Treatment of Inflammatory Myofibroblastic Tumor of the Subglottis With KTP Laser: A Case Report

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Summary: Although inflammatory myofibroblastic tumors (IMTs) are seen in the lower respiratory tract in the pediatric population, few cases occurring in the larynx have been reported in the literature. Treatment of choice is complete surgical excision because of risk of recurrence. We describe a case of pediatric subglottic IMT presenting with progressive hoarseness and symptoms of persistent reactive airway treated with potassium titanyl phosphate laser. We also enumerate the number of pediatric cases of IMT that occur in the larynx and subglottis compared with those which occur in the upper respiratory tract, specifically the trachea and bronchi. To the best of our knowledge, this is the first reported case of respiratory tract IMT excision using a potassium titanyl phosphate laser and the second reported case of a pediatric laryngeal IMT showing anaplastic lymphoma kinase-1 immunoreactivity.

Key Words: Inflammatory myofibroblastic tumor–Inflammatory pseudotumors–Plasma cell granulomas–Inflammatory fibrosarcoma–Subglottic stenosis–Laryngotracheal stenosis–Potassium titanyl phosphate laser–KTP laser–Stridor.

INTRODUCTION

Inflammatory myofibroblastic tumors (IMTs), also known as *inflammatory pseudotumors*, *plasma cell granulomas*, or *inflammatory fibrosarcoma*, are neoplastic lesions that primarily occur in children and are most frequently described in the lungs.[1] Involvement of the upper airway causing symptomatic obstruction is exceedingly rare and commonly present with symptoms that may be mistaken for asthma, such as stridor, wheezing, and dyspnea on exertion.[2–5] Nonspecific clinical manifestations and radiographic findings pose a diagnostic and therapeutic challenge to clinicians. Although classified as benign neoplasms with intermediate biologic potential, these solid tumors tend to recur locally and have a risk of distant metastasis.[1,6] Approximately 50–70% of IMTs show cytogenetic abnormalities of the anaplastic lymphoma kinase (ALK)-receptor tyrosine kinase gene on chromosome two at 2p23 resulting in overexpression of ALK protein. Previous reports have shown that ALK-reactive tumors are associated with local recurrence but may portend a more favorable prognosis indicator.[4,7] For these reasons, complete excision is the most effective treatment for IMT.[1,2,6]

CASE REPORT

A 5-year-old Caucasian female with a previous diagnosis of asthma presented to the Children's Hospital of Michigan Otolaryngology clinic with a 4-month history of persistent episodes of cough, shortness of breath, and wheezing despite aggressive treatment with multiple beta-2 agonists, inhaled corticosteroids, and antibiotics. At the time of her evaluation, symptoms had progressed to dyspnea on exertion, biphasic stridor, and dysphonia. On physical examination, the patient demonstrated tachypnea, suprasternal retractions, and biphasic stridor at rest; all other systems were negative. A lateral neck X-ray was performed, and a radiopaque lesion in the immediate subglottis was identified. To further characterize the lesion, computed tomography of the neck was done, which showed a solid subglottic mass (Figure 1). At this point, the patient was admitted and scheduled for direct rigid laryngoscopy and bronchoscopy (DLB).

The DLB exposed a large friable mass obstructing approximately 90% of the subglottic airway. It was pedicled on the left anterior subglottic mucosa, involving the inferior aspect of the left true vocal fold (Figure 2). The lesion was excised in its entirety using the potassium titanyl phosphate (KTP) laser at 3 W on a continuous setting, for a total of 984 J and sent as fresh specimen. No other lesions were identified on examination, and the case was performed without complication.

Grossly, the mass was composed of multiple red-tan soft tissue fragments, ranging in size from 0.2 × 0.1 × 0.1 to 0.7 × 0.5 × 0.1 cm. On histopathologic examination, the

FIGURE 1. Preoperative computed tomography scan showing a solid subglottic mass.

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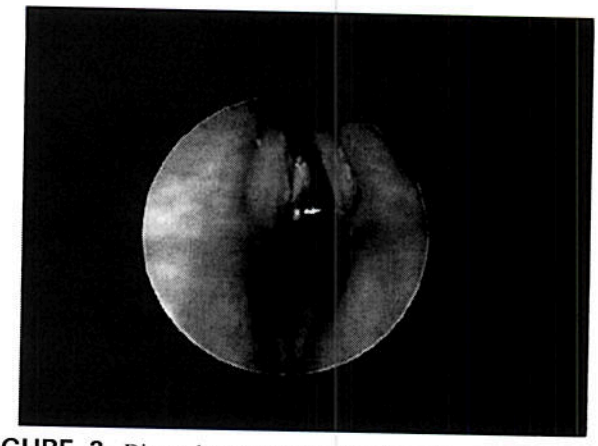

FIGURE 2. Direct laryngoscopy showing the subglottic mass, which was then excised using a KTP laser. Histopathology revealed inflammatory myofibroblastic tumor.

metaplastic squamous epithelium was covered by an acute inflammatory infiltrate with some areas showing denuded epithelium. Within the underlying stroma was a heterogeneous population of bland spindle cells and epitheloid-like cells with abundant cytoplasm and occasional prominent nucleoli. The cells were present in various patterns, consisting of haphazard arrangement, forming short fascicles or in a storiform pattern. A lymphoplasmacytic infiltrate was randomly distributed throughout the mass (Figure 3). Occasional mitotic figures were seen. No significant cytologic atypia or pleomorphism was identified. The neoplastic cells stained strongly and diffusely for smooth muscle actin (Figure 4A) and vimentin and focally with HHF-35. In addition, the spindled cells showed cytoplasmic ALK-1 immunoreactivity (Figure 4B). No immunoreactivity was seen with desmin, myogenin, S100, or CD117.

Although the patient returned to her baseline immediately after surgery, further imaging was performed after the diagnosis of IMT was determined to rule out metastatic or synchronous lesions. Computed tomography of the neck and thorax done on postoperative day 9 was unremarkable. DLB performed at 1-month follow-up was negative for recurrence, and full vocal fold mobility was observed (Figure 5). Follow-up clinical examinations have been completed at regular intervals for the last year; thus far, the patient has been entirely asymptomatic.

DISCUSSION

Comprising only 0.04–0.7% of all respiratory tract tumors,[8] airway IMTs are often misdiagnosed as asthma at initial presentation. Patients with IMT will usually present with cough, wheezing, recurrent croup, biphasic stridor, or dysphonia and will experience little or no relief on administration of asthma medications or antibiotics. Radiographic imaging is useful for identifying the site of obstruction but often does not differentiate between types of neoplasms or severity of airway involvement. DLB with excisional biopsy is essential for assessment, diagnosis, and treatment of airway obstructing lesions.

In reviewing the literature, the total number of pediatric IMTs arising within the glottis and subglottis, including our case, was 11, compared with the 22 cases involving the lower respiratory tract.[1–12] The clinicopathologic features between, and within, the two groups were variable. The characteristic symptoms appeared to correlate with the location of the tumor. The most common presenting symptoms were stridor, dysphonia, and dyspnea in laryngeal tumors versus dyspnea and cough in lower airway lesions.[1–12]

The definitive diagnosis of IMT relies on detailed histopathologic and immunohistochemical evaluation.[10] IMT is a benign solid tumor composed mainly of spindle-shaped cells and has a chronic inflammatory component consisting of plasma cells, lymphocytes, and occasional histiocytes.[3] In our specimen, the spindled cells showed cytoplasmic ALK-1 immunoreactivity, which has only been reported in one other case of pediatric laryngeal IMT.[12] No immunoreactivity with desmin, S100, myogenin, or CD117 was seen, all consistent with previous reports of IMT.[3,10]

The pathogenesis of IMTs is controversial, and clinical behavior is unpredictable. Although usually classified as benign, IMTs can display malignant features, such as local invasiveness, recurrence, distant metastases, and malignant transformation.[1] Therefore, early detection and treatment is imperative. Complete surgical resection, irrespective of anatomical site of involvement, is the preferred treatment. Information regarding recurrence was

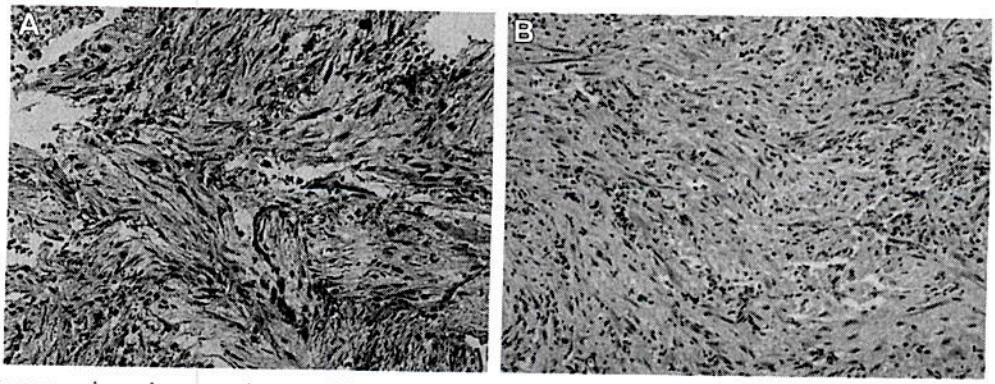

FIGURE 3. **A.** Biopsy specimen demonstrating a proliferation of bland spindle cells intermixed with larger epitheloid-like cells arranged haphazardly and forming short fascicles (hematoxylin-eosin stain, original magnification ×40). **B.** Tumor cells admixed with a lymphoplasmacytic infiltrate and scattered eosinophils (hematoxylin-eosin stain, original magnification ×40).

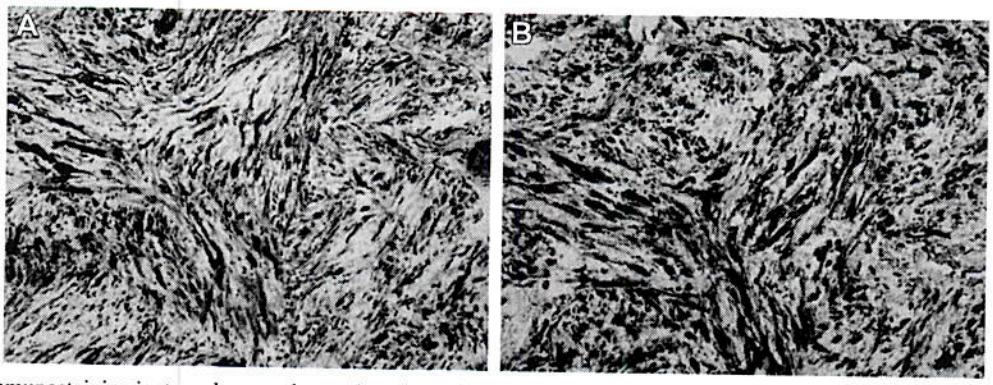

FIGURE 4. **A.** Immunostaining is strongly smooth muscle actin positive highlighting the fascicular arrangement of spindle cells. **B.** Immunostaining is strongly cytoplasmic ALK-1 positive (original magnification ×40).

available for 53% (16 cases), 11 showed no recurrence, and four of the five demonstrating recurrence underwent incomplete excision at the time of primary surgery.[1–12] Surgical excision of IMTs in the upper airway adds an additional level of complexity because the healing process may result in stenosis as a result of inflammation and scar formation.

To date, no formal studies on treatment of upper airway IMT have been published. Therefore, case reports are used as illustrations of possible treatment options. Jain et al[10] described the use of electrocautery to excise an IMT of the trachea and reported no reoccurrence at 1-year follow-up. Boloursaz et al[12] described a case of tracheal IMT with ALK reactivity, which recurred 3 months after surgical resection and eventually required resection of five tracheal rings with reanastamosis. Conservative therapy has thus far demonstrated mixed results as IMT's response to chemotherapy and radiotherapy is variable.[1] Thus, these modalities may be considered unnecessary given that complete surgical excision is curative in most cases.

To our knowledge, no clinical studies have explored the efficacy of different laser wavelengths for treatment of airway IMTs, and published case reports are rare on this topic. Carbon dioxide (CO_2) and neodymium:YAG (Nd:Yag) laser excision of airway IMTs have been described in the literature as case reports with varying success.[8,9] Thus far, no cases have been reported in the literature demonstrating the use of KTP laser for excision of IMTs.

The KTP laser has been used for medical applications since the 1980s.[13] At a wavelength of 532 nm, it produces a visible green light, precluding the need for an aiming beam.[13] It is absorbed by hemoglobin and soft tissue to a depth of 2 mm and passes through aqueous solutions easily, theoretically decreasing the likelihood of collateral damage and scarring. Both CO_2 and KTP lasers can be delivered via fiberoptic carrier, allowing maneuverability and placement[14]; however, in difficulty to visualize or expose areas such as the subglottis, KTP is preferred because the visible light allows for more precision. In their retrospective analysis, Kacker et al[13] concluded that the characteristics of the KTP laser and the KTP laser delivery system represent an improvement over the CO_2 laser in treating subglottic hemangiomas.

Our decision to use a KTP laser for the above case was based on the favorable experiences we have had in the past treating vascular airway lesions such as hemangiomas. We suspect that IMT's similar characteristics to hemangiomas is what has made our outcome favorable. However, it is important to acknowledge that continued surveillance over a longer period is necessary to make more substantive inferences.

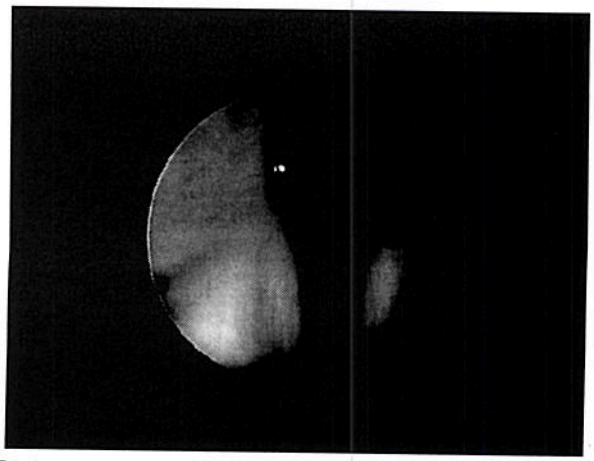

FIGURE 5. Direct laryngoscopy view, 4 weeks after KTP laser excision of tumor in Figure 2. Both vocal folds were mobile.

CONCLUSION

IMT is an unusual lesion that can mimic other more common conditions. Diagnosis and treatment of this entity poses a challenge to clinicians because of the rarity and paucity of published reports. Per these reports and our personal experience, complete surgical excision is the treatment of choice at this time.

With KTP emerging as a frequently used modality for pediatric airway lesions, it should be considered as a viable treatment option for IMT and may obviate the need for supplementary invasive treatment such as tracheal resection. Further investigation is needed to determine the efficacy and safety of lasers for excision of IMT.

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