

Partial Cricotracheal Resection (PCTR), a Rewarding Outcome for Paediatric Subglottic Stenosis : An Early Experience

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SUMMARY

This is a retrospective study examining the outcome of paediatric patients with subglottic stenosis who underwent partial cricotracheal resection (PCTR) as a primary open procedure from 2004 to 2012. There were 5 patients identified aged from 3 to 18 years old. All the subglottic stenosis were acquired type. All of them were secondary to prolonged intubation. Three patients were classified as Myer-Cotton grade III and the other two were Myer-Cotton grade IV. Two of the patients had concomitant bilateral vocal cord immobility. All patients underwent two staged PCTR . All patients underwent two staged PCTR, and one patient underwent posterior cordectomy apart from partial CTR at different setting. All patients were successfully decannulated at various durations postoperatively. Although this is an early experience in our institution, PCTR has shown to be effective and safe procedure in patients with subglottic stenosis especially those with Myer-Cotton grade III and IV.

KEY WORDS:

partial cricotracheal resection, subglottic stenosis, prolonged intubation, paediatric

INTRODUCTION

Management of subglottic stenosis (SGS) remain a challenging task to otolaryngologists. The degree of airway stenosis is determined by using grading system developed by Cotton and Myers¹. The surgical options for management of airway stenosis include intra-luminal procedures, laryngeal framework procedures, or resection procedures. Endoscopic management (laser excision of narrowing and dilation of stenosis) may be appropriate for mild lesions; however, open surgical techniques are necessary for treatment of more extensive laryngotracheal stenosis². Expansion framework procedures involve the use of anterior and/or posterior grafts (from the rib, thyroid or conchal cartilages) placed between the edges of a surgically created split in the anterior and/or posterior lamina of the cricoid cartilage. Resection procedures are used for more severe stenosis (Grades III or IV), and involve removal of the stenotic subglottic/tracheal region with reapproximation of the healthy tracheal segment to the posterior cricoid remnant and thyroid lamina. Severe stenosis with grade III and IV do not have favourable decannulation

rates. Depending upon the location and extent of stenosis, surgical intervention may be a single stage procedure involving reconstruction with intra-operative closure of the tracheostoma, or as a staged procedure requiring the tracheostomy to be maintained during the post-operative healing period².

Partial cricotracheal resection (PCTR) for the treatment of subglottic stenosis (SGS) in an adult was first reported by Conley in 1953. Its use in a child with SGS was first reported by Gerwat and Bryce in 1974³. In the early 1990s, CTR in children was strongly advocated by Monnier and coworkers, beginning with the publication of a case series in 1993 that showed excellent results. Numerous studies conducted in both Europe and the USA over the past decade have demonstrated positive outcomes, reporting decannulation rates exceeding 90% for Myer-Cotton grades III and IV stenoses⁴. In this case series we report our experience in PCTR as operative management in patients with SGS Myers-cotton grade III and IV.

MATERIALS AND METHODS

A database of patients who have undergone CTR for SGS in Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia from January 2004 to December 2012 was included in this series. Five patients were identified. Medical records of this patients were then obtained and reviewed for demographic data, diagnosis, preoperative stenosis grade using Myers-cotton grading system, preoperative vocal cord mobility, type of operation done, decannulation status, duration between operation and decannulation and complications. All the data then was tabulated and analysed (table I, II, III).

RESULTS

Five patients, who underwent CTR between January 2004 till December 2012 were identified. The mean age is 10.4 years old in which the youngest was 3 years old and the oldest was 18 years old. Four patients were male and one female. Three (60%) of these patients had grade III stenosis according to Myer-cotton classification and two (40%) had complete or grade IV stenosis. In this series , the mean length of stenosis from vocal cord is 10.8 milimeter(mm), meanwhile the mean

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Table I: Demographic & etiology of SGS

No	Age/ sex	Reason for intubation	Duration of intubation	Timing of Tracheostomy	Etiology of SGS
1	3yo/F	recurrent pneumonia & empyema	Months & recurrent	3 months after intubation	prolonged intubation
2	4yo/M	subdural haematoma	17 days	Day 17	prolonged intubation
3	16yo/M	mva with head injury	6 days	3 weeks after extubation	prolonged intubation
4	11yo/M	mva with head injury	10 days	Day 10	prolonged intubation
5	18yo/M	mva with head injury	14 days	Day 14	prolonged intubation

Abbreviations: yo: years old ; SGS: subglottic stenosis ; mth: month ; F: female ; M: male

Table II: Pre-operative endoscopic finding

Case	Cotton grading of SGS	Distance from vocal cord	Length of stenosis	tracheomalacia	VC mobility
3yr/F	Grade III	15mm	5mm	No	mobile
4yr/M	Grade IV	10mm	4mm	No	mobile
16yr/M	Grade III	11mm	15mm	No	mobile
11yr/M	Grade III	6mm	12mm	No	Bilateral immobility
18yr/M	Grade IV	12mm	10mm	NO	Bilateral immobility

Abbreviations: yr: years; mm: millimetre ; F: female ; M: male; vc : vocal cord

Table III: Surgical findings and outcome

Age/sex	Operation done	Duration from the date diagnosis to date of surgery	Post- operative endoscopic findings	Intervention	Decannulation
3yo/F	Two stage PCTR	6 mths	Vocal cords edema, early restenosis	Gentle dilatation	4 mths
4yo/M	Two stage PCTR	17 mths	Vocal cords edema, early restenosis	Gentle dilatation	20 mths
16yo/M	Two stage PCTR	11 mths	Vocal cords edema, early restenosis	Gentle dilatation	4 mths
11yo/M	Two stage PCTR	32 mths	Vocal cords edema, early restenosis and posterior commissure adhesion	Gentle dilatation	12 mths
18yo/M	Two stage PCTR	6 mths	Vocal cords edema	-	1 mth

Abbreviations : yo: years old; PCTR : partial cricotracheal resection ; mths: months

thickness was 9.2mm. All stenosis was dense, mature, circumferential and endoluminal. There was no tracheomalacia noted in all cases.

All stenosis were of the acquired type. All cases were due to prolonged intubation for various causes. Three (60%) of patients had normal vocal cord mobility while two(40%) had bilateral vocal cord immobility preoperatively. All patients presented with tracheostomy and underwent double staged primary PCTR.

All of these cases underwent PCTR as a primary surgery and successfully decannulated. The earliest was 1 month post operation and the latest was 20 month post operation. The reason for late decannulation was due to logistic issues. The patient came to our clinic 20 months post operation for follow up as he defaulted the earlier follow up. One more patient was decannulated at 12 months as patient had right posterior cordectomy at three months and left posterior cordectomy five months post operatively.

One patient underwent posterior cordectomy at a different setting due to bilateral vocal cord immobility secondary to posterior commissure adhesion. Four patients (80%) had early restenosis (grade 1), one month post operation which was treated with gentle dilatation using various size bougie dilator and later was decannulated successfully. In our series

there is no dehiscence of the reanastomosis site or recurrent laryngeal nerve palsy reported post operatively. All patients were nursed in intensive care unit (ICU) post operatively. The mean duration of stay in ICU is 3.8 days. The children below the age of 12 stayed longer (5 days) than those above 12 years (2 days). Post operatively all patients were given antibiotics for five days, antireflux and adequate analgesic. The mean duration for stay in hospital was 7 days. Flexible nasopharyngolaryngoscope was performed to all patients prior to discharge to document the supraglottic findings mainly the vocal cord mobility.

DISCUSSION

Laryngotracheal stenosis primarily occurs at the level of the subglottic and can be either congenital or acquired. The incidence of acquired subglottic stenosis is usually a result of prolonged endotracheal intubation⁵. Other causes of acquired SGS are laryngeal trauma (previous airway surgery or accidental), autoimmune, infection, gastroesophageal reflux (GERD), inflammatory diseases and neoplasm. Prolonged endotracheal intubation remains the cause of SGS in more than 90% of patients. The management of early postintubation injury is necessary to prevent the formation of cicatricial stenosis⁵. In our series all patients had SGS caused by postintubation injury.

Cricotracheal resection has become well established in the surgical procedure for treatment of SGS. Several studies conducted worldwide favors the use of PCTR for high-grade stenosis. Decannulation is the main reason for patients seeking surgery. Decannulation rates of higher than 90% for grades III and IV stenosis are common. This provides important information for the patient who can be confident in that they will have a high chance of ultimately living without a tracheostomy. Our results compare favourably with those of others, with our decannulation rate was 100%.

Primary CTR is defined as a CTR performed on a patient who has not had a previous open airway procedure. All five patients were included in this group, all of whom are decannulated. Meanwhile extended CTR is defined as a CTR performed on a patient when an additional open airway procedure is required such as laser arytenoidectomy, vocal fold lateralization, or posterior cartilage grafting.

The length of the stenotic segment and the distance of it from the vocal cords play important roles in deciding which type of surgery is appropriate. It is generally accepted that a lesion greater than 5 centimetres is not suitable for resection anastomosis due to the difficulty in suturing the two ends together without creating a sustainable tension to the airway. Similarly a lesion very close or involving the vocal cords is not suitable for resection anastomosis due to lack of tissue to stitch the proximal cut end without jeopardizing the cord's function or mobility. Ideally the resection is a minimum of 3 mm from the vocal cords⁶. In our series the minimal length from vocal cord is 6 mm and maximal length is 15 mm. meanwhile the thickness ranged from 4 mm to 15 mm.

Potential complications after CTR include postoperative laryngeal edema, restenosis, injury to the recurrent laryngeal nerve with vocal cord paralysis, and dehiscence of the reanastomosis. Laryngeal edema is often seen 1-2 weeks after the procedure and is generally managed expectantly with judicious use of systemic corticosteroids. Restenosis is observed in approximately 10% of patients. Early restenosis may be treated with gentle dilation of the stenotic area with an endoscopically placed balloon or bougie dilator however in our series its observed in 80% of patients. Recurrent laryngeal nerve injury is reported in 2% of patients and its usually due to nerve injury occurs during posterolateral dissection. Although rare, dehiscence of the anastomosis is the most serious complication of CTR³.

To date the commonest procedure for paediatrics SGS is still laryngotracheal resection (LTR) with cartilage graft although PCTR is slowly gaining popularity. This is due to PCTR involves extensive tracheal mobilization and resection of a variable amount of trachea and considered too extensive for mild stenosis. Its complications such as recurrent laryngeal nerve(RLN) palsy and anastomotic dehiscence although rare will bring high morbidity to patients.

Many publications has shown superiority of PCTR over LTR for treatment of severe SGS (grade III and IV) with decannulation rate of more than 90%^{5,7}.

With minimal postoperative complications and a life without tracheostomy together with voice restoration, CTR has become a more popular treatment option for patients with severe SGS.

Although it has higher morbidity such as RLN palsy and anastomotic dehiscence it can be overcome with careful evaluation of entire airway pre-operatively, meticulous technique in closure of the anastomosis and good post-operative care. As SGS is a dynamic process, it is essential to perform a direct laryngoscopy on the day of operation to re-evaluate the condition and act accordingly.

Post-operative endoscopic evaluation is important to look for complications and early intervention. The combined experience of the team of surgeon, paediatrician and paediatric anesthetist is also important in producing a good outcome.

CONCLUSION

The rate of decannulation remains the first outcome parameter in surgical procedures intended for the treatment of SGS. According to this measure, CTR achieved successful decannulation in the majority of patients and should be considered as the treatment of choice for grades III and IV stenosis.

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