The Use of Posterior Cricoid Grafting in Managing Isolated Posterior Glottic Stenosis in Children

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Objective: To review our experience using posterior cricoid grafts to manage pediatric patients with isolated posterior glottic stenosis (PGS).

Design: Retrospective review over a 12-year period.

Setting: Tertiary care pediatric hospital.

Patients: All patients with isolated PGS treated between 1990 and 2002, in whom PGS was the dominant airway lesion and laryngotracheoplasty was required. Patients with concomitant vocal cord paralysis, a history of posterior laryngeal clefting, a Bogdasarian type I stenosis, or subglottic stenosis worse than grade I were excluded.

Main Outcome Measures: Cause, operative intervention, decannulation rate, failure rate, and requirement for secondary procedures.

Results: A total of 29 patients ranging in age from 2 to 8 years were treated (21 with a history of prolonged intubation and 8 with a history of laryngeal trauma). Twenty patients had tracheotomies in place at the time of airway reconstruction and the remainder had stridor. Costal cartilage was the preferred graft material and was used in 27 patients. Six patients were referred with a diagnosis of bilateral vocal cord paralysis, but on evaluation were found to have PGS and mobile vocal cords. In 12 patients, repair was accomplished in a single-stage procedure; a suprastomal stent was placed in 17 patients. Overall decannulation rate was 97%, though a second procedure was required in 4 patients. One patient remained tracheotomy dependent; 4 had poor voice, including 2 with a history of laryngeal fracture; and 2 had late arytenoid prolapse.

Conclusions: Isolated PGS in children is effectively managed with costal cartilage grafting of the posterior cricoid. This series has seen an evolution in management, with shorter stenting periods, placement of flanged posterior grafts without sutures, and graft placement without complete laryngofissure.

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POSTERIOR GLOTTIC STENOSIS (PGS) is a rare but well-recognized condition that has been classified into 4 subtypes by Bogdasarian and Olson.1 Although PGS is often seen in conjunction with subglottic stenosis, it also occurs as an isolated condition. The cause is usually attributed to prolonged intubation.2-4 At present, there is no consensus as to optimal management, and a broad range of treatment modalities have been proposed, including endoscopic techniques such as laser to the posterior glottis,5-6 laser with cord lateralization,7 laser with botulinum toxin,8 laser with mitomycin C,9 and posterior mucosal advancement flaps,10 as well as open techniques such as buccal mucosal grafting11 and posterior costal cartilage grafting.12-14 To date, studies have comprised patients with concomitantly occurring PGS and subglottic stenosis and have not specifically addressed the management of pediatric patients with isolated PGS. Thus, our objective was to present our experience with this condition, using posterior cricoid grafting as a management technique.

METHODS

We retrospectively reviewed the medical records of all patients treated for isolated PGS between January 1990 and December 2002, and in whom PGS was the dominant airway lesion and laryngotracheoplasty was required. The diagnosis was established using flexible laryngoscopy, with the patient awake in the office, and was subsequently confirmed using rigid laryngoscopy and bronchoscopy in the operating room. The posterior commissure was specifically evaluated, and the entire airway inspected, particularly the subglottis. When possible, the airway was sized using...
Our series included 29 patients, of whom 18 were male and 11 were female. Patients ranged in age from 2 to 18 years. Twenty patients had tracheotomies in place at initial assessment, and the remaining 9 presented with stridor and exercise intolerance. One patient had Down syndrome, while another had respiratory papillomatosis. At initial evaluation, 6 patients that had been referred for management of bilateral true vocal cord paralysis were found to have mobile but tethered vocal cords. In 5 of these patients, the diagnosis of vocal cord paralysis had been made on flexible laryngoscopy or flexible bronchoscopy.

The cause of PGS was related to either prolonged intubation or laryngeal trauma (outlined below), with the latter being due to a direct external blow to the neck or inhalational burn or was iatrogenic in nature. Iatrogenic causes included (1) intubation for 8 days following a single-stage laryngotracheal reconstruction for subglottic stenosis and (2) scarring following laser treatment for laryngeal papillomatosis in one child and for subglottic hemangioma in another.

In 8 of 29 patients, PGS had been managed prior to referral (5 patients had previously undergone laser surgery, and 3 had undergone repeated laser procedures). In 2 patients, a previous posterior cricoid split had been performed. In 1 patient, a mucosal advancement flap had been performed.

A costal cartilage graft repair was performed on 27 patients, with placement of the graft between the split lamina of the posterior cricoid plate. Of the 2 remaining patients, a buccal mucosal graft was placed in one and a thyroid cartilage graft in the other. Early in our series, grafts were placed through a complete laryngofissure, and costal cartilage grafts without flanges were sewn in place. By the end of our series, flanged grafts without sutures were placed through a partial laryngofissure, avoiding disruption of the anterior commissure (Figure). This technique is described in an upcoming article (Rutter MJ, Ward RF, April MM, unpublished article, “How We Do It: Costal Cartilage Grafting of the Posterior Cricoid—A Non-suture Technique”). The interarytenoid muscle was usually scarred and therefore was routinely divided, with care taken to preserve the interarytenoid mucosa. In 12 patients, we performed a single-stage repair. In 17 patients, we placed a suprastomal stent for 3 to 6 weeks. Twenty-four of our 29 patients were decannulated and maintained a symptom-free airway after 1 procedure, while 5 patients had recurrent stenosis after costal cartilage grafting. Three of the 5 patients with recurrent stenosis had a history of unsuccessful surgery for PGS. Of the 5 patients with recurrent stenosis, 2 were successfully managed with laser posterior cordotomy. Of the remaining 3 patients, 1 underwent failed laser cordotomy and then a successful second costal cartilage graft; 1 had a failed revision posterior costal cartilage graft and a subsequent successful laser posterior cordotomy; and 1 was lost to follow-up following a single-stage procedure (we were notified that he had required tracheotomy replacement in his hometown—his current status is unknown).

Late arytenoid prolapse occurred in 2 patients, 6 and 8 years after surgery. Laser partial arytenoidectomy was successful in both. Four patients, including the 2 with a history of direct laryngeal trauma, had poor voice quality. One of these patients had a history of partial laser arytenoidectomy prior to his posterior graft. Of the 5 patients with recurrent stenosis, 4 required posterior cordotomy and all retained acceptable voice quality. No problems with aspiration were encountered. The overall decannulation rate was therefore 97% (28/29), with 1 patient tracheotomy-dependent when he was lost to follow-up.

In this series we have excluded patients with subglottic stenosis greater than grade I. In a previous article from
our unit, PGS was a common finding in patients with Down syndrome and airway stenosis, however, this usually occurred in conjunction with subglottic stenosis. In the present series, only 1 patient with Down syndrome had isolated PGS.

Management of PGS may be accomplished by either endoscopic or open approaches. Although endoscopic approaches have been shown to be effective, case series are small. Open approaches appear more efficacious, especially for severe stenosis, and costal cartilage grafting remains the most widely used technique.

As has been previously noted by Zalzal, PGS may be misdiagnosed as bilateral vocal cord paralysis. Six patients in the present series were referred with this erroneous diagnosis. The diagnosis of PGS is best made with rigid endoscopy specifically evaluating the posterior glottis, since flexible endoscopes may not provide adequate assessment of this area. While vocal cord paralysis may be included in the differential diagnosis of PGS, these entities rarely coexist. It is more useful to consider PGS in the differential diagnosis of vocal cord paralysis.

**CONCLUSIONS**

Isolated PGS in children is effectively managed by costal cartilage grafting of the posterior cricoid. Recalcitrant restenosis occurred in 5 patients (17%) in our series, and laser posterior cordotomy was an effective salvage intervention for most of these patients. Failed costal cartilage grafting does not preclude placement of a second costal cartilage graft.

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Dr Rutter had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of data analysis.

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**REFERENCES**