Original contribution

Management of airway in patients with laryngeal tumors

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Abstract

Study Objective: To describe our systematic approach to securing the airway in patients with laryngeal tumors, developed over a 10-year period.

Design: Retrospective analysis.

Setting: University-affiliated veterans administration medical center.

Patients: Eight hundred one patients presenting for laryngeal tumor surgery in a 10-year period, 285 of whom underwent tracheostomy (25 with local anesthesia and 260 with general anesthesia).

Interventions: Preoperative examination, including history, physical examination, computed axial tomography and/or magnetic resonance imaging, and ear, nose, and throat surgeons’ evaluation via indirect laryngoscopy or fiberoptic bronchoscopy were performed before the anesthesiologist’s interventions. Local (topical) anesthesia and mild sedation were used for laryngeal evaluation with fiberoptic bronchoscopy. Tumor grade was then established, which determined how the airway would be secured: general anesthesia induction, receive topical anesthesia for awake, direct laryngoscopy, and tracheal intubation, or undergo tracheostomy with local anesthesia.

Measurements and Main Results: When the airway was secured, surgeons performed the biopsy, (any) tumor debulking, laser excision, or tracheostomy to establish both the airway and the diagnosis. Pulmonary function, including flow-volume loops and blood gas analysis were also useful in evaluating the degree of obstruction and gas exchange. In the event of respiratory distress, tracheostomy was performed after tracheal intubation or with local anesthesia, followed by direct laryngoscopy and biopsy. Depending on the diagnosis, further surgery and radiation treatment were planned next.

Conclusions: With these guidelines, we have reduced the frequency of emergencies because of a lost airway, bleeding, or dislodging of tumor.

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1. Introduction

Patients with laryngeal tumors can present a challenge to secure the airway for their surgeries such as biopsy,
debulking of the tumor, laser excision of the tumor, and tracheostomy. Tumors of the larynx include papillomas, carcinomas (CAs), sarcomas, chondromas, hemangiomas, and other lesions. The most common tumors in our patient population are squamous cell CAs. Extensive review of head and neck cancers are addressed in the literature [1]. The incidence of CA of larynx is about 1% of all cancers. In addition, cysts in the glottic area may be encountered, which also impede tracheal intubation.

Preoperative examination and evaluation before an anesthesiologist’s intervention are important in the management of these patients, as induction of general anesthesia will result in potential total obstruction of the airway [2,3].

We have developed a systematic approach to secure the airway in 801 patients with laryngeal tumors undergoing direct laryngoscopy and biopsy over a period of 10 years. Of these patients, 285 had tracheostomies and only 25 had tracheostomies under local anesthesia and the rest under general anesthesia after securing the airway. This is not a study but a clinical experience of the authors. As this approach proved to be useful and prevented panic situations of compromised airway, we are presenting this experience.

2. Materials and methods

Preoperative examination of these patients included history, physical examination, and indirect laryngoscopy, computed axial tomography (CAT) scan and/or magnetic resonance imaging (MRI). History of hoarse voice, smoking, shortness of breath, and difficulty in swallowing were determined as all may be symptoms of throat pathology. In addition, evaluation of the airway for anatomic abnormalities such as temporomandibular joint dysfunction, short neck, abnormal cervical spine, large tongue, prominent teeth, short thyromental distance, and Mallampati [4] classification 2 or greater for planning tracheal intubation should be done. Computed axial tomography scan or MRI may show narrowing of the larynx or trachea due to tumor or external compression due to cervical lymph nodes. The surgeons provide important information about site and the size of the lesion by preoperative indirect laryngoscopy and/or fiberoptic endoscopy and when the examination was done before the day of surgery. Pulmonary function, including flow volume loops and blood gas analysis, can be useful to evaluate the degree of obstruction and gas exchange.

2.1. Evaluation before securing airway

These patients are brought to the operating room (OR) for direct laryngoscopy and biopsy; if the tumor is large, the surgeons may debulk the laryngeal tumor to establish airway temporarily. If the patient is in respiratory distress, the surgeons may prefer to perform tracheostomy after tracheal intubation or with local anesthesia followed by direct laryngoscopy and biopsy. Further surgery and radiation treatment are planned depending on the diagnosis. If the patient has anatomic abnormalities such as cervical spine disease with limited mobility, difficulty in opening the mouth, Mallampati class higher than 2, or other abnormalities, we generally proceed with fiberoptic intubation or tracheostomy. For most of the other patients, we evaluated the patient’s airway systematically and secured it. After attaching the monitors, we administer 1 mg of midazolam intravenously to reduce anxiety. After explaining to the patient, we proceed with direct examination of the larynx using fiberoptic bronchoscopy (FOB; 6-mm fiberoptic scope with Olympus Fiberoptic Evis Exera Bronchovideoscope; Olympus Co, Melville, NY) with local anesthesia. Initially, we administered 4 mL of 4% lidocaine by aerosol either in the operating room or in the waiting or holding area of the patient. In the OR, we used Cetacaine (containing Benzocaine, butyl aminobenzoate, tetracaine hydrochloride, benzalkonium, and cetyl dimethyl ethyl ammonium bromide) spray for local anesthesia. Most of the patients tolerated the FOB examination after Cetacaine use. For better exposure of the glottis, an assistant was available to hold the patient’s tongue with gentle outward traction. If the patient could not tolerate the procedure, we administered 2 to 4 mL of 4% lidocaine through the FOB port for delivery of drugs.

We evaluated the airway completely with FOB. Throughout the procedure, we administered supplemental oxygen through the FOB. Although the editorial of Friedman [5] gives some guidance, we classified the airway into the following categories depending on our findings (Table 1; Figs. 1 and 2).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No symptoms of hoarseness. Normal laryngeal findings (see Fig. 2).</td>
</tr>
<tr>
<td>1</td>
<td>History of smoking. No hoarseness of voice. Small lesions in the glottic area including leukoplakia, 1 or 2 small polyps or papillomas. The vocal folds are completely visible.</td>
</tr>
<tr>
<td>2a</td>
<td>Patients may have hoarseness of voice. Vocal folds are clearly visible fully or partly. Cysts, tumors, or papillomas are present in the vestibular folds, epiglottis, or pyriform recess, producing distortion or edema of the vocal folds. Supraglottic cysts with clear visibility of vocal folds.</td>
</tr>
<tr>
<td>2b</td>
<td>Patients have hoarseness of voice with no difficulty in breathing. Only parts of vocal folds are partly visible. Large tumors or cysts encroach or involve 1 or both vocal folds. Large supraglottic cysts producing partial obstruction of the view or distortion of vocal folds.</td>
</tr>
<tr>
<td>3</td>
<td>The patients have hoarseness of voice and some difficulty in breathing. The vocal folds may be seen with difficulty because of the lesions involving the vocal folds and edema. Laryngeal opening may be visualized with inspiration, mostly obscured by the tumor or cyst.</td>
</tr>
<tr>
<td>4</td>
<td>The tumor is large and laryngeal opening cannot be seen or identified.</td>
</tr>
</tbody>
</table>
2.2. Tracheal intubation

2.2.1. Patients with grade 0 and 1 airways

In patients with grade 0 or grade 1 findings, we proceeded with induction of general anesthesia after preoxygenation using propofol or thiopental sodium and succinylcholine for muscle relaxation. Nearly 50% of our patients were part of this group. After ventilation with 100% oxygen by mask, tracheal intubation was achieved with 5 to 6 mm internal diameter (ID) polyvinyl tracheal tube or tracheal tube made for laser surgery. This can be done with direct laryngoscopy or FOB. During surgery, anesthesia was maintained using oxygen, air, and inhalation drug. Muscle relaxation was provided using mivacurium because of the short duration of the procedure. At the end of the procedure, muscle relaxant effects were reversed using neostigmine and glycopyrrolate, if needed. The trachea was extubated at the proper time after emergence in the OR, and the patient was transported to the postanesthesia care unit. Dexamethasone was administered to these patients by the surgeons.

2.2.2. Patients with grades 2a, 2b, and 3 airways

Patients having larger tumors falling into grades 2a, 2b, or 3 categories can be problematic for securing the airways. In some patients belonging to 2a classification, with the tumors not obscuring the laryngeal opening, we proceeded with general anesthesia and direct laryngoscopy or FOB intubation. In other patients belonging to 2a whose laryngeal opening was viewed with difficulty, 2b, and 3 grades, we did not induce general anesthesia.
before securing the airway. Those patients were allowed to breathe spontaneously throughout the procedure of securing the airway by direct laryngoscopy with local anesthesia. When the tumor was large, the patients felt suffocated with the introduction of FOB, in spite of oxygen flowing through the fiberscope. With direct laryngoscopy, the patients were encouraged to breathe spontaneously, and they felt as though they could breathe more easily through the tracheal tube as it was introduced. The disadvantages we have encountered are improper local anesthesia and anxious, noncooperative patient for both the FOB and direct laryngoscopy procedures. Sufficient explanation to the patient and good local anesthesia with mild to moderate sedation, with the patient responding to commands and spontaneously breathing, are essential components for successful management. For grades 2b and 3 patients, we found that direct laryngoscopy and tracheal intubation were easier and less traumatic. An occasional patient could not tolerate the procedure because of anxiety or improper local anesthetic and, so, would instead undergo tracheostomy with local anesthesia. Our success rate in securing the airway after this stepwise

Fig. 2  Fiberoptic bronchoscoopic evaluation of the laryngeal opening and the classification of the airway from the findings. SCCA indicates squamous cell CA; Rt, right; Lt, left.
intervention was 100% in grades 2a and 2b patients and nearly 90% in grade 3 patients. With our approach, problems with bleeding or visible tumor shearing were minimal under direct vision.

2.2.3. Patients with grade 4 airways

When the airway could not be identified and the patient was in respiratory distress, we proceeded with tracheostomy with local anesthesia followed by induction of general anesthesia for direct laryngoscopy by the ear, nose, and throat (ENT) surgeons for biopsy, debulking, and further treatment. A total of 25 patients fell into this category.

3. Discussion

We present our experience in 801 patients over a period of about 10 years. The report is more an evolved methodology of practice than a formal study of patients with laryngeal tumors. The most common groups of patients were grade 1, grade 2a, and grade 2b. Grade 3 patients presented the greatest challenge. These patients were brought to the OR for diagnosis, debulking, laser excision of the tumor, and/or tracheostomy before the definitive treatment.

The steps in our practice are history and physical examination of the patient, discussion with ENT surgeons, followed by the most important step of FOB evaluation of the larynx with local (topical) anesthesia. Then we decide the method of securing the airway. The treatment of airway obstruction in patients with airway tumors may include endoscopic ablation of the tumor [6], tracheal intubation with a small tracheal tube (5 to 6 mm ID), secured with metallic adhesive tape for laser resection or without metallic tape for tracheostomy. Tracheal intubation is done using local anesthesia in some patients belonging to grade 2a and all of grade 2b and grade 3 patients. Shapsay et al [6] advocate tracheal intubation with topical anesthesia, the patient placed sitting forward, use of indirect laryngoscopy, and guidance of the tracheal tube into the laryngeal lumen. These authors also use ventilation tracheoscope in some patients or the Venturi jet instrument for ventilation of lungs until they excise the tumor to establish an airway. Davis et al [7] described partial laser excision of laryngeal CA to establish the airway followed later by elective surgery. Their patients had tracheal intubation for the surgery. Orotracheal intubation was done with topical anesthesia in awake patients followed by general anesthesia for the laser surgery. When oro tracheal intubation was difficult, tracheotomy was done, followed by general anesthesia for the laser surgery. They suggest that the anesthesiologist and the surgeons be prepared for emergency interventions if securing the airway presents a problem by performing emergency low tracheostomy, high tracheotomy, or laryngectomy.

We use FOB for evaluation of the airway using topical anesthesia. Although we used FOB for evaluation of all the patients, it was not our choice for tracheal intubation in patients with laryngeal tumors, but some authors recommended FOB as a method to secure the airway in patients with upper airway tumors [8]. However, in patients with anatomic ally difficult airway and grade 1 or grade 2a laryngeal tumors, we attempted tracheal intubation using tracheal tubes of 5 to 6 mm ID with 4 mm FOB. We also used FOB to secure the airway in patients who had radiation treatment of their laryngeal cancer. We proceeded with tracheostomy using local anesthesia in patients with anatomic ally difficult airways associated with grade 2b, grade 3, or grade 4 laryngeal pathology, as we were concerned that FOB might cause breaking of the tumor, bleeding, or loss of the airway. In patients with large tumors, Takenaka et al [9] suggested tracheal intubation under FOB video control camera guidance. Mason and Fielder [10], in their editorial, discussed the problem of the airway obstruction and securing the airway in patients with upper airway tumors. We discussed with the ENT surgeons the results of their evaluation with indirect laryngoscopy, fiberoptic laryngoscopy, CAT scan, or MRI findings, as well as their surgical plan. We also requested their presence in the OR in the event that emergency tracheostomy was necessary. Then we proceeded with topical anesthesia of the airway. In most patients, except those with grade 4 laryngeal tumors, we used direct laryngoscopy with Miller blade (2-4 sizes) to expose the glottis for intubation using a polyvinyl tracheal tube of 5 to 6 mm ID. Occasionally, we used a tracheal tube exchanger as a guide over which a tracheal tube was advanced. After tracheal intubation, general anesthesia was induced and further management was done, as discussed earlier. We do not do mask induction with an inhalation agent in our patients except in children with papillomas for securing the airway. A good topical anesthesia and a cooperative patient taking deep breaths when asked are essential for successful tracheal intubation. In the presence of laryngeal tumors, a combined retrograde guide wire with antegrade FOB [11] can be problematic, producing bleeding and difficulties in tracheal intubation; hence, we do not recommend the procedure.

Although there is no choice to secure airway except by tracheostomy with local anesthesia in some patients with grade 4 laryngeal tumors, as described above, there are complications associated with tracheostomy. Some of these include bleeding, injury to cricothyroid complex, infection, injury to the posterior laryngeal wall, pneumothorax, subcutaneous emphysema, sepsis, and, later, difficulty with formal tracheostomy. Stomal recurrence of the tumor has been attributed by some researchers to having had emergency tracheostomy. Mini tracheostomy or coniotomy is an alternate method of securing the airway in some patients with laryngeal tumor [12]. There are now MINI-TRACH kits (Portex Ltd Kent, UK) available in the market. The other methods of securing the airway using the Tuohy needle, Teflon cannula, and others, are difficult to evaluate because of the unknown extent of the tumor growth into the
subglottic area. We do not use the Laryngeal Mask Airway in these patients as the airway occlusive lesions are distal to the Laryngeal Mask Airway. Tracheal extubation in patients who did not have tracheostomy is accomplished when they are awake and cooperative. In some patients, we introduce a tube changer through the tracheal tube, extubate the trachea, attach supplemental oxygen to the tube changer, and remove it when the patient is breathing spontaneously without difficulty. The other method is jet stylet extubation [13]. We often use racemic epinephrine aerosol treatment and intravenous dexamethasone.

4. Conclusion

We present our experience in the management of patients with laryngeal tumor over the last 10 years. We proceed in a systematic way to secure the airway for surgery. Patient’s history, physical examination, CAT scan or MRI findings, and ENT surgeons' evaluation by indirect laryngoscopy or fiberoptic endoscopy are important before the anesthesiologist’s intervention. The surgeons are in the OR, ready to perform tracheostomy if there is a need to secure the airway emergently. We use local (topical) anesthesia in these patients with mild sedation and evaluate the larynx with FOB while the patient is breathing spontaneously. In grade 1 patients with fully visible vocal folds and grade 2a patients with clearly visible vocal folds with small or medium size tumors not obstructing the view of glottis, we proceed with induction of general anesthesia and securing the airway. In patients with grade 2b airway with larger tumors with partial visualization of vocal folds and grade 3 with difficult but discernable glottic opening, we proceed with topical anesthesia and awake direct laryngoscopy and tracheal intubation. In grade 4 patients, we proceed with tracheostomy with local anesthesia. We rarely use FOB for tracheal intubation in patients with grade 2b and 3 airway lesions. After the airway is secured, surgeons perform biopsy, debulking laser excision, or tracheostomy to establish the airway and the diagnosis. Definitive treatment such as laryngectomy, neck dissection, chemotherapy, and/or radiation treatment is done later [14]. By following these guidelines, we have reduced the emergency situations of a lost airway, bleeding, or dislodgement of visible bits of tumor.

References