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Emergent Awake Tracheostomy—The Five-Year Experience at an Urban Tertiary Care Center

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Objectives/Hypothesis: There are few studies that discuss the issues surrounding emergent awake tracheostomy. We aim to review the indications, anesthesia used, complications, and outcomes of patients undergoing urgent awake tracheostomy.

Study Design: Chart review.

Methods: Medical charts of patients who underwent an emergent awake tracheostomy at our institution-affiliated tertiary care center over a 5-year period from 2009 to 2014 were reviewed. Data were collected from inpatient, outpatient, and operative records.

Results: Sixty-eight patients underwent emergent awake tracheostomy. Over half presented with hoarseness (n = 37, 54.4%) and/or stridor (n = 37, 54.4%). Acute upper airway obstruction secondary to malignancy was the most common indication and accounted for 58 cases (85.3%). Thirty-nine (70.1%) of the 55 patients with squamous cell carcinoma presented with advanced disease (stage III or IV). Other indications included glottic or subglottic stenosis (4.4%), failure to intubate (2.9%), and other (7.4%). Local anesthesia was used alone in 35.3% of cases and in combination with conscious sedation in 64.7% of cases. Mild bleeding occurred postoperatively in five patients (7.4%). There were no other postoperative complications. Nineteen patients were lost to follow-up. The mean follow-up of 49 patients was 7.2 weeks, ranging from 2 to 261 weeks. Long-term complications occurred in three patients and included tracheitis 7.4% and suprastomal granuloma 2.9%. Eleven patients (22%) were decannulated at a mean of 11.8 months following tracheostomy.

Conclusions: Emergent awake tracheostomy should be considered in patients with impeding airway obstruction and is a safe and effective method to secure an airway in these patients.

Key Words: Awake tracheostomy, tracheostomy, head and neck malignancy, emergent tracheostomy, surgical airway.

Level of Evidence: 4

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INTRODUCTION

Tracheostomies secure access to the tracheobronchial tree for adequate ventilation of the patient. Awake tracheostomies are indicated for acute upper airway obstruction when other methods of securing the airway, such as intubation and cricothyrotomy have failed or are inappropriate.[1] Indications for awake tracheostomies include malignancies and external compression of the airway by deep neck abscesses or trauma. Since the standardization of the procedure in the early 20th century, elective tracheostomy has been widely evaluated in the literature to compare its complications and outcomes with traditional alternatives such as orotracheal intubation, nasotracheal intubation, and cricothyrotomy. However, there have been very few studies that have addressed these parameters in emergent awake tracheostomies.[1–4] The goal of this study was to investigate the indications, complications, and outcomes of emergent awake tracheostomy at our institution over a 5-year period.

MATERIALS AND METHODS

The protocol for this study was reviewed and approved by the institutional review board of Rutgers New Jersey Medical School, Newark, New Jersey. A retrospective review of the medical and surgical records of all patients who underwent an emergent awake tracheostomy by the otolaryngology service at The University Hospital, Newark, New Jersey, from February 2009 to February 2014 was performed. Subjects were initially identified by the following billing codes: Current Procedural Terminology 31600, 31603, 31605, 31610 and International Classification of Diseases, Ninth Edition 162.0, 161.0, 161.1, 161.2, 161.9, 478.3, 519.19, 235.6, 518.81, 786.05, 786.1, 478.34, 478.7, and 784.42. Patients under 18 years of age were excluded. Patients who were administered general anesthesia before time of tracheostomy were excluded. Patients who presented with malignancy and underwent composite resection at time of tracheostomy were also excluded. Both inpatient and

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TABLE I.
Summary of Patients Undergoing Awake Tracheostomy.

Characteristic	Totals
No. of subjects	68
Demographics	
Age, y, mean (range)	61 (18–83)
Sex, male/female	53/15
Presenting signs and symptoms, no. (%)	
Stridor	37 (54.4)
Hoarseness/voice change	37 (54.4)
Dyspnea	26 (38.2)
Dysphagia	18 (26.5)
Neck pain	10 (14.7)
Weight loss	8 (11.8)
Neck mass	8 (11.8)
Hemoptysis	8 (11.8)
Odynophagia	7 (10.3)
Throat pain	7 (10.3)
Cough	7 (10.3)
Ear pain	6 (8.8)
Epistaxis, failure to intubate, orthopnea	2 (2.9)
Snoring, wheezing	1 (1.5)

outpatient charts and electronic medical records were reviewed. Data collected included patient demographics, presenting symptoms, indication for tracheostomy, type of anesthesia used, postoperative complications, follow-up, and patient outcome.

RESULTS

A total of 68 emergent awake tracheostomies were done during the time period of this study. Of the 68 cases, 53 (80%) were male and 15 (20%) were female. The median age of these patients was 61 years (mean 60.3 ± standard deviation 11.5 years), ranging from 18 to 83 years. Of all of the patients, 82.4% (n = 56) had a history of smoking and 57.4% (n = 39) had a history of alcohol use. Seventeen patients (25%) had a history of radiation to the head and neck. Presenting signs and symptoms are listed in Table I. The most common presenting symptoms were hoarseness or change in voice (n = 37, 54.4%) and dyspnea (n = 26, 38.2%). A neck mass was noted in eight patients (11.8%). On physical examination, over half of the patients presented with stridor (n = 37, 54.4%).

Malignancy accounted for 58 cases (85.3%) of upper airway obstruction leading to the need of an awake tracheostomy. The remaining 10 cases (14.7%) had nonmalignant etiologies (Table I). None of our cases were conversions from cricothyroidotomy. The most common type of malignancy was squamous cell carcinoma (n = 55). The most common site of malignancy was the supraglottis (n = 28, 48.3%) followed by the glottis (n = 13, 22.4%), oropharynx (n = 5, 8.6%), subglottis (n = 1, 1.7%), and thyroid (n = 1, 1.7%). Ten patients (17.2%) had tumor involvement of more than one area of the larynx. Staging of disease was available in 45 of the 55 patients who presented with squamous cell carcinoma. A large majority of these patients presented with advanced disease. Thirty-five patients (77.8%) presented with stage IV disease and four patients (8.9%) presented with stage III. Of the 58 patients who presented with malignancy, 12 (20.7%) had recurrence of disease. Twenty-seven patients had a diagnostic biopsy of the obstructing mass performed at the time of tracheostomy. Twenty-seven patients who presented with malignancy also had a percutaneous endoscopic gastrostomy tube placed following tracheostomy during the same hospital admission for inadequate intake of oral feeds.

A large majority of the cases (n = 66, 97.1%) were performed in the operating room, whereas the remaining (n = 2, 2.9%) were done emergently at the bedside. Local anesthesia (1% lidocaine with 1:100,000 epinephrine) was used in 35.3% of cases (n = 24). Sedation in addition to local anesthesia was used in 64.7 % of cases (n = 44). The most common sedative used was midazolam, used alone in 21 cases. Fentanyl and ketamine were used alone in eight and two cases, respectively. A combination of the aforementioned sedatives was used in 13 cases.

Postoperative imaging was used to assess proper placement of the tracheostomy tube and was available for analysis in 53 cases. Forty-eight patients had a postoperative chest radiograph, and five patients had a postoperative computed tomography scan of the neck. Pneumomediastinum was noted in one patient. There was no previous imaging available, however, to assess whether this was a new finding. Neck soft tissue emphysema was noted in another patient. Atelectasis was seen in nine patients and consolidation was seen in four patients. There was no incidence of pneumothorax.

Immediate postoperative complications occurred in 11 (16.2%) patients. Mild bleeding occurred in five patients. Five patients developed pneumonia postoperatively. Tracheostomy tube dislodgement occurred in one patient. There were no perioperative complications or deaths secondary to acute airway obstruction or the

TABLE II.
Postoperative Outcomes of Patients Undergoing Awake Tracheostomy.

Characteristic	No. (%)
Immediate complications, N = 11	
Bleeding	5 (7.4)
Pneumonia	5 (7.4)
Tracheostomy tube dislodgement	1 (1.5)
Long-term complications, N = 28	
Bleeding	5 (7.4)
Obstructed tracheostomy tube	4 (5.9)
Tracheostomy tube dislodgement	4 (5.9)
Pneumonia	3 (4.4)
Neck abscess	3 (4.4)
Tracheitis	5 (7.4)
Pneumothorax	2 (2.9)
Tracheal suprasternal granuloma	2 (2.9)

tracheostomy procedure. Long-term complications were reported in 22 patients (32.4%). Four of these patients presented with more than one long-term complication, totaling 28 complications (Table II).

Nineteen patients were lost to follow-up. The mean period of follow-up of the remaining 49 patients was 7.2 weeks, ranging from 2 to 261 weeks. Eleven patients (22%) were decannulated at an average of 11.8 months following tracheostomy. Thirty-four of the 58 patients who presented with malignancy underwent chemoradiation therapy following their tracheostomy. Seven patients proceeded to a total laryngectomy for management of their malignancy.

Three patients had more than one awake tracheostomy performed at our hospital. All three of these patients had squamous cell carcinoma of the upper airway and were decannulated post-treatment; however, they developed recurrent symptoms necessitating airway intervention. One patient had three emergent tracheostomies performed under awake conditions over the span of three years. The indications for these tracheostomies were acute airway obstruction secondary to supraglottic mucus plug, oropharyngeal bleeding, and tumor burden. All three patients did not have any immediate or long-term postoperative complications. One patient was lost to follow-up, and two of the three were eventually decannulated successfully.

DISCUSSION

Otolaryngologists are frequently involved in the management of acute upper airway obstruction. Establishment of a secure airway for acute airway obstruction becomes imperative when other means fail or are not appropriate. Two methods available in this setting are cricothyroidotomy and tracheostomy. Cricothyroidotomy has traditionally been advocated as the surgical procedure of choice because it is faster, simpler, and easier to teach to nonsurgical staff.[5] However, cricothyroidotomy does not guarantee successful placement of a surgical airway.[6,7] In these same studies, an emergent tracheostomy was effective in 100% of attempts. Emergent tracheostomy has been received with greater enthusiasm since standardization of the techniques and indications in the early 1900s.[8] The indications for tracheostomy are currently defined by the American Academy of Otolaryngology–Head and Neck Surgery in the 2000 Clinical Indicators Compendium and include upper airway obstruction with either stridor, air hunger, retractions, obstructive sleep apnea with documented arterial desaturation, bilateral vocal fold paralysis, previous neck surgery, throat trauma, or irradiation to the neck.[9] Although the indications and complications of elective tracheostomy are well-established in the literature, these issues have not been thoroughly addressed regarding tracheostomy performed emergently in the awake patient.

Altman et al.[1] reviewed 197 tracheostomies done over a 3-year period, of which 90 were performed under awake conditions. They proposed use of an awake tracheostomy for an airway that cannot be visualized with flexible fiberoptic laryngoscopy or in the "cannot intubate" situation. The indication for awake tracheostomy in their study was primarily malignancy (80%). Similarly, malignancy was the predominant underlying etiology of airway obstruction requiring awake tracheostomy in our study. A large proportion of these patients presented with late-stage laryngeal squamous cell carcinoma. In addition, nearly half of the 58 patients who presented with malignancy had no preexisting diagnosis of malignancy and underwent a diagnostic biopsy at the time of tracheostomy. This proportion of undiagnosed high-burden lesions presenting as acute airway obstruction illustrates the nature and location of our institution. Our hospital provides healthcare for medically underserved populations in northern New Jersey. There are numerous factors that may contribute to a delay in diagnosis in this population, including but not limited to the lack of transportation, language barriers, unaffordable or lack of easy access to healthcare.[10] Similar numbers have been reported by other public tertiary care centers. Patel et al. compared the stage of presentation of head and neck cancer patients at their public tertiary care center in Chicago, Illinois to those found in nationwide hospital-based tumor registries.[11] A large majority (85%) of their patients had advanced disease (stage III or IV) at the time of presentation compared to 55% at the national level.

The gold-standard anesthesia for awake tracheostomies has not yet been well-established. In our study, local anesthesia was used alone in 35.3% of cases. Light sedation with fentanyl, midazolam, or ketamine was given in addition to local anesthesia in the remaining cases. General anesthesia is avoided in patients with severe airway compromise because induction of anesthesia causes decreased airway tone and approximation of the soft palate and pharyngeal wall leading to further airway obstruction.[12,13] Mason and Fielder advocated for the use of local anesthesia for awake tracheostomies in patients with severe stridor, large tumors, distortion of the larynx, or a fixed hemilarynx.[14] In the setting of an awake tracheostomy, local anesthesia allows the patient to maintain spontaneous respirations and protective airway reflexes, allowing time for the surgeon to perform the procedure without losing an already critical airway.[15] In patients with only moderate stridor, however, they suggested induction with an inhalational agent prior to an attempt at intubation. A successful uncomplicated awake tracheostomy requires good local anesthesia and a cooperative patient; however, patients with acute airway obstruction are oftentimes hypoxic and anxious. In this setting, sedation in addition to local anesthesia can provide the surgeon with a more cooperative patient and a less-difficult procedure. If adequate sedation cannot be achieved with conscious sedation alone, the use of general anesthesia can be considered. Smith and Fallon report a case in which a patient with a difficult airway secondary to head trauma remained uncooperative despite sedation and local anesthesia.[16] They opted to induce general anesthesia with inhaled 4% sevofluorane and were able to perform a successful tracheostomy before loss of spontaneous respiration.

Complication rates of emergent tracheostomies are higher than those of elective tracheostomies given that patients are often dyspneic, struggling, and unable to lie supine in the emergent setting.[17] Previous studies have reported complication rates of awake tracheostomy to range from 7.8% to 38.9%.[1–3,18] Perioperative and early postoperative complications included, but were not limited to, hemorrhage, pneumothorax, hypoxia, cardiopulmonary arrest, infection of the tracheotomy site, obstruction of the tracheostomy tube, and chest infection. Long-term complications resulting from emergent tracheostomy included tracheocutaneous fistula, postoperative pneumonia, and scars that required revision. Immediate postoperative complications occurred in 11 patients (16.2%) in this current series, a rate that is comparable to those previously reported. Five patients with minor bleeding were successfully managed conservatively. Of note, the other half of this cohort were patients who developed postoperative pneumonia. It is possible these patients were predisposed to this postoperative condition given the increased risk of microaspiration secondary to their tumor burden. However, this is purely speculative. Pneumomediastinum was noted on postoperative imaging in one patient. This patient was successfully managed conservatively. Pneumomediastinum was not reported in previous reports of patient outcomes following emergent awake tracheostomy.[1–3,6] In a review of 135 postoperative chest radiographs following elective open tracheostomy, there was no finding of pneumomediastinum.[19] Our findings suggest that the risk of pneumomediastinum, although low, may be increased following emergent awake tracheostomy compared to elective tracheostomy. Overall, complications following tracheostomy can be prevented by using good surgical technique, avoiding the cricoid cartilage during dissection, and meticulous postoperative care.[17]

Decannulation was achieved in 22% of the patients in this study at time of follow-up. Although reported decannulation rates for elective tracheostomies are quite high, ranging from 66.0% to 72.4%,[17,20] rates are substantially reduced in patients undergoing emergent tracheostomy. Few studies report decannulation rates for emergent tracheostomies; however, a study by Altman et al.[1] yielded a rate of 21%, similar to that of our current study.

To our knowledge, the literature contains only one report of a repeat tracheostomy in an awake patient.[21] Rashid et al. details a successful repeat percutaneous dilational tracheostomy for respiratory failure in a 20-year-old female patient. There were no complications in this case. In this study, we report three patients who underwent repeat awake tracheostomy for laryngeal squamous cell carcinoma. There appears to be no increased risk for postoperative complications in patients who undergo repeat awake tracheostomy, and two of three patients were successfully decannulated at time of follow-up. There is clearly a paucity of data regarding the outcomes of patients who undergo repeat awake tracheostomy that should be explored further.

A limitation of this study is that it is a retrospective study from a single institution. Patient variables were not reported in a standardized fashion and may have introduced bias in the results. A prospective study including multiple institutions would be ideal and provide a more powerful study.

CONCLUSION

Upper airway obstruction secondary to late-stage laryngeal malignancy was the most common indication for awake tracheostomy at our institution. Sedation in addition to local anesthesia may provide the surgeon with a more cooperative patient. Emergent awake tracheostomy in a standardized fashion appears to result in an acceptable rate of complications and is a viable option for establishing a secure airway in the setting of acute airway obstruction.

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