Role of Arytenoid Adduction plus Medialization Laryngoplasty in Paralytic Dysphonia and Aspiration

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Background on vocal fold paralysis
Etiology

A) Surgical trauma

- Thyroid and parathyroid.
- Esophageal operations.
- Carotid end-arterectomy.
- Cervical spine fusion operation.
- Malignant resections of head & neck.
- Skull base surgery.

B) Malignancy: Occult tumor in:

- Base of the skull.
- Neck, Thyroid and hypopharynx.
- Chest and mediastinum.

C) Idiopathic (including post-viral infection).
### D) Non-surgical trauma:
- Blunt and penetrating trauma to the neck.
- Endo-tracheal intubation.
- Nerve compression by nearby pathology:
  - Aortic aneurysm.
  - Cardiomegally.
  - Pulmonary TB.

### E) Neurological:
- Central or peripheral lesion.

### F) Metabolic:
- Diabetes mellitus.

### Clinical presentations

<table>
<thead>
<tr>
<th></th>
<th>Unilateral vocal fold paralysis (UVFP)</th>
<th>Bilateral vocal fold paralysis (BVFP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dysphonia</strong></td>
<td>breathy</td>
<td>breathy / leaky</td>
</tr>
<tr>
<td><strong>Stridor</strong></td>
<td>rare</td>
<td>Common</td>
</tr>
<tr>
<td><strong>Aspiration</strong></td>
<td>Yes +</td>
<td>Yes ++</td>
</tr>
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</table>
Investigations

A. To search for the **cause**.

B. **Differentiate** between paralysis & mechanical fixation.

C. To measure the **vocal functions**.

A) **Searching for the cause:**

- C.T for base of the skull, neck and chest.
- Barrium swallow.
- Thyroid scan.

B) **Differentiate between paralysis and fixation:**

EMG for thyroarytenoid muscle (TA), lateral and posterior cricoarytenoid muscles (LCA & PCA).
C) Vocal functions:

- Videostroboscopy / videokymography.
- Aerodynamic studies: MFR, subglottic pressure, glottic resistance, glottic efficiency and MPT.
- Acoustic study by multi-dimentional voice analysis program (MDVP).
- Voice range profile.

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Treatment of unilateral VFP

A. Treatment of the underlying cause.

B. Treatment of phonatory glottal gap:

- Improve dysphonia.
- Eliminate any associated aspiration.

Line of treatment decision:

1. Size of the phonatory glottal gap.
2. Clinical presentation.
1) **Voice therapy**: Gap < 2.5 mm, early presentation and no aspiration.

2) **VF injection** (fat, hyaluronic acid, Ca hydroxlapatite & gel foam).
   Failed voice therapy (done after 6 ms from onset) Except in aspiration which is resistant to positioning techniques >> Don’t wait >> Gel foam injection.

3) **Thyroplasty type I (Th-I)**: Gap > 2.5 mm.

4) A**rytenoid adduction (AA)**: Gap > 3 mm or mainly posterior gap or + aspiration.

5) **AA + Th I**: Gap > 3 mm (whole glottis) ± aspiration.

6) **AA + Nerve-muscle pedicle transplantation (selected cases).**

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**Combined arytenoid adduction (AA) and type I thyroplasty Th I (AA + Th I)**

**Advantages of AA:**

1. Put the paralyzed VF in midline without changing its morphology.

2. Tense the VF passively.

3. Correct any vertical level difference of the vocal folds.

4. Eliminate the phonatory gap especially posterior gap.

5. Eliminate aspiration.

6. Permanent result (no need for repeated injections).
Vertical glottal gap

Advantages of Th I with Gore-Tex strip:

1. Highly biocompatible material.
2. Easily to impact and fix into the window.
3. Can be done on mobile VF without damage.
4. Reversible operation.
5. Permanent results.
Aim of the work

The aim of this work is to evaluate the efficacy of combined arytenoid adduction and medialization laryngoplasty using Gore-Tex strip in treatment of unilateral vocal fold paralysis with large phonatory glottal gap with or without aspiration.
Subjects and methods

Nine Japanese subjects with breathy dysphonia grade 3 due to UVFP of more than 1 year duration. They were treated by AA + Th I.

Two Egyptian subjects have UVFP after resections of carotid body tumor.

Case 1 has paralysis of right vagus, glossopharyngeal and hypoglossal nerves for a year with frequent aspiration.

Case 2 has left VF (vagus) paralysis for 6 years with infrequent aspiration.

Both cases underwent voice therapy for 2 months with no improvement.
Technique of AA + Th I (Gore-Tex)

1. Local infiltration with xlocain + 1: 100,000 epinephrine.
2. Horizontal neck incision at midthyroid line extend from the midline to anterior border of SCM.
3. Raise skin-platysma flap.
4. Split strap muscles in midline, then cut strap muscles on the operated side.
5. Expose thyroid ala and make window measurement for proper placement of the window.

Measuring position and dimension of the thyroid window
Thyroid window design.

Thyroid window on the left thyroid ala

Thyroid window opened
6) Infuse 500 mg hydrocortisone IV over 20-30 ms to delay the laryngeal edema to adjust the voice on table.

7) Make approach to the muscular process of arytenoid cartilage.

8) Confirm passive mobility of arytenoid by Adson forceps.

9) Two Nylon threads 3-0 passed through the muscular process of arytenoid for later fixation.

Grasping muscular process of Lt arytenoid
10) Tying knots in the muscular process of arytenoid.

11) Traction and fixation of the nylon threads around the cartilaginous rim below the window
12) Impact the Gore-Tex strip in folds onto cartilage piece until obtain best voice quality.

Sample Video for AA + Th I operation
Results

Maximum phonation time in sec (MPT)

Time in months

Mean MPT in seconds

preop  3 ms  12 ms
2 Egyptian case samples underwent AA + Th I in Sohag University Hospital
Case 1 (male 34 year old)
Laryngoscopy

Preoperative | Postoperative 6 months

Case 1 (male 34 year old)
MDVP

Preoperative | Postoperative 5 months
Case 1 (male 34 year old)
Voice sample

Case 1: (GRBAS, MPT and acoustic analysis)
Case 2 (Female 26 year old)
MDVP

Preoperative        Postoperative 1 month

Case 2 (Female 26 year old)
Voice sample

Preoperative        Postoperative 1 month
Case 2: (GRBAS, MPT and Acoustic analysis)

Discussion
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Gore-Tex implant medialize the paralyzed vocal fold to the midline allowing good voice production. The arytenoid adduction corrects any posterior and vertical glottal gap. So, it eliminates aspiration and further improves the voice. Laryngeal edema developed soon after operation and lasted 4–6 weeks postoperative (irregular dysphonia). So, the first postoperative evaluation should be made after one month.

Conclusion
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Provided the healthy vocal fold is freely mobile and fully abducted, the AA + Th I is a successful surgical treatment for unilateral vocal fold paralysis associated with large glottal gap (breathy dysphonia and aspiration).

Thank you

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