OPEN EXCISION OF SUBGLOTTIC HEMANGIOMA

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Treatment of subglottic hemangiomas lacks a standard treatment algorithm defining the role and proper place for the multiple medical and surgical therapeutic alternatives. Open excision of subglottic hemangiomas represents an emerging operative technique with the advantage of being a single-stage procedure with limited morbidity that, at the same time, avoids the potential complications of long-term medications, such as corticosteroids, as well as avoids subglottic stenosis caused by repeated endoscopical laser procedures. This procedure is evolving as the first-line surgical option for symptomatic subglottic hemangioma requiring therapy at our institution. A discussion of the preoperative work-up, the operative technique, and our results is presented.

The pathophysiology of subglottic hemangioma has been well documented. Most infants with such lesions are born without stridor, the clinical symptoms develop when the hemangioma has entered a proliferative phase and begins to obstruct the airway. Sie et al have reported an average age at time of symptom presentation of 5 weeks. The symptom complex for these children is variable and dependent on the size to which the hemangioma grows. The natural history for the majority of these hemangiomas is one of proliferation followed by stabilization and, finally, involution. Treatment is therefore tailored towards the severity and timing of the airway symptoms. At our center, children with presentation of airway difficulty before 3 months of age are viewed as children who will likely go on to experience increasing respiratory compromise requiring therapy. On the other hand, children presenting after the age of 6 months may be reaching that period of stabilization of growth of the hemangioma, and medical therapy or endoscopic procedures may be used as a first-line therapeutic modality.

The work-up for a child with stridor suspected of having a subglottic hemangioma begins with a careful history and physical examination. Approximately 50% of children with subglottic hemangioma have cutaneous hemangioma as well. A flexible fiberoptic examination is performed to evaluate for other causes of stridor, such as laryngomalacia or vocal cord paralysis. A high Kilovoltage (KV) film of the airway is obtained before performing an endoscopy in the operating room, not only to seek the pathognomonic eccentric subglottic swelling, but also to evaluate for the possibility of concomitant distal airway lesions, such as complete tracheal rings. Operative endoscopy confirms the diagnosis (Fig 1). Before operative intervention is planned, the child receives a magnetic resonance imaging examination to rule out thoracic extension of the hemangioma and clarify whether the hemangioma is infiltrative or well-circumscribed.

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OPERATIVE TECHNIQUE

To begin with, children who will have open excision of the subglottic hemangioma performed are pretreated with 3 doses of corticosteroids preoperatively in an attempt to reduce vascularity. The operative technique is similar to the technique used for single-stage laryngotracheal reconstruction (Fig 2). After endoscopy to confirm the exact size and position of the hemangioma, the child is intubated with an age-appropriate endotracheal tube. A horizontal skin incision is made at the level of the cricoid cartilage, subplatysmal flaps are elevated, and the strap muscles are separated in the midline to expose the laryngotracheal skeleton. A temporary, intraoperative tracheostomy is performed with placement of an oral RAE tube fashioned so that the distal tip rests above the carina. The endotracheal tube is then withdrawn. A midline incision through the cricoid cartilage is made with a straight beaver blade, and 4-0 prolene sutures are used to distract the cricoid plates laterally. This approach gives excellent exposure of the subglottic hemangioma. Local anesthetic with 1:100,000 epinephrine is infiltrated into the mucosa above and surrounding the hemangioma, and topical oxymetazoline soaked pledges are placed for hemostasis. The mucosa is then incised over the hemangioma to develop a mucosal flap over the hemangioma (Fig 3). The exact placement of the mucosal incision depends on the location of the hemangioma (posterior or lateral) and its proximity to the vocal cord. The key point is to allow for the elevation of a flap that is sturdy, does not reduce vocal fold mobility, and suits the surgeon in terms of positioning and the ease of the surgeon’s ability to elevate the flap. Once the mucosa has been elevated, the submucosal hemangioma is excised in a submucosal plane. Excision is facilitated by an incision made down to the perichondrium of the cricoid plate, allowing for the posterior margin of the hemangioma to be elevated (Fig 4). If the hemangioma extends close to the level of the vocal fold, then it may be necessary to leave a small rest of hemangioma rather than risking injury to the vocal cord itself. The subglottic mucosa is then redraped over the cricoid plate and sutured with fast-absorbing material (Fig 5). The patient is nasally intubated with an endotracheal tube one-half size smaller than that which would be age-appropriate. The majority of our patients

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have a mild subglottic stenosis and closure of the anterior cricoid plate is easier with an auricular cartilage or thyroid ala graft to relieve this tension (Fig 6). The neck is then closed in the usual manner with a Penrose drain. The patient remains intubated for 3 days, after which point s/he is extubated (Fig 7). The degree of sedation varies according to the child, and close interaction with the intensive care unit personnel is a necessity. An endoscopic view of a postoperative case is shown in Fig 8.

**FIGURE 1.** Endoscopic view of a subglottic hemangioma.

**FIGURE 2.** Drawing depicting the single-stage surgical approach to the larynx and upper trachea.

**FIGURE 3.** Drawing depicting the placement of the mucosal incision after having exposed the subglottic hemangioma by dividing the cricoid in the midline and distracting the cricoid lamina laterally.

**FIGURE 4.** Drawing depicting mucosal flap that has been elevated off the subglottic hemangioma.
FIGURE 5. Drawing depicting the incision down to the cricoid perichondrium to free the posterior edge of the subglottic hemangioma.

FIGURE 7. Drawing depicting the thyroid ala cartilage graft placed over the anterior cricoid and upper tracheal incision to relieve tension on the closure.

RESULTS

Eight patients underwent open excision of subglottic hemangiomas between April 1998 and June 2001. There were 4 girls and 4 boys; age ranged from 2 to 42 months (mean 19.1 months). The presenting symptom was stridor in all 8 cases. The position of the hemangioma was posterior in 5 cases and laterally based in 3 cases. One of the hemangiomas involved the undersurface of the vocal fold. A total of 7 patients underwent single-stage procedures with no postoperative tracheostomy, and 1 patient who had an existing tracheostomy was treated as double-stage procedure with decannulation 6 weeks after the hemangioma had been excised. Cartilage grafts were positioned in 5 patients. Three patients had thyroid ala grafts placed, and 2 patients had posterior costal cartilage grafts positioned for associated posterior subglottic stenosis. All patients

FIGURE 6. Drawing depicting mucosal flap that has sutured back to cover the posterior cricoid plate.

FIGURE 8. Endoscopic view of the airway 1 week after surgical excision.
had been previously treated with systemic steroids. Two patients had previous CO₂ laser treatment, and one patient had been treated with previous intralesional steroid injection and intubation. These prior procedures rendered raising of the mucosal flap more difficult. Length of follow-up ranged from 12 to 29 months. One patient developed a granuloma at the excision site, which was removed endoscopically.

**DISCUSSION**

The treatment of subglottic hemangiomas must, of necessity, be individualized according to the growth pattern of each child's hemangioma and its extension. Historically, treatment has also varied according to the particular experiences at the center at which the child was receiving care. There are several viable treatment alternatives for the management of pediatric subglottic hemangiomas, each with its own incumbent risks and benefits. Alternatives include observation (only for those small hemangiomas with no significant proliferative phase), intralesional steroid application,³⁴ long-term systemic steroid administration,³⁵ CO₂ laser obliteration,³ and the use of interferon ² alpha.⁶ Perhaps the 2 most commonly used therapeutic modalities are the long-term administration of corticosteroids and the repeated use of the CO₂ laser for volume reduction of the hemangioma and associated airway improvement. Corticosteroids have been shown to be effective in reducing the size of the subglottic hemangioma in many children; however, a significant number of these children experience return of the symptoms when the corticosteroids are removed, therefore necessitating long-term corticosteroid administration. The risks associated with long-term corticosteroids administration can be severe. An alternative to prolonged corticosteroid administration is the use of the CO₂ laser for partial obliteration and volume reduction. The advantages of this technique are that it is performed endoscopically and that it does not require open surgery. Overzealous lasering can, however, lead to the development of subglottic stenosis.⁷ Conservative serial laser obliteration is therefore recommended; this subjects the child to multiple general anesthetic procedures.

Single-stage open excision of subglottic hemangiomas avoids the potential sequelae of prolonged corticosteroids; it also avoids the multiple procedures that are commonly needed when the CO₂ laser is used as primary treatment modality. In our experience, it can be performed without violating the anterior commissure; therefore, concerns regarding the voice are limited. We have found that a number of these children have relatively small subglottic diameters and have benefitted from cartilage expansion. All of the children have been decannulated. As is the case for single-stage laryngotracheal reconstructions for subglottic stenosis, a working relationship with an intensive care unit that is equipped to handle the sedation and anesthetic concerns of these children is a prerequisite. In our center, open excision of subglottic hemangiomas with the single-stage laryngotracheal reconstructive technique has become our first-line surgical option for children with symptoms warranting surgical intervention.

**REFERENCES**