFP in the treated population definitely calls for a serious conversation on standardization of care and management algorithms.

**Conflicts of interest**

The authors do not have any conflict of interest.

**Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Aknowledgments**

The authors would like to thank all survey respondents.

**References**