



Contemporary Management of Supraglottoplasty Patients:

A Survey of Pediatric Otolaryngologists

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ABSTRACT

Objective: Supraglottoplasty is the most common procedure performed for patients with laryngomalacia. Since its first description, much has been written about the technique, outcomes, and complication. A paucity of data exists on post-operative care. This study was designed to gather data on the contemporary management of post-supraglottoplasty patients.

Study Design: A web-based survey.

Methods: A twenty-six question survey was sent to members of the American Society of Pediatric Otolaryngology.

Results: A total of 127 members responded to the survey. Cold instruments were used by 62.7% of the respondents. Division of the aryepiglottic folds was the most common technique used (85.5%). 94.5% of respondents performed bilateral procedures routinely or most of the time. About 75% of respondents prescribed anti-reflux medications post-operatively. Only 32% of respondents routinely prescribed antibiotics post-operatively. Intensive care unit admissions always or frequently occurred in about 65% of respondents. Very few practitioners advocated post-operative intubation routinely (4%). Steroids were commonly used peri-operatively (86%) and post-operatively (52%). About 96% of respondents reported that patients were discharged within 3 days. Feeding and respiratory issues ranked as the most common cause of a prolonged hospital stay. Persistent stridor was the most common issue post-operatively (66%).

Conclusion: To date, very few studies exist that examine the post-operative management of supraglottoplasty patients. Although some general trends are present, still much heterogeneity occurs between practices. Further studies are needed to better define the safest and most efficacious management strategies.

BACKGROUND

Laryngomalacia is the most common cause of congenital stridor, affecting 54% - 75% of infants ¹. It is characterized by inspiratory stridor that presents soon after birth. In a majority of cases, the disorder is self-limited, peaking around 6-8 months and resolution around 12-24 months. Direct rigid or flexible laryngoscopy is used to diagnose laryngomalacia by observing supraglottic tissue collapse and obstruction during inspiration. Infants with laryngomalacia can present with feeding difficulties, aspiration, cyanosis, apnea, hypoxia, and failure to thrive. In the most severe cases, infants can develop pectus excavatum due to subcostal retractions and pulmonary hypertension and cor pulmonale due to chronic hypoxia ².

Although a majority of infants with laryngomalacia can be managed conservatively, about 20% of infants will have disease severe enough to warrant surgical intervention ¹. Since the introduction of the supraglottoplasty (SGP) procedure by Lane et al. ³, Seid et al. ⁴, and Zalzal et al. ⁵ in the 1980's, many authors have written about how to perform the procedure, its outcomes, and complications. Fortunately, success rates approximate 94% ¹ and complication rates are about 7.4%. Despite the myriad of information about the procedure itself, limited information exists on post-operative management. Perusal of the literature yields very disparaging methods ranging from post-operative intubation and routine intensive care unit (ICU) admissions to 24-hour observation (see table 1) ⁶⁻¹⁶.

Recently, Fordham et al. ¹⁶ published their institution's data on post-operative management of supraglottoplasty when using spontaneous ventilation and cold knife techniques. They concluded that post-operative intubation and ICU care might not be necessary utilizing their methods. In light of the wide variability in management, the goal of this study was to solicit the vast experience of the members of the American Society for Pediatric Otolaryngology (ASPO) and their methods in post-operative management of supraglottoplasty patients.

Authors	Year	Post-Op Management					
		ICU	Intubation	Hospitalization Days	Beroids	Antibiotics	PPI
Marcus, et al. ⁷	1990	Y	Y	4.00	-	-	-
Kelly, et al. ⁸	1995	Y	N	2.00	-	-	Y
Valera, et al. ⁹	2006	Y	Y	-	Y	Y	-
Jani, et al. ¹⁰	2007	Y	N	3.00	N	N	-
Lee, et al. ¹¹	2007	Y	Y	4.55	Y	Y	-
O'Donnell, et al. ¹²	2007	N	N	1.50	N	N	N
Richter, et al. ¹³	2008	Y	Y	-	Y	N	Y
Schroeder, et al. ¹³	2008	Y	N	-	Y	Y	Y
Groblewski, et al. ¹⁴	2009	Y	N	-	Y	Y	Y
Chan, et al. ¹⁵	2012	Y	N	-	Y	N	Y
Fordham, et al. ¹⁶	2013	N	N	0.95	-	-	-

Abbreviations: Intensive Care Unit, ICU; Proton Pump Inhibitor, PPI

MATERIALS & METHODS

After obtaining approval from our local institutional review board and also the ASPO research committee, a twenty-six question survey was sent out to the members via e-mail. The survey was designed to gather data on their current management methods of patient who have undergone a supraglottoplasty. Demographic data included work setting, level of training, and years in practice. With regards to supraglottoplasty, we collected data on indications for surgery; number of supraglottoplasties performed per year; and preferred technique (figure 1). Post-operatively, questions were geared towards use of anti-reflux medications, use of steroids, routine admissions to the intensive care unit, post-operative intubations, and complications.

SURVEY

Survey to ASPO Regarding Post-Operative Management of Supraglottoplasty

Laryngomalacia is the most common cause of congenital stridor in an infant. Although a majority will have resolution by 18 months, about 10% will require surgical treatment. Over the years, many methods of performing supraglottoplasties have been described and complication rates have improved. Perusal of the literature, however, shows very disparate methods in post-operative management. These include: post-operative intubation for 24 hours, routine ICU admissions, and 24 hour observation in the ward to name a few.

The purpose of this study is to gather data about the contemporary practices in post-operative management of patients who have undergone a supraglottoplasty. This data may help guide us towards a more unified method of management that is safe and cost effective.

Your participation is voluntary and all data collected is anonymous. We hope to present this data in the near future. Thank you for your participation.

General Information

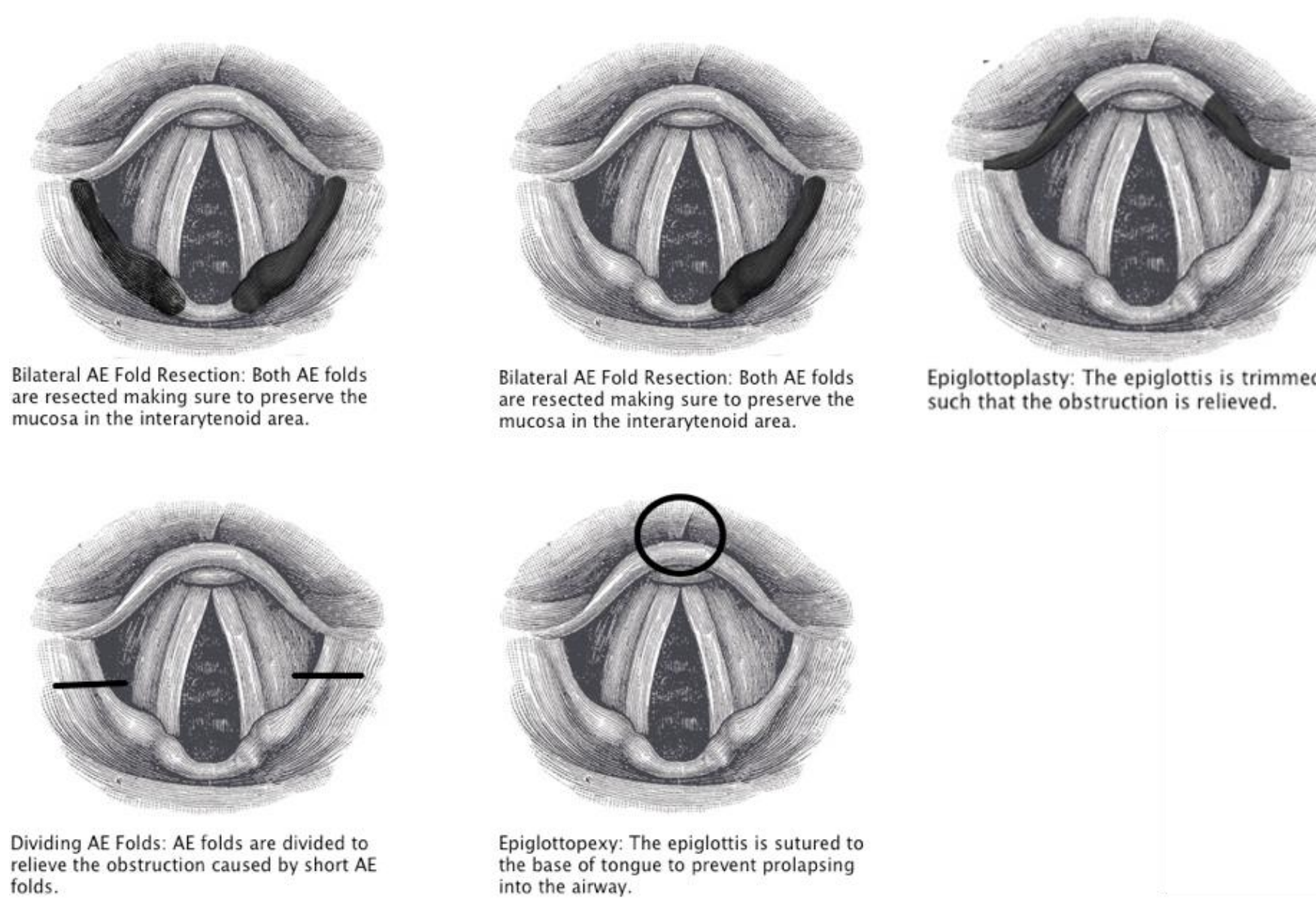
1. What is your type of practice?
 - a. Academic
 - b. Solo
 - c. Group – Single Specialty
 - d. Group – Multispecialty
 - e. Government
 - f. Other. Please specify.
2. Where do you primarily work?
 - a. Academic center caring for both pediatrics and adults
 - b. Academic center caring for only pediatric patients
 - c. Private children's hospital
 - d. Community hospital
 - e. Primarily outpatient setting
 - f. Other
3. What is your level of training?
 - a. Completed Otolaryngology Residency
 - b. Fellowship Trained Pediatric Otolaryngology
 - c. Fellowship Trained, but not in Pediatric Otolaryngology
4. How many years have you been in practice?
 - a. 0-5 years
 - b. 6-10 years
 - c. 11-15 years
 - d. Greater than 15 years

With Regards to Supraglottoplasties

5. What are the indications in which you perform a supraglottoplasty? (Choose all that apply).
 - a. Sleep Apnea
 - b. Failure to Thrive
 - c. Feeding Dysfunction
 - d. Respiratory Distress
 - e. Other. Please list.
6. How many supraglottoplasties do you perform each year?
 - a. 0-10
 - b. 11-20
 - c. 21-30
 - d. 31-40
 - e. Greater than 40
 - f. Actual number or rough estimate if available.
7. What is your preferred method of performing a supraglottoplasty? (Choose all that apply)
 - a. Cold knife
 - b. CO2 Laser
 - c. KTP Laser
 - d. Microdebrider
 - e. Other. Please specify.
8. What type of supraglottoplasty performed? (Choose all that apply) [See pictures below]
 - a. Resecting bilateral AE folds
 - b. Resecting one AE fold
 - c. Dividing AE Folds
 - d. Epiglottomy
 - e. Epiglottoplasty
 - f. Other. Please specify.
9. Do you perform unilateral or bilateral supraglottoplasties.
 - a. Always unilateral
 - b. Always bilateral
 - c. Unilateral
 - d. Bilateral
 - e. Other. Please specify.

Post-Operative Management

10. Do you give patients a PPI post-operatively?
 - a. Always
 - b. Never
 - c. Only if they have a history of reflux.
 - d. Other. Please specify.
11. Do you give patients an H2-antagonist post-operatively?
 - a. Always
 - b. Never
 - c. Only if they have a history of reflux.
 - d. Other. Please specify.
12. Do you use antibiotic perioperatively, specifically for supraglottoplasty (e.g. not because the patient needs antibiotic for some other reason)?
 - a. Yes
 - b. No
 - c. Only if indicated. Please list indication.
13. Do you use an antibiotic post-operatively?
 - a. Always
 - b. Never
 - c. Only if indicated. Please list indication.
14. In your patients who have undergone a supraglottoplasty, do you routinely admit to ICU post-op?
 - a. Always
 - b. Frequently
 - c. Rarely
 - d. Never
 - e. Only if indicated. Please list indications.
15. Do you keep your patients intubated post-op?
 - a. Always. For how long?
 - b. Frequently. For how long?
 - c. Rarely. For how long?
 - d. Never
 - e. Only if indicated. Please list indications and for how long.
16. Do you use steroids peri-operatively?
 - a. Always
 - b. Never
 - c. Only if indicated. Please list indications.
17. Do you use steroids post-op?
 - a. Yes. For how long and what dose?
 - b. No.
 - c. Only if indicated. Please specify indications and dosage.
18. How long on average do your supraglottoplasty patients stay in the hospital?
 - a. Outpatient
 - b. 24-hour observation
 - c. 2-3 days
 - d. 3-5 days
 - e. 4-5 days
 - f. 6-7 days
 - g. Greater than 7 days
 - h. Other. Please specify.
19. What are the reasons that lead to a longer than expected hospital stay? (Choose all that apply).
 - a. Feeding issues
 - b. Respiratory issues
 - c. Pain issues
 - d. Social issues
 - e. Infection
 - f. Other. Please list.
20. How long do you follow up with these patients?
 - a. 1 month
 - b. 2 months
 - c. 3 months
 - d. Greater than 3 months.
 - e. Other. Please specify.
21. What is the most common complication of supraglottoplasty in your practice?
 - a. Aspiration
 - b. Persistent stridor
 - c. Respiratory Issues. Please list.
 - d. Persistent feeding dysfunction. Please list.
 - e. Supraglottic stenosis.
 - f. Other. Please list.



DEMOGRAPHICS & SGP DATA

Work Setting	# of Responses	% of Total
Academic Adult/Children's Hospital	22	17.3%
Academic Children's Hospital	77	60.6%
Private Children's Hospital	17	13.4%
Community Hospital	8	6.3%
Outpatient Center	3	2.4%

Level of Training	# of Responses	% of Total
General	4	3.1%
Fellowship Trained in Pediatrics	121	95.3%
Fellowship Trained, not in Pediatrics	2	1.6%

Years in Practice	# of Responses	% of Total
0-5 Years	14	11.0%
6-10 Years	23	18.1%
11-15 Years	18	14.2%
Greater than 15 Years	72	56.7%

# of SGP Performed Per Year (N = 127)	# of Responses	% of Total
0-10	91	71.7%
11-20	25	19.7%
21-30	6	4.7%
31-40	3	2.4%
Greater than 40	2	1.6%

Instrument	# of Responses	% of Total
Cold Instruments	79	62.7%
CO2 Laser	43	34.1%
KTP Laser	1	0.8%
Microdebrider	25	19.8%

Technique	# of Responses	% of Total
Resecting AE Folds	43	34.7%
Dividing AE Folds	106	85.5%
Epiglottoplasty	19	15.3%
Epiglottomy	9	7.3%
Ablating Lateral AE Fold Mucosa	46	37.1%

Approach	# of Responses	% of Total
Always Unilateral	2	1.6%
Always Bilateral	69	54.3%
Mostly Unilateral	5	3.9%
Mostly Bilateral	51	40.2%

POST-OP MANAGEMENT

Post-Operative Anti-Reflux Medication (N = 127)	# of Responses	% of Total
Always	95	74.8%
Never	0	0.0%
Only if indicated	32	25.2%

Antibiotic Use	# of Responses	% of Total
Always	40	32.0%
Never	85	68.0%

ICU Admission	# of Responses	% of Total
Always	51	40.16%
Frequently	32	25.20%
Rarely	23	18.11%
Never	5	3.94%
If indicated	16	12.60%

Intubation	# of Responses	% of Total
Always	5	4.0%
Frequently	7	5.6%
Rarely	45	35.7%
Never	49	38.9%
If indicated	20	15.9%

Steroid Use	# of Responses	% of Total
Always	107	86.3%
Never	17	13.7%

Steroid Use	# of Responses	% of Total
Yes	65	51.6%
No	25	19.8%
Only if indicated	36	28.6%

LENGTH OF STAY & POST-OP ISSUES

Days in the hospital (N = 124)	# of Responses	% of Total
0-1 Day	64	51.6%
2-3 Days	56	45.2%
3-4 Days	2	1.6%
4-5 Days	2	1.6%

Reason	# of Responses	% of Total
Feeding Issues	104	84.6%
Respiratory Issues	104	84.6%
Pain	14	11.4%
Social Issues	36	29.3%
Infection	3	2.4%

Issue	# of Responses	% of Total
Aspiration	23	19.3%
Persistent Stridor	78	65.5%
Respiratory Issues	10	8.4%
Persistent Feeding Dysfunction	20	16.8%

DISCUSSION

Amongst our respondents, the **most commonly used instruments are cold instruments and/or the CO2 laser**. While the specific surgical technique employed is tailored to the area of collapse, **division of the aryepiglottic (AE) folds appear to represent the most common technique**. In 2001, Reddy et al. ²⁰ advocated a unilateral procedure at the initial procedure given its high rate of success, low complication rate, and avoidance of supraglottic stenosis. Despite this, a **vast majority of surgeons prefer a bilateral procedure at the time of the initial operation**.

A **majority of our respondents prescribed anti-reflux medications to their patients post-operatively to aid in healing** although a paucity of data shows a benefit. A common belief is that the increase in intrathoracic pressure can predispose infants to reflux by overcoming the lower esophageal sphincter. Hartl et al. ²¹, however, did not find overly convincing evidence to support such a claim. Conversely, Hadfield et al. ¹⁹ showed an improvement in reflux scores after supraglottoplasty. Given the safe profile of reflux medications, until further studies can elucidate the link between laryngomalacia and reflux, practitioners are unlikely to change their current practice.

With regards to post-operative antibiotics, a **majority of practitioners do not prescribe antibiotics in our study**. Acute wound infections have not been reported in the literature. In our study, only three respondents reported infection as a reason for delayed discharge, but the specific type of infection is unknown. **Given the increasing concern for multi-drug resistant organisms, consideration should be given towards not prescribing antibiotics routinely post-supraglottoplasty unless otherwise indicated**.

Of significant interest, a **majority of practitioners continue to routinely admit their patient to the intensive care unit for post-operative monitoring**. Given the recent findings by Fordham et al. ¹⁶ and the increasing familiarity of the procedure, surprisingly, admission to an ICU is not an exception, but the rule. Individual patient data was not provided in our study. This situation makes analysis difficult of the particular reasons for an ICU admission. Specific criteria should be developed. For example, Schroeder et al. ²², discovered that in their cohort, patients with neurologic conditions, hypoplastic mandibles, subglottic stenosis greater than 35%, and pre-existing laryngeal edema pertended a worst post-operative course. Fordham et al., however, did not find that patients with neurologic issues had a worst post-operative course. They postulated that the difference in technique and the added time to set up the laser may contribute to increased post-operative edema ¹⁶.

Routine post-operative intubation for airway protection is generally not practiced by most practitioners. With the instantaneous improvement in airway after removal of the obstructing tissue, patients should breathe better immediately after surgery. One can infer from our data that most practitioners feel that the airway is safe post-supraglottoplasty and any post-operative edema is likely not significant enough to warrant intubation.

Almost universally, steroids, are given prior to the start of the procedure. Post-operatively, a little more than 50% of respondents continue steroids for up to 3 days. Currently, no published literature exists addressing the benefits of steroids post-supraglottoplasty. Fordham et al. did not use steroids post-operatively and had very favorable outcomes ¹⁶.

A **majority of patients are discharged from the hospital within 3 days after surgery** and within that group, a majority were discharged within 1 day. Indeed this data highlights the safety of the procedure. Complication rates are low for this procedure and our respondents agree with the literature. **The most commonly reported complication was persistent stridor**. Although aspiration post-operatively was the second most commonly reported complication, the method of assessment is unknown (e.g. clinically, radiographically, etc.).

CONCLUSIONS

The purpose of this study was to gather data on the contemporary practices in the post-operative management of supraglottoplasty patients. Since the introduction of the procedure in the 1980's, much has been learned about the techniques, safety, and efficacy of the procedure. Certainly with greater experience, management of these patients have changed, but slowly. Routine intubations are no longer practiced. Admission to the ICU, while still common, may not be necessary. **Based on this survey, some cost saving and risk saving behaviors in the treatment of laryngomalacia might be 1) avoiding the ICU postoperatively, and 2) avoiding antibiotics**.

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