Partial cricotracheal resection for pediatric subglottic stenosis: Long-term outcome in 57 patients

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Objective: We sought to assess the long-term outcome of 57 pediatric patients who underwent partial cricotracheal resection for subglottic stenosis.

Methods: Eighty-one pediatric partial cricotracheal resections were performed in our tertiary care institution between 1978 and 2004. Fifty-seven patients had a minimal follow-up time of 1 year and were included in this study. Evaluation was based on the last laryngotracheal endoscopy, the responses to a questionnaire, and a retrospective review of the patient's data. The following parameters were analyzed: decannulation rates, breathing, voice quality, and deglutition.

Results: A single-stage partial cricotracheal resection was performed in 38 patients, and a double-stage procedure was performed in 19 patients. Sixteen patients underwent an extended partial cricotracheal resection (ie, partial cricotracheal resection combined with another open procedure). At a median follow-up time of 5.1 years, the decannulation rates after a single- or double-stage procedure were 97.4% and 95%, respectively. Two patients remained tracheotomy dependent. One patient had moderate exertional dyspnea, and all other patients had no exertional dyspnea. Voice quality was found to improve after surgical intervention for 1 ± 1.34 grade dysphonia ($P < .0001$) according to the adapted GRBAS grading system (Grade, Roughness, Breathiness, Asthenia, and Strain).

Conclusions: Partial cricotracheal resection provides good results for grades III and IV subglottic stenosis as primary or salvage operations. The procedure has no deleterious effects on laryngeal growth and function. The quality of voice significantly improves after surgical intervention but largely depends on the preoperative condition.

Although the treatment of pediatric subglottic stenosis (SGS) has been a matter of debate over the past two decades, partial cricotracheal resection (PCTR) has now been widely accepted as a superior alternative to laryngotracheal reconstruction (LTR) for the treatment of severe grades III and IV SGS,¹⁻⁴ as based on the Myer-Cotton classification.⁵

After the first cricotracheal resection performed by Conley in 1953⁶ and subsequently described by Ogura and Powers in 1964,⁷ PCTR became the treatment of choice for acquired adult SGS during the mid-1970s.^{1,8} However, pediatric otolaryngologists and surgeons have long been reluctant to carry out this challenging procedure in children because of the risk of anastomotic dehiscence, injury to the

recurrent laryngeal nerve, and unknown consequences on laryngeal growth and function.⁹

Ranne and associates¹⁰ are credited with the first report of a series of 7 PCTRs performed in children with recurrent SGS. This report did not stimulate otolaryngologists and pediatric surgeons to adopt the procedure for several reasons, including a lack of training in tracheal surgery. At our own institution in Lausanne, Savary performed the first pediatric PCTR in 1978, resulting in a publication by the senior author (P.M.) in 1993.⁹ Since then, this institution's ongoing experience has been documented in several publications.^{11,12} Likewise, other groups have published their own series of pediatric PCTRs, and their successful results have encouraged the widespread use of this technique in children.¹³⁻¹⁸ PCTR has been found to be superior to LTR in children when considering factors such as decannulation rates and the need for additional procedures, especially for acquired grades III and IV SGS.¹⁹

Despite the increasing number of published results of pediatric PCTRs, there is still a lack of data on the long-term outcomes of the technique, especially for procedures conducted during infancy and early childhood. Furthermore, previous studies most often focused on parameters such as decannulation rates, degree of restenosis, number of repeated operations, and complications. Analyses of voice quality and deglutition have not often been included. This study was aimed at estimating the long-term outcome of pediatric PCTRs performed in our institution, with a special emphasis on functional parameters.

Patients and Methods

The Department of Otolaryngology, Head and Neck Surgery of Lausanne has established an ongoing database of results from all infants and children who underwent a PCTR from the beginning of its use in our institution. This retrospective review was conducted by 2 residents (Y.J. and R.P.) who independently reviewed the results of the surgical procedures. The data were collected from the latest endoscopic reports, in-patient clinical evaluations, and responses to a questionnaire. The sole inclusion criterion was a minimal follow-up period of 12 months from the first operation (PCTR) performed in our department to the latest available data.

Questionnaires intended to assess the current functional state of the patients were sent in November 2003. The following items were rated by the patients or their parents by using the scales as indicated: dyspnea (grade 0 = absent to grade IV at rest); noisy breathing (grade 0 = absent to grade 3 = very noisy breathing even at rest); coughing (grade 0 = absent to grade II = frequent episodes); dysphonia (grade 0 = normal voice to grade III = aphonia); dysphagia (grade 0 = absent to grade III = nasogastric tube feeding); and global satisfaction (grade 0 = outstanding to grade IV = unsatisfied). These items were clearly explained on the questionnaire in understandable words to the patients and their parents. The degree of hoarseness or voice abnormality was evaluated at each appointment and was classified by using a 4-point grading system adapted and simplified from the GRBAS scale

(Grade, Roughness, Breathiness, Asthenia, and Strain) currently used at our institution.²⁰ Because the evaluation of voice quality is essentially subjective and is subject to high interobserver variation, we could not use it as a rough and precise estimate of outcome. However, this study allowed an acceptable comparison of voice quality preoperatively and postoperatively (within the first 3 postoperative months) and of the long-term outcome to assess any improvement or deterioration over time.

The evaluation focused on both the period before the operation and the patient's condition at the latest examination. The questionnaires were returned from December 2003 through May 2004, with a response rate of 91% (52/57 questionnaires). For the patients who did not reply, we considered the latest in-patient history and endoscopic reports as an adequate means of assessing postoperative results if a minimal follow-up of 1 year was achieved. In every patient the same observer assessed the preoperative, postoperative, and long-term endoscopic results.

Patients and Preoperative Data

From 1978 through 2004, 81 infants and children underwent a PCTR at our institution. Four patients were lost to follow-up during the first postoperative year, but none of these 4 patients presented with an early recurrence of stenosis (minimum of 4 months' follow-up) or with a postoperative complication. Twenty patients were followed up for less than 1 year and were consequently excluded from this series. Two of these 20 patients died of unrelated associated malformations and not as a consequence of their surgical procedure. The remaining 18 patients are regularly monitored at the department of otolaryngology.

Fifty-seven patients had a minimum follow-up time of 1 year and were all included in the present study. The mean age at the time of the operation was 5.5 years (range, 1 month to 16 years). Forty-seven percent of the patients were younger than 3 years of age at the time of their operation. Most of the patients (93%) were referred from other countries. The preoperative data are summarized in Table E1.

The majority of patients (81%) were tracheotomy dependent. Preoperative assessment revealed impaired voice in all but 2 patients, and 47% of them had aphonia caused by a total or subtotal obstruction of the airway. Associated malformations were present in 39% of the cases.

All children had preoperative investigations according to the guidelines jointly formulated by 3 European Centers.³ Most of the patients had severe grade III (n = 39, 68%) and IV (n = 16, 28%) laryngotracheal stenosis (Table E2). Pure SGS was encountered in 34 (60%) patients. The stenosis also involved the glottis in 15 patients and the trachea in 9 additional patients, including 1 case of transglottic stenosis. Impaired vocal cord mobility was found in 32% of the patients and consisted either of limited abduction (n = 11) or vocal cord fixation (bilateral, n = 12; unilateral, n = 1). Postintubation injury was the most frequently recognized cause.

Surgical Technique

The technique of pediatric PCTR has already been described in detail in many publications,^{9,11,12} with only few variations from the original description by Pearson and colleagues¹ published in 1975. Likewise, similarities and differences in the technique for adult versus pediatric age groups have been previously described

TABLE 1. Operative data on 57 PCTRs

Primary operation		39/57 (68%)
Salvage operation		18/57 (32%)
After	LTR + endoscopic treatment(s)	7
	LTR only	2
	PCTR only	1
	Endoscopic treatment(s) only	8
No. of stages	Single-stage	38 (67%)
	Double-stage	19 (33%)
Type of operation*	PCTR only	46 (81%)
	PCTR + Rethi	6
	PCTR + free mucosal graft	1
	PCTR + pedicled mucosal graft	5
	PCTR + vocal fold separation	7
	PCTR + supraglottoplasty	2
	PCTR + laryngeal release	2
Extension of the resection	Cricoid only	5
	Cricoid + 1-4 tracheal rings	37 (65%)
	Cricoid + 5-8 tracheal rings	15 (26%)

LTR, Laryngotracheal reconstruction; PCTR, partial cricotracheal resection. *Several combined procedures are shown; hence there is a total number greater than 100%.

and discussed by Monnier and associates.²¹ Thus the operative technique will not be further explained here.

Surgical Data

Primary surgical intervention was performed in our institution in 39 (68%) of the 57 patients. The remaining patients were referred after unsuccessful surgical treatments performed at other institutions. These data are summarized in Table 1. A single-stage procedure with concomitant resection of the tracheostoma was done in 38 (67%) of the 57 patients. Double-stage procedures (33%) were undertaken for SGS associated with posterior glottic stenosis or complete synechia of the vocal cords. Extended PCTRs (ie, PCTR combined with another open procedure) were performed in 16 patients.

Postoperative stenting was necessary in 13 patients after double-stage procedures for a period of 1 to 12 weeks. A Montgomery T-tube (n = 8) or an Easy LT-Mold (CHUV, Lausanne, Switzerland) (n = 5)²² was used for stenting.

Postoperative endoscopies were performed in all patients with or without therapeutic interventions, such as granulation tissue removal or dilatation. Single-stage procedures required a mean number of 2.5 postoperative endoscopies (range, 1-7) compared with 3.9 (range, 1-10) for double-stage procedures.

Statistical Analysis

Statistical analysis (JMP 5.0; SAS Institute, Inc, Cary, NC) was performed by a *t* test for comparison of voice quality between the preoperative and long-term assessments. A paired *t* test was done to compare the 2 subgroups (injured versus noninjured glottis). Results are expressed as the mean $\pm$ 1 standard error.

Results

Among the 81 infants and children who underwent a PCTR at our institution, 74 (92%) are presently decannulated. The decannulation rate was 97.5% (40/41 patients) for primary PCTRs, 95% (20/21 patients) for salvage PCTRs, and 74% (14/19 patients) for extended PCTRs. The latter group was much more challenging, with combined glottic stenoses and SGSs. In this group 4 children are still being treated.

Up to now, 55 (96%) of the 57 patients included in the present study have achieved successful decannulation. One patient sustained a complete restenosis after a double-stage PCTR, but he refused any further attempt at reconstruction of the airway. One patient in whom a temporary tracheotomy was performed after a single-stage PCTR still awaits decannulation, despite a patent airway. This patient also requires a distraction osteogenesis of the lower jaw for a hypoplastic mandibula.

Among the patients who underwent a single-stage procedure, a decannulation rate of 97.4% (37/38 cases) was reached. Of these 38 patients, 87% were successfully extubated 2 weeks or earlier after the operation, and 3 of them who needed a secondary temporary tracheostomy were eventually decannulated within 3 months after the operation (Table E3). Eighteen (95%) of the 19 patients who underwent a double-stage PCTR are presently decannulated, and 74% of them achieved this result within the first postoperative year.

Figure 1. Grade IV SGS after prolonged intubation for head and neck trauma. **a**, Preoperative view: total subglottic obstruction reaching the under surface of the right vocal cord. **b**, Postoperative view: patent airway with integrity of both vocal cords.

Open revision surgery was necessary in 6 of 57 patients. Three (5%) patients required revision surgery for anastomotic dehiscence and achieved an excellent final result. In 2 other patients a Rethi procedure (posterior cricoid split with costal cartilage graft) was performed to widen the posterior subglottic space, and the remaining patient underwent an anterior LTR for an early restenosis. No damage to the recurrent laryngeal nerves was observed. One patient presented with paraplegia caused by medullar ischemia. This event occurred in a 12-year-old girl who had sustained a severe head and neck trauma with prolonged intubation and subsequent grade IV SGS. She was extubated the day of the operation and had no dyspnea. At postoperative day 5, she suddenly had paraplegia caused by a thrombosis of the anterior spinal artery. A medical review attributed this event to the previous head trauma and not to the operation. The final result of her PCTR is shown in Figure 1.

No other minor or major complications were observed.

Long-Term Follow-up

The median long-term follow-up period was 5 years (range, 1-23 years). Thirteen of the 57 patients had reached adulthood by the time of the last evaluation included in the study. In all of them, laryngotracheal development was found to be normal by means of endoscopy.

Results of the questionnaire revealed good to excellent global satisfaction in 52 (91%) of the 57 patients. Three patients were moderately satisfied, and 2 patients judged their final result as unsatisfactory. One of these 2 patients

had an ischemic medullar injury during the operation with concomitant paraplegia. The second patient still has severe dysphonia.

Breathing. At the long-term follow-up examination, 54 (95%) of the 57 patients had no exertional dyspnea or dyspnea only during forceful exertion. One patient reported having dyspnea with moderate exertion, and 2 patients were still tracheotomy dependent at the time of the assessment. For verification, patients who had “noisy breathing” were compared with those presenting with dyspnea, and there was a precise match (Table 2).

Voice. After the operation, in 12 (21%) of 57 patients, the voice was evaluated as being normal, and in 28 (49%) moderate dysphonia was found (Table 2). Evaluation of the voice at long-term follow-up compared with the preoperative assessment revealed an improvement of voice quality in 40 (70%) of 57 patients. Eight patients did not notice any change, and 9 patients described varying degrees of deterioration of their voice quality. Overall, a significant mean improvement of 1.0 ± 1.34 grade, according to the 4-grade adapted scale of dysphonia, was found. These results were statistically significant ($P < .0001$).

Patients with a preoperatively recognized glottic impairment demonstrated a mean improvement in voice quality of 1.2 grades (range, -1 to $+2$). Patients without an injured glottis at the preoperative assessment showed an improvement of 0.9 grades (range, -2 to $+3$). However, the difference between these 2 groups was not statistically significant ($P = .5$).

TABLE 2. Long-term evaluation

	Grade	Overall	Stage		Glottis involvement	
			Single (n = 38)	Two (n = 19)	Yes (n = 15)	No (n = 42)
Dyspnea	No dyspnea	36	25	11	8	28
	With forced exertion	18	12	6	6	12
	With moderate exertion	1	0	1	0	1
	At rest	0	0	0	0	0
	Tracheotomy	2	1	1	1	1
Noisy breathing	No noise	35	24	11	6	29
	With forced exertion	17	12	5	8	9
	With moderate exertion	3	1	2	0	3
	At rest	0	0	0	0	0
	Tracheotomy	2	1	1	1	1
Coughing	Absent	45	31	14	11	34
	Moderate	9	6	3	3	6
	Severe	1	0	1	0	1
	Tracheotomy	2	1	1	1	1
Voice impairment	No	12	6	6	2	10
	Moderate	28	20	8	7	21
	Severe	15*	11	4	6	9
	Aphonia	2†	1	1	0	2
Deglutition	Normal	54	36	18	13	41
	Minor impairment	3	2	1	2	1
	Major impairment	0	0	0	0	0
Satisfaction	Excellent	28	19	9	8	20
	Very good	19	14	5	6	13
	Good	5	3	2	0	5
	Moderate	3	2	1	1	1
	Insufficient	2	1	1	0	0

*One patient with tracheotomy. †One patient with tracheotomy.

Comparison of long-term and short-term (first postoperative month) outcomes only demonstrated a mean improvement of 0.04 grades regarding voice quality ($P > .05$).

Swallowing. Nine patients had preoperative dysphagia. One of these patients had esophageal atresia associated with a laryngeal malformation. In 6 patients, a nasogastric tube was used before surgical intervention, and in another 3 patients, dysphagia presented as occasional coughing episodes or as slight dysphagia during meals. Eight of these 9 patients improved after PCTR. No patient required prolonged or long-term feeding by nasogastric tube after the operation. Only 3 patients are still living with symptoms of minor dysphagia.

Discussion

Development of the Larynx After Surgical Intervention

Major concerns about the growth of the larynx after pediatric PCTR or other subglottic airway procedures have now

been elucidated. An animal study by Sullivan and coworkers²³ did not show any adverse effects of anterior laminectomy of the cricoid arch on laryngeal growth. Weidenbecher and associates²⁴ demonstrated that cricotracheal resection together with laminotomy did not interfere with the development of the normal larynx of young rabbits in terms of growth, stability, and size of the subglottic lumen. These laboratory investigations, however, did not determine whether the growth of the subglottis was affected after removal of scarred laryngotracheal tissue resulting from many previous operations. Monnier and colleagues¹¹ observed similar endoscopic laryngeal aspects and sizes of surgically treated SGS in infants and children with a minimum of a 5-year follow-up period after PCTR compared with healthy nontreated children of the same age group. Thirteen patients of this series have currently reached adulthood and have not shown any abnormal laryngeal growth. A

larger number of patients is needed to confirm these findings definitively.

Airway Patency

Studies concerned with PCTR, as well as other airway procedures, have mainly used the rate of decannulation as the main outcome measure. Reported results have ranged between 90% and 100% decannulation for PCTRs in both children and adults.¹⁵⁻¹⁹ Other publications, such as from the Cincinnati group, have reported results similar to ours, with the first report by Stern and associates¹³ (33/38 patients successfully decannulated) updated by Rutter and coworkers in 2001.¹⁴ In their series extended PCTRs (ie, PCTR combined with another open procedure) were less successful, with only 5 of 9 patients eventually decannulated. Our long-term results are henceforth very reassuring, with more than 97% of decannulations after a single-stage PCTR and around 94% after double-stage procedures.

At long-term follow-up, most of our patients did not experience exertional dyspnea after PCTR. This adds value to the good decannulation rates that were obtained with this technique. Moreover, patients who had noisy breathing matched those who had dyspnea, thus rendering the appreciation of dyspnea as being more reliable. The efficacy of pediatric PCTR for the cure of severe congenital or acquired SGS has now been substantiated by several studies with comparable encouraging results.¹³⁻¹⁷

Voice Outcome

The voice outcome was very difficult to assess in this retrospective study design. Furthermore, our evaluation was limited by the usual biases, such as subjectivity of the patients' self-estimation of the voice, lack of independent evaluation of the voice by multiple observers, and lack of objective assessment by videostroboscopy or acoustic analysis. The latter are always difficult to perform in children.

However, this study offered the advantage of providing a reliable estimation of the changes in voice quality when comparing results before and after surgical intervention. Grillo and associates²⁵ reported a series of 80 adult PCTRs with a 97% successful decannulation rate. He further subdivided patients into groups according to their voice quality and exercise tolerance. Among them, 22.5% had an excellent outcome. This included patients with only slight attenuation of maximum voice volume, slight hoarseness that did not impede vocal use, slight weakness after prolonged vocal use, diminished ability to sing, and adequate breathing for all regular activities. Ten percent had satisfactory results, which included those with a hoarse voice and either shortness of breath on exercise or slight wheezing, although not sufficient to impair usual activities. More recently, Macchiariini and coworkers²⁶ analyzed early complications after PCTR in a series of 44 adult patients with SGS. Their results

did not especially focus on voice outcome, but they mentioned that 41% of their patients had postoperative hoarseness and that 23% of them had a weak voice. However, neither study evaluated voice quality before surgical intervention. The only voice assessment after pediatric PCTR was reported by Triglia and colleagues,¹⁵ who presented a follow-up study on 7 patients with normal preoperative voice undergoing PCTR. They did not find any deterioration of the voice after the operation.

Our series demonstrated that voice quality improved significantly after surgical intervention at long-term follow-up compared with the preoperative evaluation. Interestingly, this result was obtained in most of the patients, regardless of the extent of involvement of the glottis by scar tissue before the operation. This is most likely explained by the consequence of increased subglottic pressure during phonation after resection of the stenotic segment, the effect of laminary flows observed in regular airways instead of turbulences caused by the stenosis, or both.

LTR as an alternative way to treat SGS has also been evaluated for its outcomes on the voice. MacArthur and associates²⁷ published results from endoscopies and speech analyses of a series of 12 patients with a mean age of 6 years undergoing LTR. They found that 100% of the children had decreased voice quality, but they did not perform any comparison with the preoperative findings. Other studies, including analysis of the voice after LTR, have also demonstrated high rates of dysphonia but with restoration of functional voice quality.²⁸ Although the incidence of postoperative dysphonia seemed high in these series, 100% of the infants and 80% of their parents preferred some residual voice problem after surgical intervention rather than a permanent tracheostoma.²⁹

Surgical Technique and Voice

Some technical aspects of pediatric PCTR require special attention when attempting improvement or preservation of the voice. In pure SGS the partial inferior midline thyrotomy that is used to enlarge the subglottic lumen further²¹ should not be performed at a level higher than that of the lower half of the thyroid cartilage. Any unwanted enlargement of the anterior laryngeal commissure will dramatically increase the degree of postoperative dysphonia. This phenomenon certainly explains some of the bad voices encountered after LTR when the costal cartilage graft is placed too high between the alae of the thyroid cartilage. This can also occur in pediatric PCTRs when the subglottic anastomosis is enlarged by a pedicled wedge of anterior tracheal cartilage.

During resection of the stenotic segment, the posterior subglottic incision of the mucosa on the cricoid plate should be made as caudally as possible to diminish the risk of interarytenoid scarring with possible subsequent cricoarytenoid joint fixation.

Conversely, the interarytenoid space should not be made too large, especially in extended PCTRs with combined posterior costal cartilage graft. The favorable outcome on airway patency is then counterbalanced by an incomplete closure of the vocal cords during phonation. This large residual glottic gap might lead to spontaneous arytenoid prolapse while the child is trying to phonate between the arytenoids and the laryngeal aspect of the epiglottis. Unfortunately, there is no specific technique to avoid this complication. An adequate airway is a prerequisite for a safe decannulation, and a large interarytenoid space cannot be considered as a failure in this type of operation.

Nevertheless, voice evaluation after LTR or PCTR remains an unresolved issue. The preoperative condition can vary from a normal aspect and function of the vocal cords to bilateral cricoarytenoid fixation with posterior glottic stenosis in aphonic children with grade IV SGS. A patent airway with a normal voice can be considered a good result in the first case, whereas a subnormal airway with severe dysphonia and minor aspiration during deglutition is close to the best result that can be expected in the second case. There is certainly no straightforward solution to assessment of the optimal result on phonation in such different cases, albeit with the same preoperative voice.

Conclusion

The rate of decannulation remains the first outcome parameter in surgical procedures intended for the treatment of SGS. According to this measure, PCTR compares favorably with other treatment modalities and should be considered as the treatment of choice for grades III and IV stenoses.

The patient's voice improves after PCTR, but this is closely related to the preoperative vocal fold anatomy, mobility, and voice quality. The ability to pressurize air under the glottis tends to improve voice quality after PCTR. Analysis of this series also demonstrated that good long-term results can be expected for patients successfully decannulated who do not show any sign of restenosis after 3 months; this crucial period generally determines the final outcome.

We thank all infants and children who underwent a PCTR in Lausanne and their parents for having kindly replied to the questionnaires.

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TABLE E1. Preoperative data on 57 PCTRs

Sex	Male	36 (63%)
	Female	21 (37%)
Age at operation	Mean	5.5y (1 mo-16 y)
	Median	3.9 y
Referred cases		53/57 (93%)
Dyspnea	Tracheotomy	46 (81%)
	At rest	10
	With moderate exercise	1
Dysphonia	Aphonia	27 (47%)
	Severe	19 (33%)
	Moderate	9
	None	2
Dysphagia	Aphagia (atresia)	1
	Severe (nasogastric tube)	6
	Moderate	2
	None	48 (84%)
Associated malformations	Down syndrome	4
	Other syndromes	5
	Cardiovascular anomalies	7
	Other anomalies	6
	Total	22/57 (39%)
Type of stenosis	Congenital	11 (19%)
	Acquired	31 (55%)
	Mixed cause	15 (26%)
Cause	Postintubation	44 (77%)
	Elliptical cricoid	5
	Anterior cricoid thickening	6
	Laryngomalacia	1
	Trauma	1

TABLE E2. Preoperative endoscopic staging

Grade (Myer-Cotton)	I	0
	II	2
	III	39 (68%)
	IV	16 (28%)
Site	Subglottis only	34 (60%)
	Glottis and subglottis	14
	Subglottis and trachea	8
	Glottis, subglottis, and trachea	1
Vocal cord mobility	Normal	33 (58%)
	Limited abduction	11
	Unilateral fixation	1
	Bilateral fixation	12

TABLE E3. Extubation or decannulation time

Single-stage PCTRs	Extubation time (d)	Nb (n = 38)
	≤7	22
	≤14	11 92%
	≤21	1
	≤30	1
	125 (temporary tracheotomy)	1
	686 (temporary tracheotomy)	1
	Awaiting decannulation (temporary tracheotomy)*	1 (3%)
Two-stage	Decannulation time (mo)	Nb (n = 19)
PCTRs	≤3	5
	≤6	6 73%
	≤12	3
	≤18	1
	≤24	2
	39 (temporary tracheotomy)	1
	Not decannulated	1 (5%)

*Associated micromandibula.