International Journal of Pediatric Otorhinolaryngology Extra 10 (2015) 87–90

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology Extra

journal homepage: www.elsevier.com/locate/ijporl

Case Report

Nd:YAG LASER treatment of a complex airway venous malformation in a child

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ARTICLE INFO

Article history:
Received 9 September 2015
Accepted 18 September 2015
Available online 28 September 2015

Keywords:
Nd:YAG LASER
Pediatric
Venous malformation
Airway

ABSTRACT

Nd:YAG LASER therapy is traditionally used for the treatment of superficial cutaneous and mucosal venous malformations. Venous malformations of the endolaryngeal airway may complex and difficult to manage given the sensitivity and access to this anatomic area. Nd:YAG LASER, may be a good modality to be included in management of these rare lesions with its versatility in delivery systems and hemostatic properties. We reviewed the presentation and response to treatment with Nd:YAG LASER in a 10-year-old child with extensive venous malformation involving the larynx.

1. Introduction

Venous malformations are low-flow congenital vascular malformations that consist of aggregates of ectatic venous channels. The estimated incidence is 1–2 per 10,000 births and the prevalence is 1% [1]. Venous malformations commonly appear in the head and neck, extremities, and trunk, and grow in proportion with the individual. Medical intervention in cephalic malformations is indicated by the presence of cosmetic concerns, bleeding from mucosal sites, pain from phlebothrombosis, or impingement on the aerodigestive tract. These lesions often become more symptomatic in children during puberty and times of significant hormonal shifts. Currently, non-medical management utilizes LASER therapy, sclerotherapy, surgical excision, or any combination of these interventions [2]. The success of these interventions is well documented for uncomplicated lesions of the head and neck, however, the treatment for complex airway malformations is less certain [2,3].

LASER therapy, also referred to as selective photothermolysis, is often used for mucosal and superficial cutaneous venous malformations. Photothermolysis utilizes specific wavelengths to target absorption by hemoglobin in the vascular malformations, while minimizing dermal absorption and damage. The neodymium:yttrium–aluminum–garnet (Nd:YAG) LASER has gained popularity in the treatment of venous malformations. Compared to the CO2 LASER, the Nd:YAG LASER achieves better photocoagulation because of its deeper penetration and soft tissue scatter [4,5]. Nd:YAG LASER therapy is particularly valuable in laryngeal lesions because complete surgical resection or ablation is often not practical as it may necessitate an open approach or concomitant tracheotomy [6,7].

Sclerotherapy may be the preferred treatment for symptomatic, deep venous malformations that are not amenable to surgical excision and do not intimately involve critical neurovascular or vital structures [2]. Under fluoroscopic or ultrasound guidance, a percutaneous approach is taken to inject sclerosing agents inducing thrombosis and involution. Complications occur when the sclerosing agent induces local endothelial inflammation, leaks into adjacent vasculature, or extravasates into the surrounding tissue. Despite the potential for these adverse events, sclerotherapy can be especially useful in venous malformations of the head and neck [8,9]. Given the potential adverse complications and collateral damage associated with sclerotherapy, this treatment modality has significant concerns for application in treating venous malformations affecting the pediatric airway.

2. Methods

We reviewed the presentation and response to treatment in a 10-year-old child with an extensive venous malformation of the larynx and neck managed with Nd:YAG LASER for the endolaryngeal

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http://dx.doi.org/10.1016/j.pedex.2015.09.002
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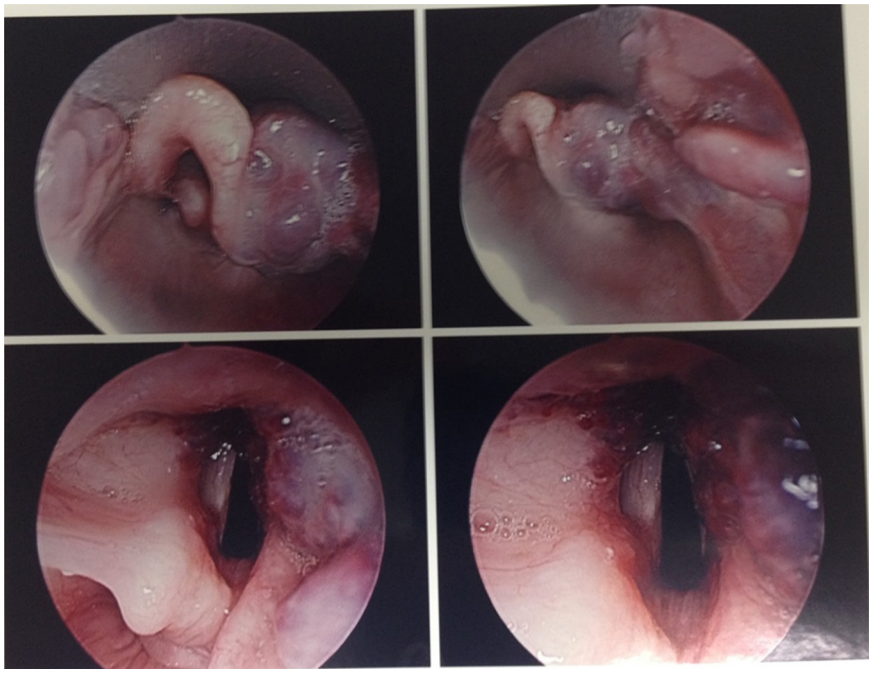

Fig. 1. Operative endoscopy images of the predominantly right-sided venous malformation.

component. A literature review utilizing PubMed, EMBASE, Cochrane Library, and Medline was also performed using the MeSH terms: "pediatrics," "vascular malformations," and "laser, solid state" and/or the free terms: "airway," "venous malformation," and "Nd:YAG LASER." Institutional Review Board (IRB) permission was obtained.

2.1. Nd:YAG LASER surgical technique

Laryngoscopy was performed and an optical endoscope was used to visualize, magnify, and illuminate the laryngeal structures. The fiberoptic delivery system was secured to the endoscope using moistened and wet adhesive strips. Strict laser and airway fire precautions and safety measures were employed throughout. Settings of 25 W with the single pulse setting of 1 second for the Nd:YAG LASER was utilized. The targeted area was treated while taking caution to not overlap application spots or apply to opposing mucosal surfaces to prevent synechiae formation. The fiberoptic wire was placed several millimeters above the area of venous malformation intended for treatment in a non-contact application technique.

3. Results

A 10-year-old boy presented with a right-sided neck lesion with indolent growth over the last 5 years. There was no associated dysphagia, dyspnea, difficulty with speech or cervical mobility issues. Examination revealed a diffuse, right-sided cervical, engorged, superficial venous malformation, which increased in size with the Valsalva maneuver. Endoscopy, as illustrated in Fig. 1, revealed a right-sided venous malformation extending along the right lateral pharyngeal wall toward the supraglottis. It extended onto the right side of the epiglottis and into the vallecula as well as onto the right vestibular fold, anterior commissure, and left vestibular fold. The subglottis and trachea were uninvolved and vocal cord motion was symmetric and full bilaterally.

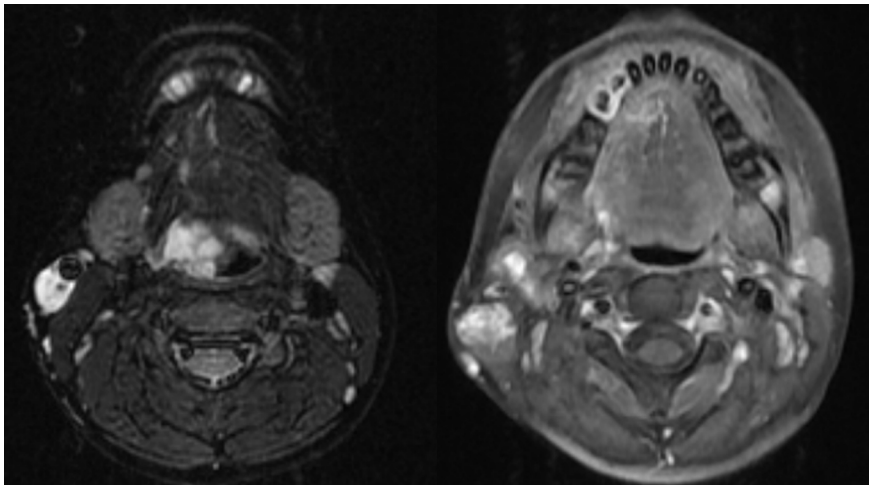

Fig. 2. (Left) Axial STIR sequence showing a hyperintense right neck mass involving the hypopharynx and base of tongue. (Right) Axial post-contrast T1 sequence also demonstrating extensive involvement of the right neck and base of tongue.