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Unilateral Supraglottoplasty for Severe Laryngomalacia in Children

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Objective: To study the efficacy of Unilateral Supraglottoplasty (USGP) in treating severe laryngomalacia (LM) in children.

Design: Retrospective Medical Record Study.

Setting: Aseer Central Hospital and Abha Private Hospital, Saudi Arabia.

Method: Thirty-seven patients, aged 7 days to 9 months underwent Unilateral Supraglottoplasty for severe LM from January 2000 to December 2014. Patients who underwent preoperative tracheotomy and or previous airway surgery were excluded.

Result: Successful extubation in the second postoperative day was achieved in 31 (84%) patients; contralateral supraglottoplasty (CSGP) was required in 6 patients (16%). Aspiration was noticed in 2 (5%) patients and 1 (3%) developed supraglottic stenosis (SGS).

Conclusion: USGP was found to be safe surgical procedure with high success and low complication rate for treating severe LM.

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Laryngomalacia (LM) is the most common cause of upper airway obstruction in children. It presents with inspiratory stridor at birth, which worsens around 4 to 6 months and the frequency starts to decrease and resolve spontaneously by 18 to 24 months[1]. The stridor typically deteriorates with crying, agitation or exercise, but improves with neck extension.

Stridor is the sound produced by the turbulence of air going through a narrow or partially obstructed lumen. It occurs secondary to the force of air causing collapse of the soft supraglottic cartilages (the epiglottis, aryepiglottic folds, and arytenoid mucosa) inside the larynx.

Apart from frequent association with gastro esophageal reflux (GERD), most cases are isolated; however, laryngomalacia could be associated with recognized syndromes which have been reported in several studies of severe cases, the association could be 17% to 47%[2].

Severe cases present with chronic dyspnea (CD), cyanosis, failure to thrive (FTT) and obstructive sleep apnea (OSA); these cases usually need to undergo a surgical procedure to improve the obstruction caused by the collapsed supraglottic cartilages. This procedure is referred to as supraglottoplasty (SGP). Treatment of severe cases is surgical through endoscopy and using micro-instruments or carbon dioxide laser; both procedures were reported to be successful for LM with minor side effects[3,4].

The procedure could be done unilaterally (USGP); contralateral side (CSGP) could be done as a second stage or bilateral (BSGP) in the same sitting[5].

The aim of this study is to review the success and complication rate of USGP in treating severe cases of LM.

METHOD

A retrospective review study of 37 USGP cases was performed from January 2000 to December 2014. The patients aged 7 days to 9 months. Cases that had previous airway surgery were excluded. Data documented were age at presentation, sex, presenting symptoms, associated congenital anomalies, need for CSGP, operative notes, failure of the procedure and need for tracheotomy. Clinical evaluations and surgical procedures were done and followed by one surgeon.

All patients were classified as severe LM because of chronic dyspnea (CD), obstructive apnea (OSA), and failure to thrive (FTT). The diagnosis of LM is done using fiberoptic nasolaryngoscopy. The diagnosis is confirmed under GA. A microscope with 400mm lens was used; the supraglottic structures of the larynx were exposed using appropriate size Benjamin laryngoscope. The redundant mucosa of the aryepiglottic fold is excised on one side. The patient is taken to pediatric intensive care unit (PICU) and extubated after 24 hours.

Corticosteroids (betamethasone 1 mg/kg/day) were given for 3 days, systemic antibiotics (amoxicillin-clavulanic acid) for one week and anti-gastroesophageal reflux therapy (omeprazole 1mg/kg) for two weeks after surgery. All cases that showed disappearance of their preoperative stridor, dyspnea and tolerated oral feeding were followed up for 4 weeks and were considered successful cases.

Failure of procedure is considered in cases which failed extubation and required tracheostomy; patients required continuous oxygen support and/or continued the need for nasogastric feeding.

RESULT

Thirty-seven patients had USGP, 26 (70%) were males and 11 (30%) were females. Table 1 shows that 24 (65%) (patients' age) ranged from 0-2 months, 13 (35%) range from 3-9 months. Patients presented with severe inspiratory stridor associated with one OSA or CD/FTT. Thirty (81%) patients presented with CD while 10 (27%) patients had OSA. Eleven (30%) patients presented with CD and oxygen saturation ranging from 70%-90%, and significant FTT, see table 1. Their initial physical examination using flexible fiberoptic nasolaryngoscopy revealed an

omega shaped epiglottis, a shortened aryepiglottic fold and a redundant arytenoid mucosa in all cases. The vocal cords could not be visualized at the initial evaluation in all cases due to the severe collapse of supraglottic structures and total blockage of the glottis. Review of the rigid endoscopy operative notes confirmed the diagnosis of LM in all studied cases.

Table 1: Preoperative Characteristics of Study Sample

Preoperative Variables		Number and Percentage
Sex	Male	26 (70%)
	Female	11 (30%)
Age (months)	0-2	24 (65%)
	3-9	13 (35%)
Presenting symptoms	Chronic dyspnea	30 (81%)
	Failure to thrive	11 (30%)
	Obstructive apnea	10 (27%)

Success was achieved in 32 (86%) and failure in 5 (14%) patients; 31 (84%) had USGP and 1 (3%) was decannulated after CSGP. Six (16%) patients required CSGP; one (3%) was successfully extubated only and the other 5 (14%) failed extubation and required tracheostomy, see table 2.

Table 2: Postoperative Results

Postoperative Results		Number and Percentage	Total
Success	USGP	31 (84%)	(86%)
	CSGP	1 (3%)	
Complications	Aspiration	2 (5%)	
	Supraglottic stenosis	1 (3%)	
Failure	Tracheostomy	5 (14%)	(14%)

Thirty-one (84%) patients had single stage USGP were successfully extubated on the second postoperative day in PICU and discharged home on the third day. Thirty-two patients were followed up for 4 weeks, which revealed no respiratory distress and the patients continued to gain weight grow steadily.

Those who failed extubation were aged 7 to 22 days; two (5%) patients who had tracheostomy were found to have associated UVCP which was missed in the preoperative evaluation. One (3%) patient developed SGS. Three (8%) of the tracheostomy patients were followed for two years and were eventually decannulated, the other 2 (5%) patients were lost for follow-up.

Aspiration was troublesome in 2 (5%) patients, both had CSGP and required tracheostomy. Their aspiration was difficult to control and required NGT feeding.

DISCUSSION

Laryngomalacia is a benign congenital weakness of the supraglottic cartilages that result in inspiratory stridor. Most of the time, LM achieves complete resolution in early childhood,

usually by the second year of age. However, 10% of LM cases could be severe and presents with airway obstruction resulting in cyanosis, OSA, FTT. These severe cases require surgical intervention, which is known as supraglottoplasty[1,5].

Supraglottoplasty proved to be a successful alternative operation for tracheostomy in treating severe LM. From 1987-1995, the common practice was bilateral supraglottoplasty (BSGP) where both aryepiglottic fold redundant mucosa are excised. The problem with bilateral aggressive mucosal excision is development of SGS, which results in severe upper airway obstruction and usually requires tracheostomy[6]. In order to avoid such complication, USGP procedure was developed. This procedure is more conservative and successful. The disadvantage of the USGP is the possible need for CSGP.

The success rate of USGP in our study was 86%. All failed cases had associated anomalies (missed unilateral vocal cord palsy) and were less than one month of age. Patients who failed USGP and required tracheostomy are those who failed the second stage CSGP. Two of the 5 failed patients had UVCP. It has been reported that infants with associated airway lesions or medical comorbidity presenting with severe LM would need an increased postoperative airway support and a prolonged hospital stay[6,7,8].

In this study, one patient developed SGS after undergoing CSGP and required tracheostomy. Many other studies reported similar incidence of SGS[5,6,9]. In this study, 6 patients required CSGP (16%), which is comparable to other studies[10]. In USGP, the parents should be informed about the possibility of second stage CSGP or even the need for tracheostomy in case of failure.

Feeding problems, GERD and aspiration are common in LM patients. In this study, 2 (5%) of those who had CSGP had some degree of aspiration for which they needed NGT feeding. This may point to a possibility that bilateral excision of the aryepiglottic mucosa not only lead to higher incidence of SGS but it may also result in a higher incidence of postoperative aspiration. The incidence of aspiration following USGP needs to be investigated futher[5,6] . We routinely use omeprazole in all our SGP patients to minimize the effect of GERD on healing and prevent possible granulation tissue formation. Aspiration is an expected postoperative complication.

Chronic dyspnea, chronic tissue hypoxia and feeding problem difficulties result in severe weight loss and eventually FTT[11].

CONCLUSION

Unilateral supraglottoplasty is effective, safe and has a low complication rate. The success rate of the procedure seems to be higher in children older than one month of age and in children who have no associated airway lesions, encephalopathy or medical comorbidity. Major complications are rare; the most common are supraglottic stenosis, aspiration and failure of the procedure that necessitate tracheostomy.

We recommend USGP for all severe cases of LM and we reserve CSGP for those cases that fail extubation as a second stage procedure. Parents should be counseled about the procedure and expected surgical outcome.

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REFERENCES

1. Hollinger PH. Clinical aspects of congenital anomalies of the larynx, trachea, bronchi and oesophagus. J Laryngol Otol 1961; 75:1-44.
2. Toynton SC, Saunders MW, Bailey CM. Aryepiglottoplasty for Laryngomalacia: 100 Consecutive Cases. J Laryngol Otol 2001; 115(1):35-8.
3. Zalzal GH, Anon JB, Cotton RT. Epiglottoplasty for the Treatment of Laryngomalacia. Ann Otol Rhinol Laryngol 1987; 96(1 Pt 1):72-6.
4. McClurg FL, Evans DA. Laser Laryngoplasty for Laryngomalacia. Laryngoscope 1994; 104: 246-252.
5. Reddy DK, Matt BH. Unilateral vs. Bilateral Supraglottoplasty for Severe Laryngomalacia in Children. Arch Otolaryngol Head Neck Surg 2001; 127(6):694-9.
6. Denoyelle F, Mondain M, Gresillon N, et al. Failures and Complications of Supraglottoplasty in Children. Arch Otolaryngol Head Neck Surg 2003; 129(10):1077-1080.
7. Schroeder JW Jr, Bhandarkar ND, Holinger LD. Synchronous Airway Lesions and Outcomes in Infants with Severe Laryngomalacia Requiring Supraglottoplasty. Arch Otolaryngol Head Neck Surg 2009; 135(7):647-51.
8. Preciado D, Zalzal G. A Systematic Review of Supraglottoplasty Outcome. Arch Otolaryngol Head Neck Surg 2012; 138(8):718-721.
9. Reddy DK, Matt BH. Unilateral vs. Bilateral Supraglottoplasty for Severe Laryngomalacia in Children. Arch Otolaryngol Head Neck Surg 2001; 127:694-9.
10. Kelly SM, Gray SD. Unilateral Endoscopic Supraglottoplasty for Severe Laryngomalacia. Arch Otolaryngol Head Neck Surg 1995; 121(12):1351-4.
11. Richter GT, Rutter MJ, de Alarcon A, et al. Late-onset Laryngomalacia: A Variant of Disease. Arch Otolaryngol Head Neck Surg 2008; 134(1):75-80.