ABSTRACT

Objective: Photodynamic therapy (PDT) has been proposed as a minimally invasive and effective treatment for mucosal carcinomas such as early-stage laryngeal squamous cell carcinoma. Its advantage over other conventional modalities of surgery, radiation, and chemotherapy lies in its ability to treat disease while preserving the function and structure of the larynx. While not FDA-approved in the United States, it is used in some countries as a treatment for laryngeal cancer. This report documents a severe complication of tracheostomy-dependent laryngotracheal stenosis resulting from PDT.

Methods: Case report and review of the literature.

Results: A 65-year-old male presented with severe stenosis of the hypopharynx, glottis, and subglottis following successful treatment of his laryngeal carcinoma with PDT. His presentation, staged airway reconstruction, and outcome are detailed.

Conclusion: PDT is a minimally invasive technique which is touted to be as effective as other conventional therapies for the treatment of early squamous cell cancers of the head and neck. It uses a photosensitizing agent which is retained by tumor cells, allowing for the selective destruction of neoplastic cells with preservation of normal tissue. Permanent sequelae following treatment have rarely been reported, as the most commonly described adverse effects include transient pain, edema, hoarseness, and phototoxic cutaneous lesions; however, our case report illustrates the potential for significant laryngotracheal stenosis requiring tracheostomy and airway reconstruction following PDT.

INTRODUCTION

Treatment for laryngeal cancer has traditionally consisted of surgical excision, radiation therapy, chemotherapy, or a combination thereof. Local recurrence rates after salvage surgery in patients with head and neck squamous cell carcinomas are major causes of treatment failure and development of distant metastases. [1] Local intraoperative adjuvant treatment strategies are thus important in improving outcomes. [2]

Photodynamic therapy (PDT) is one such minimally invasive treatment modality. [2] PDT involves three elements—a photosensitizer, light, and oxygen; an intravenous or topical photosensitizer is first administered and then followed 48-60 hours later by intraoperative light photoactivation. Upon activation of the drug, cytotoxic reactive oxygen species are generated. These cause damage to tumor cells through cell necrosis and microvascular collapse, sparing adjacent normal tissues which have not concentrated the photosensitizer. [2]

PDT is generally considered to be safe, with most adverse events related to transient pain, edema, and cutaneous phototoxic effects. Despite its well-established drug safety profile, we present a case of severe post-treatment laryngotracheal stenosis in an otherwise healthy male patient.

CASE PRESENTATION

We present a 66-year-old male physician from China who developed hypopharyngeal, glottic, and subglottic stenosis secondary to laryngeal photodynamic therapy following treatment for left (T1aN0MO) true vocal cord squamous cell carcinoma. (Figs 1a and b) According to records, he received an intravenous infusion of 325 mg of a hematoporphyrin-derivative photosensitizer and then underwent endoscopic laser treatment two days later. He was treated with intracheal steroids and bronchodilators for shortness of breath and cough immediately following the treatment. The patient did develop prompt post-PDT laryngeal stenosis, subsequently leaving him tracheostomy dependent.

For two years following his initial PDT treatment, the patient underwent multiple endoscopic procedures including CO2 laser laryngoplasty and balloon dilatations. The monthly dilations improved his voice and breathing quality transiently for only 3-4 weeks at a time. Despite an open laryngofissure procedure with scar excision, the patient continued to have persistent symptoms from his stenosis.

DISCUSSION

The generated cytotoxic oxygen species then cause the destruction of tumor cells. PDT is promising for laryngeal cancer. A study by Biel evaluated 115 patients with recurrent or primary CIS, T1NO, and T2N0 laryngeal tumors treated with PDT. Cure rates with a single treatment were 91%. There were no episodes of airway compromise or other serious complications. [8]

The theoretical advantage of PDT over conventional modalities of surgery, radiation, and chemotherapy is its minimally invasive nature, since there is less photosensitizer in adjacent normal tissue, only the neoplastic tissue is damaged while preserving normal tissue. In areas such as the larynx where tissue loss can result in functional impairment, techniques like PDT are highly advantageous. Additionally, unlike radiation, PDT treatments can be performed repeatedly even after failure of conventional modalities. [9] It can be used prior to or after these traditional treatments without negatively affecting their effects.

The drug has a generally safe toxicity profile, although we present a case of severe airway stenosis following treatment. It is unclear what causes stenoses in some individuals and not in others. Previous laryngeal insults, patient comorbidities, varying depths of light penetration, and dose of drug administration likely contribute to this complication.

CONCLUSIONS

Photodynamic therapy (PDT) has been proposed as a generally safe, minimally invasive, and effective treatment for mucosal carcinomas such as early-stage laryngeal squamous cell carcinoma. Its advantage lies in its ability to treat disease while preserving the function and structure of the larynx.

We report a case of severe post-PDT laryngotracheal stenosis which left the patient tracheostomy dependent. Further research is needed to understand why some patients develop stenosis following PDT. Additionally, studies to develop newer photosensitizers which have less phototoxic effects in normal tissues are needed to potentially limit the rare adverse airway events.

REFERENCES